UNIVERSITY OF
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A CASE STUDY OF THE RELATIONSHIP BETWEEN STUDENTS' HOME BACKGROUNDS AND THEIR MATHEMATICS PERFORMANCE

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by

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ABSTRACT

This is an investigation explaining the relationship between the home environment and mathematics performance of 12 grade eight students from a high school in Durban, South Africa. One of the data collection methods was a 25-question test, based on the TIMSS test, namely a TIMSS equivalent mathematics test. The test was analysed and its relation to the South African syllabus, the students' familiarity with the type of questions and the multiple-choice mode of answer used in the TIMSS study, was investigated. The test scores were also used to identify high performing and low performing students to be interviewed about their mathematical, personal and home backgrounds. A student questionnaire was administered to these selected students as a basis for the interviews. An in depth one on one interview and records of the students' achievements in grade 7 and grade 8 in languages and mathematics, as well as school family records were used for the analysis. The life stories of the six high performing and six low performing students were then constructed and analysed with respect to: their achievements in mathematics and language; their home backgrounds; how their mathematics performance is affected by their home environments; and the effect of parental involvement in their lives. Finally research findings from the interviews on the home lives and experiences of the 12 grade 8 students from a high school in Durban are presented. Implications are put forward and recommendations made.

DECLARATION

I, Barak Tom Salakoff, declare that the work presented in this document is my own, and that reference to the work of other people has been duly acknowledged.

Signed .....

Signed .....

Supervisor

Durban

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LIST OF ABBREVIATIONS

TIMSS: Trends In Mathematics and Science Study (Originally called the Third International Mathematics and Science Study)

HSRC: Human Sciences Research Council

KZN: KwaZulu-Natal, a province of South Africa

IEA: International Association for the Evaluation of Educational Achievement

TADA: Teenagers Against Drug Abuse

SA: South Africa

USA: United States of America

UNISA: University of South Africa

Mod-cons: Modern Conveniences such as television sets, DVD players, microwaves, refrigerators, radios, electric stoves and ovens, kettles, indoor toilets

Matric: Matriculation Examinations

Escom: Largest supplier of electricity in Southern Africa

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CHAPTER ONE

BACKGROUND OF THIS STUDY

1.1 INTRODUCTION

In the 12 years I have taught mathematics in KwaZulu Natal I have found the level of mathematical performance, among grade 8 students, to be extremely poor. I tried for years to ascertain what factors contributed to the problem. I found that with many of the students I taught, if their home environment was secure and positive, they were able to focus on their studies and achieve satisfactory results in mathematics and science. This was in spite of the many instances, where their teachers were not suitably qualified, and their school environments were not ideal.

In 1994 I taught two classes each of grade 12 mathematics and physical science. In those classes there were two students whose home environments were causing them severe stress. Patrick travelled each day from Pietermaritzburg to Durban and always arrived late and in a tense state. This severely affected his ability to concentrate and succeed. Moses had come to Durban from GaRankuwa near Pretoria. The finishing school where I taught, was the only place Moses could find at that time to complete his education. His mother was battling to pay school fees and Moses had no place to live. I offered Patrick and Moses a secure and comfortable home with my family while they completed the year of study.

Both Moses and Patrick had the correct textbooks, highly qualified and experienced teachers, and a comfortable, clean and well-equipped classroom. I was teaching them both mathematics and physical science. At the time of moving in with my family, Patrick and Moses were failing both subjects. However once they settled into the family routine and with nothing more to worry about than their studies, their progress was remarkable and at the end of the year they both achieved high results in mathematics and physical science, each of them then going on to tertiary institutions.

At Ross[1] High School, Nkosi[2] had studied mathematics with me from grade 8, yet in grade 12 his results were poor and his attitude aggressive. I knew his potential. Why was he suddenly constantly in trouble? Why at this time, when his results were so important to his future, was he doing so badly, particularly in mathematics? Was there something I was missing?

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[1] Not the real name of the school
[2] Pseudonym

On interviewing Nkosi I discovered that he felt he had no future. His father was out of work, his mother was an invalid, his three elder brothers, although all with tertiary qualifications, did not have employment, and the story was the same for his two elder sisters. "What was the point of putting in all that effort, when I would be spending the next few years in fruitless pursuit of an unattainable dream?" he asked.

On analysis there were severe problems at home. This plus the knowledge that these problems would affect any hope he had of a tertiary education, led to his hopeless approach to life. When this changed, his smile, behavioural change, excellent matriculation results and subsequent successes after two years at Technikon SA, spoke volumes. His family home is happy today, all the members of his family have work in their respective fields of ability and Nkosi is on his way to a great future.

This interview jolted my complacency. Here I had taught this young man for five years and yet I had had no idea of the problems, which dogged him daily. How many other learners were underachieving due to home problems that for them were insurmountable?

I have had many experiences like the above during my years of teaching, and in each case when the home problems were solved, the student's achievements improved. Thus I began to think that a student's ability to succeed in his/her studies was directly related to the home environment experienced.

I thus set out to research the relationship between the mathematics performance of students and their home and personal backgrounds.

1.2 THE RELATIONSHIP BETWEEN MATHEMATICS PERFORMANCE AND HOME ENVIRONMENT

In order to link home environment to the mathematics, a mathematics test was needed by which to select the students to be interviewed about home background. In my study TIMSS, which used to stand for the "Third International Mathematics and Science Study", but now is referred to as "Trends In Mathematics and Science Study", was chosen, as it was a link to international mathematics achievements, and had been well described with respect to South African mathematics achievements. It also looked at home environment as part of the study.

A TIMSS equivalent test was used together with the students' school achievements because it created a basis with which to:

- Locate Ross High School grade 8 students in relation to a national and international benchmark.

- Expand on the fact that TIMSS did not provide qualitative data to explain student mathematics performance.
- Allow a broader and deeper understanding of the relationship between students' home and personal backgrounds and their mathematics performance.

TIMSS, at the time I started my research, was very prominent in the media. The fact that South African students had done so poorly raised questions for me about the TIMSS tests. Also the different way mathematics is tested at high schools in South Africa as compared with the way it is tested worldwide and in the TIMSS could have affected the results. Finally what effect the home environment may have on these results needed exploring.

The comments on the students as expressed below spoke directly to my question both with Patrick, Moses and with Nkosi.

> **Home Background.** Students come to school from different backgrounds and with different experiences. The number of books in the home, availability of a study desk, the presence of a computer, the educational level of the parent, and the extent to which students speak the language of instruction have been shown to be important home background variables, indicative of the family's socio-economic status, that are related to academic achievement. Also important are the attitudes of parents and their involvement in their child's education. The extent to which employment, sports and recreational pastimes and other activities occupy the student's time may also affect learning.
>
> **Prior Experience.** Students engage with mathematics and science with a host of prior experiences that affect their preparedness to learn. These include past learning in the subject, positive or negative interactions with past teachers, and the difficulty or ease with which the subject matter was learned.
>
> **Attitudes.** Creating a positive attitude in students toward mathematics and science is an important goal of the curriculum in many countries. Students' motivation to learn can be affected by whether they find the subject enjoyable, place value on the subject, and think it is important in the present and for future career aspirations. In addition, students' motivation can be affected by the degree to which they attribute success and failure in the subject to internal or external factors.
> (TIMSS Assessment Frameworks and Specifications Contextual Framework, 2003).

These are the issues, which I felt needed to be looked at in depth in this study.

Every day my students came into my classroom, sat and attempted to do mathematics. Their behaviour in the classroom and their frustrations demonstrated in their unwillingness to interact with the subject matter, their inattentiveness and their apparent unwillingness to do the limited homework received, could be indicative of a deeper problem. With much hard work and

repetition we achieved slow progress in the curriculum. After repeated attempts they passed the tests. What was I missing?

In the TIMSS studies of 1998-R and 2003 South Africa had achieved one of the lowest scores. Why? What effect had the home environment had on the students' lack of achievements? I needed to know more.

I decided to examine what I had read, in the TIMSS Assessment Frameworks and Specifications document, and use this information with respect to a group of learners at the school where I teach and extend the question: " What factors are related to the students' opportunity to learn the concepts, processes and attitudes required for successful achievement in mathematics?" asked by Howie and Hughes [1998).

Perhaps an in depth study of home background would help answer many questions, and guide me to answers which could improve the teaching and learning of mathematics, for myself and others grappling with the "difficulty" of mathematics education?

1.3 TIMSS AS A MEASURE OF MATHEMATICS PERFORMANCE

TIMSS is a project of the International Association for the Evaluation of Educational Achievement (IEA).

Over 40 countries from around the world entered their grade 4, grade 8 and grade 12 students into the study. The first study was done in 1994 and reported on in 1995. In 1998 the study was repeated and the 1998-9 TIMSS-R report was written and analysed in detail in 2000. In 2002 a third set of testing was done and this analysis is due for release in 2006.

The purpose of the study was to provide countries with the opportunity to measure progress in mathematics and science education achievements against other countries and a set of international norms.

The students answered multiple-choice questions as well as a substantial number of constructed-response items (Robitaille Beaton and Plomp, 2000,) on a series of mathematics and science problems covered by the curricula, as set down in National documents and syllabuses and as described in policy statements, regulations, curriculum guides and other official documents; the spirit of which is reflected in textbooks, resources and examinations. The curriculum analysis component of TIMSS included detailed analyses of the above from all participating countries. Robitaille, Beaton and Plomp (2000) described this as the Intended Curriculum.

Teachers and principals also answered questionnaires. These questionnaires looked at teacher qualifications, experience and attitudes, as well as classroom size, class size, school facilities and availability of textbooks and computers in schools. Robitaille, Beaton and Plomp (2000) called this the Implemented Curriculum. Howie (1999) also looked at the analyses of teacher and principal questionnaires and identified many problematic areas, namely teacher training, classroom size, class size and lack of many basic facilities.

The students' attitudes towards mathematics as well as the opportunities made available to them were obtained from a student questionnaire, which all students answered. This questionnaire asked students questions about themselves, their home environments and their opinions. It looked at their attitudes towards mathematics, their gender, their home language and use of English, their age, and availability of books, and other modern commodities present in the home. There were questions on the level of education of the parents, the students' own expectations for education and their attitudes towards the learning of mathematics. There were also questions on homework assigned and time spent doing homework. See Appendix B. (TIMSS 2003, Main Survey: Student Questionnaire, grade 8.)

These questionnaires gave information, which was intended to examine the impact of students' homes and social environments on their academic achievements. This data provides the participating countries with a dynamic picture of the current implementation of their educational policies and practices and helps to raise new issues relevant to the improvement in this regard.

The results of the studies in 1994 and 1998 (called the TIMSS-R) have been extensively analysed and reported on by Robitaille and Beaton (2002) as well as Howie from the HSRC who has done a number of studies namely, Howie (1997), Howie and Hughes (1998), Howie (1999), Howie (2001) and Howie (2003) on the South African achievements.

In 1998 and 2003 South Africa entered approximately 10 000 students from grade 8 and grade 12 into the study. Of all 42 participating countries, South Africa achieved the lowest scores in 1998 (Howie,1999).

There are however a number of problems with these kinds of international test score comparisons. Howie and Hughes (1998) analysed the curriculum tested in the TIMSS study and found that only 50% of the South African curriculum was tested. The format of the test using mainly multiple-choice questions and mixing mathematics and science questions in the same paper were

unfamiliar and thus a distinct disadvantage for the South African students.

Although these issues are extremely relevant, I am particularly interested in the analyses of the student backgrounds and interests in mathematics, as they deal with a number of problems and questions I have identified over many years of teaching.

Using the student questionnaire data from the 1998 and 2003 TIMSS to provide a starting point for my study, I used these identified factors and explored in greater depth their effect on the students' results as achieved in a TIMSS equivalent test.

1.4 CRITICAL QUESTIONS OF AND RATIONALE FOR THE STUDY

The critical questions of this study are:

Question 1: How do grade 8 students in one school perform on a TIMSS equivalent test, that is: what is their location in relation to national and international benchmarks?

Question 2: What are the personal and home backgrounds of a selected group of high performing and low performing grade 8 students, who wrote the TIMSS equivalent test?

Question 3: What is the relationship between the high performing and low performing students' mathematics, achievements as indicated on the TIMSS equivalent test, and their backgrounds?

Home environment is seldom mentioned when poor mathematics and science results are discussed in research or in the media. In a recent document by the Centre for Development and Enterprise (2004) headed "From Laggard to World Class", the curriculum, the teachers and the schooling are discussed and examined in detail. Their effect on the results and standards achieved is discussed and analysed. However, home environment and parental input is not examined as an important factor in the equation. Yet children are affected as much by what they experience socially and in the home as by the curriculum, the quality of their educators, and school environment.

When reading the newspapers and listening to the many discussions on students' poor achievements in mathematics and science, I constantly noted that the blame was frequently put at the door of poor teaching, lack of qualification of teachers, poor school environments, lack of textbooks and classrooms and other factors related to the intended and implemented curricula. Very little comment was made on the effect in our society of the home environment and the parents' role in the students' achievements.

Quantitative data on student attitudes and home environment was produced in TIMSS but no in depth qualitative analysis was done to support the findings from the questionnaires (Howie and Hughes, 1998, and Robitaille and Beaton, 2002).

Yet, in my experience during 25 years as a science and mathematics educator, I noticed that home environment seemed to play a crucial role in a students' ability to focus and internalise what is being taught in the classroom. Those students with severe problems at home appeared to struggle to concentrate and achieve, even with excellent textbooks, highly qualified and capable teachers, magnificent school buildings and sport facilities. I suspected that parental support and encouragement meant more to a student than prizes or certificates. I was interested to research and investigate my hunches. This was the motivation for my undertaking this investigation.

The purpose of this study is to take an in depth look at the personal and home backgrounds of a group of grade 8 students and examine the effect on their mathematics performance.

In order to address this, the study first examined how grade 8 students in one school do on a TIMSS equivalent test. That is, the study established their mathematical location in relation to national and international benchmarks. The personal and home backgrounds, of the six high performing and six low performing grade 8 students' in this TIMSS equivalent test, were obtained during personal interviews and from the school records. These case stories were then analysed to find the relationship between their mathematics achievements and their backgrounds.

1.5 CONTEXT OF THE STUDY

The study was done at Ross High School in South Durban. It was a model D school started in 1993 as a school for elite black students. The school was controlled by the previous Natal Education Department at a time when there was a great deal of change. A special dispensation was given to the headmaster to start this school. Before 1994 most schools in the Natal Education Department accepted only White students. There were approximately three hundred Zulu speaking students in the school and one White male student. This was a very rare occurrence.

There were ten staff members. The headmaster, the deputy head educator and the two heads of department as well as most of the educators were White. However two of the educators were Black and had been hired to teach Zulu. The cleaning staff were all Black but the administration staff were all White. The first headmaster died in 1994.

In 1995 under a new headmaster the school was moved to much larger premises, and the doors were opened to students from the Cato Manor informal settlement. The school fees were set at R200, 00 per year and a further 400 students of all race groups and from a variety of home backgrounds were accepted. The elite status of the school was no longer maintained although the school fees remained relatively high.

Over the years the staff compliment changed too. The school staff now consists of 25 educators, nine of whom are Black, nine are Indian, five are White, one is Coloured, and one is Chinese. The Headmaster is White, the deputy Head teacher is Black and of the five heads of department, one is Indian, one is Black and three are White. All the educators have teaching qualifications, three have master's degrees, nine have first degrees and two have honours degrees. There are two secretaries to deal with the administration and a financial secretary. The school also employs three cleaners, an administration clerk, and four handymen from all race groups. The mathematics department consists of six educators. One White male head of subject (the researcher in this study), two Black females, one Indian male, one Indian female, and one Chinese female.

There are 826 students at the school, with approximately 200 students each in grades 8, 9 and 10, 126 students in grade 11 and 100 students in grade 12. The student population comes from many areas in Durban, with the largest groups coming from Umlazi, Kwa Mashu and Lamontville. Most of the students are IsiZulu speaking, approximately 20 students are White, 25 are Indian, a few are Coloured and a few in each class are Xhosa or Sotho speaking.

The present school fees are set at R3400, 00 per year.

Physically, the school has excellent facilities. Every teacher has a well-equipped classroom; individual desks and chairs are provided for each student; and there are large sports fields where soccer, netball and cricket practice take place throughout the year. A basketball court has been provided and coaching takes place twice a week. There is a tuck-shop, many toilet facilities and a large hall for assemblies and meetings. There is a well-fitted motor mechanics workshop, technical drawing room and a library containing many reference books as well as novels, which cater to every level of reading ability. A fully equipped kitchen is provided for the hotel studies, and two well-equipped computer rooms and three well-endowed laboratories complete the facilities offered to the students.

Cultural activities are also well catered for in the form of a TADA[3] group, a Christian group, a debating society, a drama society, a dance group, a choir, a chess club, a catering club and an environment club. The mathematics department offers extra mathematics lessons at break time, assemblies are held twice a week and sports matches are frequently arranged in all the sports.

Functions held at the school during the year comprise: a sports day, a matric dance function which is always well attended by staff and matric students, a cultural day, where students dress up to represent the cultural diversity at the school and different foods are sold, and a Mr and Miss Ross High competition, where certain students are chosen to model clothes for the rest of the school, are held.

The grade 8's come from many different primary schools. Most of the students attended English language primary schools in and around Durban. An English test is set for all the grade eight students during their orientation week at the school. This is marked and the classes are created and graded according to the written ability and understanding in English of each student. All the students experience all the subjects offered at the school during their first two years and only select subjects when they proceed to grade ten.

Thus the school offers the student body a well rounded education experience, where those that participate complete their time at the school with a great deal of knowledge and a rich growth.

1.6 THE STRUCTURE OF THE STUDY

This first chapter introduces the study. The introduction discusses the scope and context of the study, gives a rationale for an in depth home background assessment and explains how the study will relate this to the TIMSS using an equivalent test.

The second chapter is a review of selected literature focusing on the TIMSS studies and theories with particular reference to the analysis of the home background questionnaire.

The third chapter presents an outline of the methodology, procedures and the type of research process used in the study.

The fourth chapter focuses on the students' mathematics performance in a TIMSS equivalent test. As well as the type of questions asked in the test, and the relationship between these questions and the South African syllabus. It also looks at the students' responses and thus familiarity with the type of question

[3] Teenagers Against Drug Abuse

posed and the multiple-choice mode of answer. For an international comparison the whole group's achievements in the TIMSS equivalent test are compared with those of Dr Marvin Rich's group as seen in the graph analysis of the group's achievements. Their mathematics problems are analysed. Finally, it explains the way in which the students were selected for the group to be interviewed.

The fifth chapter presents the life stories of the students interviewed[4]. The life stories look first at a day in the life of the student. Then there is a description of the student's personal and home background, followed by a description of the student's early childhood and education, interest in reading, obtaining of books and school language results. Finally the student's school mathematics education, performance and interest in mathematics is discussed.

The sixth chapter sets out an analysis of the factors and themes found from the background life stories, the implications of the investigation are set out and recommendations are then presented.

This chapter has provided an overview of the study; the next will examine the literature, which underwrites the process and methodology.

[4]Names have been changed to safeguard the privacy and confidentiality of the students.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the literature applicable to the critical questions which are:

Question 1: How do grade 8 students in one school perform on a TIMSS equivalent test, that is: what is their location in relation to national and international benchmarks?

Question 2: What are the personal and home backgrounds of a selected group of high performing and low performing grade 8 students, who wrote the TIMSS equivalent test?

Question 3: What is the relationship between the high performing and low performing students' mathematics achievements and their backgrounds?

Firstly the literature is explored with regard to what other researchers have found as to the effects of home background and parental influence on a student's educational achievements.

Secondly the literature on TIMSS, which has been extensively reported on, is reviewed as to the relevance of TIMSS as a benchmark test for this study. The greater focus has been on those references applicable to the South African experiences.

2.2 EFFECT OF HOME BACKGROUND ON THE MATHEMATICS ACHIEVEMENTS OF A STUDENT.

A student's ability to achieve in mathematics is based on a variety of important factors, namely the student's innate abilities, the quality of the education offered by the school and national department, the school facilities, the qualifications and teaching skills of the educators and support and security at home (Howie and Hughes, 1998). These factors can be understood from the perspective of three curriculum levels, the intended curriculum, the implemented curriculum and the attained curriculum.

> "In addition, it is believed that there are factors outside formal schooling that affect the students' achievements" (Howie and Hughes 1998, p15).

> "The intended curriculum is a statement of society's goals for teaching and learning; the implemented curriculum is mathematics content as interpreted by teachers and made available to students; the attained curriculum is the outcome of schooling, the mathematics knowledge and skills that

> students have acquired in the course of the studies as well as the attitudes they have developed towards the subject" (Robitaille, Beaton and Plomp, 2000, p12).

The continuity, mutual understanding and relationship between the home and the preschool are believed by early childhood professionals to be of benefit in reinforcing and sustaining the work done with the children. The stresses experienced by families, from work or its absence, poverty, single parenthood or social isolation are also recognised as affecting the learning of the preschool child and these problems need to be addressed so that the parents can then adequately nurture their children and help them succeed in their education (*Cross-Site Analysis,* 1996).

This supports the concept that if students are to succeed in their education it is essential that the families are secure and parents understand their important role in their child's ability to achieve.

A student's attitude to his/her education, and the opportunities made available to the student are the result of the home environment and parental attitudes to education, the parental involvement in the education of the student and a good grounding in the basics of reading, writing and arithmetic. This was supported by the research done by Pollard (1990).

Pollard (1990), did a longitudinal ethnography in 1987 of 10 primary school students. His main sets of data were field notes from participant-observation interviews, teacher records, parent diaries, school documents, photographs, video recordings and examples of the childrens' work. In the thesis he comments particularly on the effect of the home backgrounds on the school experiences of two of the children. "Sally" and "Daniel". "Sally", the younger of two children lived with both her parents, who took an enormous pleasure and pride in her achievements. Her mother worked at her school as a meals service assistant and cleaner. Both parents constantly encouraged her. She had a good deal of self-confidence, took a leading role in several class assemblies, made good progress in reading and schoolwork. Her teacher's comments were that she was delightful and rewarding to teach. She mixed easily with her peers and was at the centre of a popular group of girls in the class. "Daniel" was the youngest of five children. His father was an extremely busy business executive. His mother devoted all her time to her large family. "Daniel" who had difficulty establishing his identity in the bustle of the family, was not very confident and played on being the baby. In the lower grades he had established a friendship with "Harriet" but in the higher grades this friendship with a girl was "sissy" and unacceptable. His baby habits isolated him and affected his acceptance by the dominant group of boys in his class. His classroom experience increased his isolation and

insecurity. There were 31 children in the class including a "difficult" group of boys. The teacher was new and felt the class needed a firm hand. This harsh treatment further increased "Daniel's" fearfulness and poor achievements (Pollard, 1990). Thus Pollard supports the conjecture that home background and parental involvement play a big role in a student's achievements and successes in school.

A number of factors have been reported on by Howie(2003), Robitaille and Beaton(2002) and Cronje (1998) as pertaining to poor performance of pupils in mathematics, such as curriculum, class size, educator qualifications, and availability of textbooks. None of these reports dealt with the effect of home environment on the mathematics performances of the students. Most of the reports were based on classroom observations and discussions with teachers. The students and their parents were not interviewed (Howie, 2003).

The poor results achieved in mathematics matriculation examinations in South Africa have been frequently commented upon and analysed. In 2001 the decision was finally taken at National level to introduce sample-based national assessments at Grades 3, 6 and 9 levels to enable policy makers to assess the effectiveness of the education system. Although case study research on local and regional samples, have been conducted that included achievement data, limited inferences could be made from these studies with regard to the effect of home background on the mathematics achievements (Howie, 2003).

However although there is a study quoted by Howie (2003) involving data from 100 schools as part of the Quality Learning Project that has collected background data in order to infer reasons for pupils' performance in mathematics (and science) (see Prinsloo, Kanjee, Pfeiffer and Howie, 2001; as cited by Howie 2003), she did not report the depth of the study.

2.3 TIMSS AS A MEASURE OF MATHEMATICS PERFORMANCE RELATED TO HOME BACKGROUND

TIMSS provided South Africa with the first national overview relating mathematics performance of South African students and home background (Howie, 2003).

South African Grade 8 students came last out of 41 countries. On a scale of 1 to 800 South Africa scored an average of 354. Singapore scored the highest with 643. The international average score was 513 for grade 8 students. These scores were obtained by means of an item response theory (IRT) scaling method (Rasch model). These scores translate into the following percentages: 24% average for South Africa, 79% for Singapore, and 55% for

the international average, only the most proficient pupils in South Africa attained the level of the average pupils from Singapore (Cronje, 1998). The top 10% of South African students did not compare with the top 10% internationally. The fact that less than 40 South African students (0,5%) achieved the top 10% benchmark internationally for both mathematics and science is cause for concern (Howie, 1999).

The provinces in South Africa with the highest average scale score for mathematics was the Western Cape with 381 scale points followed by Northern Cape and Gauteng with 318 points. Then came KwaZulu-Natal with 292 points, Free State (276), North West (267) Eastern cape (256), Mpumalanga (253) and finally Northern Province (226) (TIMSS-R, 1999).

The TIMSS curriculum framework underlying the mathematics and science questions asked in the TIMSS tests were developed in 1995 by groups of mathematics educators with input from the TIMSS National Research Coordinators. Within this framework mathematics test specifications for TIMSS included items representing a wide range of mathematics topics and eliciting a range of skills from students. The tests were developed in 1995, and improved upon in 1998, through an international consensus process involving experts in mathematics, science and measurement, ensuring that the tests reflected current thinking and priorities in mathematics and science education (Martin, Gregory and Stemler, 2000).

Five content areas were assessed in the mathematics tests. They were: fractions and number sense, measurement, data representation, analysis and probability, geometry and algebra (Martin, Gregory and Stemler, 2000).

The original 1995, 1998 and 2002 TIMSS questionnaires were set out in nine booklets of questions with mathematics and science questions randomly set out. The learners answered as many questions as they could from one of the booklets in 90 minutes. There was no fixed number of mathematics questions in each booklet; the selection of questions was random and depended on the booklet answered. This is a format unknown to most South African learners and was not a factor discussed in any document analysing results. Multiple-choice questions were the main mode of questioning, and this too is not a form commonly used in South Africa for testing mathematics. Howie and Hughes (1998) analysed the curriculum tested in the TIMSS study and found that only 50% of the South African curriculum was tested. Thus in this study these factors were looked at and their effect on the students to be interviewed, as to their mathematics achievements, was questioned.

There are thus many factors that have been found at school, class and student levels to affect mathematics achievement (see Howie, (2002), as cited in Howie (2003), for a comprehensive discussion). A summary of these factors is presented below as cited by Howie (2003).

The factors that have been discussed in the literature from Southern Africa at the student level include: socio-economic status, books in the home, parental education, parents' occupation, parental relationships, parental pressure, parent's self-concept, pupils' attitudes to mathematics, family size, jobs in the home, pupils' aspirations, peer group attitudes, pupils' self concept, self expectations, pupils' anxiety, enjoyment of mathematics, attitudes towards mathematics, reading ability, gender, time spent on homework.(Howie, 2003). Most of these factors were investigated in depth during the interviews in this study.

Education articles focusing on the home are emerging, as it is slowly being realised that parental involvement in a child's education is essential to helping the child succeed. In her article Oswald notes:

> "The size, composition and interpersonal dynamics of families have changed, as has the way families are represented in popular culture" (Oswald, 2003, p 309).

In her analysis she also writes:

> "Today family includes a vast array of configurations, such as households formed of two or more blended families of divorce, unmarried couples, childless households and even gay parents" (Oswald, 2003, p 310).

So the effect of these family arrangements on a child's ability to study, focus and achieve in mathematics requires in depth investigation related to mathematics performance.

In the United States of America, many school districts have established teacher home visit programmes. "These home visits by teachers get parents involved in their child's education – and they let parents and children know how much teachers care." Steele-Carlin,(2001). The article discusses the value of home visits for the parents and teacher. Thus Steele-Carlin recognised the importance of home background to a child's education. However the article does not relate the advantages of these home visits to the students or their mathematics achievements. Thus it was of interest but of little help for this research paper.

Howie (2003) found that in the TIMSS research:

> "Six factors were found to have a direct effect on South African pupils' proficiency in mathematics, namely the pupils' proficiency in English (*engtest*), their own self concept in terms of mathematics (*selfcnp*), the language pupils spoke at home (*lang*), their socio-economic status at home (ses), and whether or not they, their friends and their mothers thought that maths was important (*mathim*) and language of learning in the classroom (*lanlearn*)."

One of the main studies in the literature, which dealt with the relationship between achievement in mathematics and the home, was thus the TIMSS study of 1998. The TIMSS student questionnaire (see Appendix B) was one of the few studies which dealt extensively with home environment, and was answered by all students involved in the TIMSS studies of 1994, 1998, 2002. This TIMSS student questionnaire is used in this study to help highlight the effect home environment has on a student's achievements in mathematics.

In the TIMSS study 1998, student questionnaires were administered to 10 000 grade 8 students, at the national level, throughout South Africa.

> "The student questionnaires queried students' backgrounds, opinions and attitudes to mathematics and science. Also their in and out of school activities"(Howie and Hughes 1998, p18 and p33).

This questionnaire asked students questions about themselves, their home environment and their opinions. It looked at their attitudes to mathematics, their gender, their home language and use of English, their age, books, as well as many other modern commodities present in the home. There were questions on the level of education of the parents, the students' own expectations for education and their attitudes towards the learning of mathematics. There were questions on homework received and time spent doing homework. A number of questions revolved around students' current training and their plans for future education. Some questions looked at the issue of educational resources in the home and the effect on students' achievements in mathematics. "This is particularly relevant to the South African case," say Howie and Hughes (1998), "as disparities in resources have pervaded South African society for many years." (See appendix B).

From the TIMSS 1998 literacy study,

> "definite positive relationships were identified, i.e. academic performance is supported by student perceptions and liking mathematics is positively related to higher achievement" (Howie and Hughes 1998, p44).

Also in the study,

> "South African students were found to be almost the oldest, spent the most time on household chores, their homes boasted fewer books and students' parents had close to the lowest educational levels" (Howie and Hughes 1998, p44).

This was found to be the case in the TIMSS-R 1998 study as well (Howie, 1999). TIMSS 2002 is still being analysed at present. Howie and Hughes (1998) propose, "that these unique features (among others) are likely to limit academic performance considerably." These are all important facets that are explored further in this study.

From the questionnaires it became apparent that students report spending an excessive amount of time on homework without any return on performance, and students' perceptions of their good performance in the literacy test (Howie and Hughes, 1998). Howie states that on average South African pupils reported spending 1,8 hours per day studying or doing mathematics homework, compared with the international average of 1,1 hours (Howie,2001). However it also appeared that although students spent a great deal of time doing mathematics homework Robitaille and Beaton (2002), found that the amount of homework assigned to Grade 8 students (in South Africa) was much lower than the international average. It is possible to conclude from this that South African students take longer to do less homework. This will be queried in this research as well.

In addition Howie and Hughes in their analysis of data on home background supplied by TIMSS student questionnaires (1998) state:

> "South African pupils were on average much older than the international average. Almost half of the pupils i.e. 40% lived without fathers at home. Only 26% of the pupils spoke the language of the test as their first language, and more that 70% did not always speak the language of the test at home.....Pupils with more books and educational aids achieved better results in mathematics" (Howie and Hughes, 1998). "Pupils whose parents had higher education achieved higher scores in mathematics" (Howie and Hughes, 1998).

Howie (1999) found these statements to be applicable as well, in her analysis of the TIMSS-R grade 8 student questionnaires.

In this study, these factors were explored in greater depth by interviewing students who achieved top results in the TIMSS equivalent test and those who were low performers in this test. By doing so it was hoped that the findings and claims of Oswald,

Robitaille, Howie and Hughes are investigated as to their actual effect on student achievement in mathematics.

Elmore (1997) reports, "American schools face uniquely difficult conditions of student diversity in socio-economic status, language and cultural background that make simple international comparisons suspect." Given the greater resource base advantage of countries like the United States, in my study I asked: "Does this also apply in the case of South Africa, where the diversity of home language, culture and socio-economic conditions is even greater than that of the USA?"

Huberman (1997) states, "What teachers can do depends on who the pupils are." This statement is very significant as "who students are" is shaped in part by their home and personal background.

Robitaille, Beaton and Plomp (2000) summarised the 1998 TIMSS-R data and reported their findings for each country that took part in the survey. Howie (1999) reported on the South African achievements in the study.

2.4 SIGNIFICANT FACTORS

The factors which appeared to be of significance and thus important to look at in this study were:

Gender:

One of the factors that appears to influence mathematics performance, is gender. This was regarded by most countries as significant and was reported on by both Howie (1999) and Robitaille and Beaton (2002). This difference however, amongst grade 8 students who wrote the TIMSS, was found to be small in all countries including South Africa. New Zealand and the Philippines found girls outperformed boys, though not in significant numbers. Canada, England, Iceland, the Netherlands, Korea, Japan, Iran and Denmark reported that boys outperformed girls, though again not in significant numbers. (Robitaille and Beaton, 2002).

Language:

Language was one factor that was of significance in all countries and is reported by all analyses. However there is little consensus amongst those who reported on the TIMSS as to the importance of language usage at home and its connection to the language used for explanation and study in mathematics.

It was found in the 1998-R report that language factors may have had a negative impact on achievement, as students with Afrikaans and English as home languages performed significantly better that those students with other home languages. However Howie and Hughes (1998) do not support this statement. They found that: "there was no relation between the students' use of language at home and their performance in either mathematics or science."

Howie and Hughes (1998) found "that students in the Northern Cape who sometimes spoke the language of the test at home, had better scores in both mathematics literacy and science literacy than the students who always spoke the language at home."

Howie and Hughes (1998) support the above statement in their analysis of the international data: "There is a trend in Indonesia and Malaysia where pupils who never spoke the language of the test at home.....still appeared to outperform those who always or sometimes spoke the language of the test at home."

In the interviews there were a number of students whose home language is not English, the language of the test. However all the students have studied and read mathematics in English for many years, and it was hoped that a clearer picture of the effect of language in the study of mathematics would be found.

Zevenbergen (2000) found that a difference exists between home language usage and school language. He found that students' world experience was shaped through language. That the language games of the classroom "register, context, interaction", when similar to that of the home environment, help students participate more effectively and efficiently and be seen as mathematically able. If the language games are not part of the students' social or cultural backgrounds, then subsequent constructions of their success are far more elusive. Without substantial reconstruction of familial habits, effective participation in the mathematics classroom is transitory and intangible, making access to mathematics and success difficult to achieve (Zevenbergen, 2000). This could be an explanation for the poor mathematics results achieved by the low achieving group and so many South African students and requires further investigation.

During the interviews it became clear that, reading in English (the language of teaching in South Africa) however appears to be applicable to mathematics achievement. Reading skill was a problem for the low achieving students and limited their ability to understand, interpret and apply the principles of arithmetic and mathematics in answering the questions in the TIMSS equivalent test.

Parental Education Level:

Parental education level is often linked to students' achievements. This was reported on by researchers in a number of countries, namely Spain, Singapore and Latvia, where the higher the parental education level, the more likely their children were to do well in school (Robitaille and Beaton, 2002). Holland did not report any significant relationship between parental education levels and student achievements, but about 30% of the students did not know their parents' education level (Robitaille and Beaton, 2002). In Romania, students with parents who had higher levels of education, tended to perform better (Robitaille and Beaton, 2002). In South Africa only 15% of grade 8 students reported that either their mothers or their fathers had completed tertiary education (Howie, 1999). The HSRC reported that: "The majority of South African students reported that the highest education level attained by either parent was primary school or secondary school at most." This is supported by the Howie and Hughes (1998) analysis.

Books and Educational Aids in the Home:

The HSRC analysis report stated that almost 60% of students had less than 26 books in their home and 92% had no computer at home. This is supported by the research of Howie and Hughes (1998).

Neither Howie nor Robitaille reported any country as finding that books in the home significantly correlated with the students' mathematics achievements. Latvian students reported the largest number of books at home; this did not correlate to a higher achievement in the international comparison (Robitaille and Beaton, 2002).

Howie and Hughes (1998) focused on three aids in the home, namely a dictionary, a study desk and a computer. It was found that only 5% of students in Iran, Moldavia and Morocco and 8% of students in South Africa, Thailand and Turkey, had all three aids compared with the international average of 41%. However, only in South Africa, was the difference between achievement and having these resources found to be significant (Howie, 1999).

Extramural Time Spent on Studies:

South African students reported spending a great deal of time after school on mathematics yet their achievements were poor compared with most other countries. More than 50% of students in Malaysia, Singapore, Tunisia, Morocco, Korea and Romania spend significant time after school on their studies yet they did achieve significantly high scores in the TIMSS. In contrast, fewer than 20% of students from the Netherlands high achieving students spend significant time after school on their studies (Howie, 1999; Robitaille and Beaton, 2002). Robitaille and Beaton reported that Danish grade 7 students appeared to spend the least time on homework in mathematics, yet performed the best in mathematics in TIMSS (Robitaille and Beaton, 2002).

Attitudes towards Mathematics:

In South Africa 62% of students reported being positive towards mathematics (Howie, 1999), as did a large percentage of students from Kuwait although they did badly compared with most countries (Robitaille and Beaton, 2002,). In Korea 74% of students, and a large percentage of students from Japan and New Zealand did not enjoy doing mathematics (Robitaille and Beaton, 2002). South African students with higher positive attitudes achieved higher scores in mathematics. This same pattern was found internationally, though Japan was an exception (Robitaille and Beaton, 2002). Japan attained the highest standards amongst the surveyed countries, but this high achievement in mathematics is not reflected in student attitudes towards the subject. Relatively few Japanese students reported liking mathematics. "They do not see mathematics as important in their lives and they do not think mathematics will be useful in their future careers" (Robitaille and Beaton, 2002).

Dutch students seemed to have a no-nonsense attitude concerning what is necessary to succeed in mathematics. They reported that good luck and memorising did not help, that natural talent and lots of hard work are the only factors that affect performance (Robitaille and Beaton, 2002). Robitaille and Beaton stated: "90% of students in all countries agreed it was more important to have time to have fun than to do well in mathematics. In Romania only 80% agreed" (Robitaille and Beaton, 2002).

The factors identified in chapter one by the authors of the assessment frameworks (TIMSS Assessment Frameworks, 2003) and my observations over many years of teaching mathematics in KZN, led to my interest in looking deeper into the social factors in a students' life and their relationship to the students' mathematics achievement scores.

The factors identified by Howie and Hughes (1998), those tested in the students' questionnaires, those identified by Robitaille, Beaton and Plomp (2000) and others led me to the questions I have asked and hoped to answer in this research.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter provides an account of how this study was designed and conducted. In describing the research design, emphasis is laid on the method of investigation that was employed, the research instruments used, reasons for choosing them, the size of the sample, the sampling procedure, the method of data collection and the data analysis.

3.2 FOCUS OF THE STUDY

Question 1: How do grade 8 students in one school perform on a TIMSS equivalent test, that is: what is their location in relation to national and international benchmarks?

Question 2: What are the personal and home backgrounds of a selected group of high performing and low performing grade 8 students, who wrote the TIMSS equivalent test?

Question 3:What is the relationship between the high performing and low performing students' mathematics achievements and their backgrounds?

Thus the study sets out to explore what home and prior experiences in the lives of the selected students possibly affected their mathematics achievement score as indicated by the TIMSS equivalent test and their mathematics performance at school. The following questions are asked and hopefully answered:

- Are there common experiences and how are they related, if at all, to the achievement in mathematics?
- What are the implications of this relationship for the teaching and learning of mathematics in grade 8?

3.3 GENERAL METHODOLOGY

The research approach was a case study. However while this is a case study of a group of students in a particular school, life history strategies have been used to construct the lives and backgrounds of the students.

A case study is a particular method of research. A case study method involves a detailed analysis of a person or group, especially as a model of social phenomena (http://www.answers.com/topic/case-study).

The noun 'case study' has two meanings:

1. A careful study of some social unit (as a corporation or division within a corporation) that attempts to determine what factors led to its success or failure.
2. A detailed analysis of a person or group from a social or psychological or medical point of view.

Rather than using large samples, case study methods involve an in depth, longitudinal examination of a single event. The product is a sharpened understanding of why the situation happened as it did, and what might be important to look at more extensively in future research. Case studies generate rather than test hypotheses. (http://encyclopedia.laborlawtalk.com/Case_study.)

There are two parts to this case study namely:

1. Establishing background.
2. Exploring mathematics performance.

Howie and Hughes (1998) identified certain issues in the students' home background and previous experiences from the TIMSS student questionnaires and their effect on their mathematics scores, (these have been discussed in Chapter Two). The authors of the TIMSS assessment frameworks and specifications document (2002) also identified these issues. These issues were used as the basis for interviews with the high performing and low performing students as regards their home environment and their understanding in mathematics.

Initially the idea was to interview students who had actually written the TIMSS 1998 or 2003 test. However this proved impossible, as the students in Durban who wrote the TIMSS test in 1996 were untraceable due to the amount of time that had passed, and the 2002 TIMSS results would only be available in July 2006.

It was thus decided to focus on the home backgrounds and prior experiences of a selected group of grade 8 students from a particular school in Durban, which is demographically representative of schools in South Africa. All the grade 8 students in Ross High School were tested with a set of TIMSS equivalent mathematics questions to see if their results coincided with those of the national norm.

The top achievers and the bottom performers from this group were selected and given the TIMSS student questionnaire to answer.

Then using this questionnaire as the starting point, semi-structured interviews with the selected sample of students were done. The interviews were taped. These semi-structured

interviews gave added information, which was not obtained in the student questionnaires. Thus a deeper investigation showed up criteria, which were not accessible from the student questionnaires where many questions were multiple choice, while others just required a yes or no answer.

The personal life story of each student from childhood to the present day was explored. The background of each student was investigated with respect to: the important care givers in the students' lives, number of books in the home, living space and available study space, number of people residing in the home, the students' responsibilities to the family and chores in the home, computers, calculators, presence of electricity, time available for study, extra mural activities, homework received and achieved, parental involvement and interest, help available from other members of the family and their view of prospects for the future.

Particular attention was paid to the students' memory of learning between the ages of 2 years and 5 years, which was not identified and questioned in the student questionnaires. Thus obtaining a fuller picture and deeper understanding of the student. Language usage and interpretation of mathematics questions were important factors. The students' school background both primary and high, with respect to their experiences in their mathematics classroom were investigated as well as their achievements and attitudes towards mathematics.

Thus by investigating these students' personal backgrounds based on their personal accounts, and relating this to their mathematics achievements in the TIMSS equivalent test, it was hoped that a greater understanding of the effect of home background and prior experience on their understanding, studying and ability to do mathematics would be achieved.

This study is a cumulative case study, which is defined as: having a retrospective focus, collecting information across studies done in the past, or a prospective outlook, structuring a series of investigations for different times in the future, and allows generalisation without unmanageably large numbers of cases in process at any one time.
(http://encyclopedia.laborlawtalk.com/Case_study.)

This case study focused on the students' home backgrounds and was used to assess the effect of home life on mathematics achievement. The methodology was a biographical research approach. Miller (1999), as quoted by Cohen, Manion and Morrison, (2001), and demonstrates that biographical research is a distinctive way of understanding social activity. Miller goes on to outline three main approaches, namely:

- The realist approach, which focuses upon grounded theory techniques;
- The neo-positivist approach, which employs more structured interviews; and
- The narrative approach, which emphasises the use of interplay between interviewer and interviewee, to actively construct life histories.

It is this third approach, which questioned and explored the students' lives at home and at school, which was used in this research project.

Cohen, Manion and Morrison (2001) go on to recommend "in exploring the appropriateness of life history techniques to a particular research project, it is useful to distinguish life histories by type and by mode of presentation." The types and modes are described in a table in Cohen, Manion and Morrison (2001).

The two types of presentation used here: Retrospective life history: which is a reconstruction of past events from the present feelings and interpretations of the individual concerned, and contemporaneous life history: which is a description of an individual's daily life in progress here and now (Cohen, Manion and Morrison, 2001). Thus in effect this study is a cumulative case study which encompasses both retrospective and contemporaneous life histories.

The mode of presentation used was the interpreted and edited mode, in which the researcher's influence is most marked as to his/her version of a subject's life story, which the researcher has sifted, distilled, edited and interpreted (Cohen, Manion and Morrison, 2001).

Thus in this study the following three points of direction for the writing of a life history defined by Plummer (1983), as quoted by Cohen, Manion and Morrison (2001), were used.

Namely:

- Have a clear view of whom you are writing for and what you wish to accomplish by writing the account. Is it a case history or a case study? The case history tells a good story; the case study uses personal information for wider theoretical purposes such as the verification and or generation of a theory.
- Decide how far you should intrude upon your data. Intrusion occurs through editing and interpreting. "Editing involves getting your subject's own words, grasping them from the inside and turning them into a structured, coherent statement that uses the subject's words in places and your

own, as researcher, in others, but retains their authentic meaning at all times."
- The writing of a life history requires much work in drafting, revising and redrafting.

Five research processes are involved as identified by Plummer (1983) and described by Cohen, Manion and Morrison (2001) namely:

Preparation: This involves selecting an appropriate problem and devising relevant research techniques, such as: "Who is the object of the study? What needs clarifying? The motivation needs to be made clear to the intended subject. The issue of anonymity must be addressed, as life histories reveal intimate details and provide scant cover from prying eyes."

Data collection: A variety of interview techniques may be used as the occasion demands. These may range from relatively structured interviews to informal, unstructured conversations or a mixture of participant observation and casual chatting, supplemented by note taking. In this study the interviews were informal, semi-structured (see Appendix E) and casual.

Data storage: Life histories generate enormous amounts of data. The use of a tape recorder is essential. The how, when and what of transcription and editing, and the development of coding and filing, all need to planned in advance to avoid being swamped by the material.

Data analysis: Three central issues underpin the quality of data generated by life history methodology. They have to do with representation, reliability and validity.

Data presentation: Have a clear view of whom you are writing for, and what you wish to accomplish by writing the account. Decide how far you should intrude upon your data. Then after much work in drafting, revising and redrafting, the final work is presented.

In this study preparation was done by firstly researching TIMSS in depth. Then V.J.Reddy from the HSRC was approached and the student questionnaire was obtained. The students to be tested were selected and a TIMSS equivalent test was found. The students to be interviewed were identified and letters were sent to their carers to address the issue of anonymity.

Mathematics data was collected by giving the Ross High School students the TIMSS equivalent test to do. The high performing and low performing students wrote the student questionnaire obtained from the HSRC. Semi-structured interviews were done

with these high performing and low performing students selected. The students' school records were accessed and used to gain greater insight into their lives.

Data was stored by filing the written tests, questionnaires and student records. The interviews were taped transcribed and summarised.

The data was then analysed using all the data collected and stored.

3.4 DESIGN OF THE STUDY

From the literature review it was discovered that although there had been a student questionnaire used for each TIMSS study, which asked questions about family and home life, students' backgrounds, opinions and attitudes to mathematics and science and their activities in and out of school, the questionnaire phrased most of the questions using multiple choice, or yes and no questions and was thus very superficial. Howie (1999), as well as the authors of the TIMSS assessment frameworks and specifications document (2002), had identified certain issues in the students' home background and previous experience from their answers to the questionnaires, as affecting their mathematics scores in TIMSS. However, these analyses did not explore the lives of the students in greater depth.

A more in depth study through actual interviews would be appropriate as there was a lot more information regarding grade eights in the TIMSS studies, which needed clarification, such as the realities of their home and personal backgrounds as experienced by he students. The student questionnaire was too simplified and the information limited. For example the questionnaire assumed that all students live with both parents in the home. It also assumed that the caregivers are always the parents. However this was found not to be a true reflection of the Ross High School students' realities.

Not being able to use the students from the TIMSS study, the grade 8 students at Ross High School in Durban, where I teach were sampled. Also being unable to receive a set of questions from the original TIMSS questionnaires, a set of TIMSS mathematics questions was downloaded from the Internet. There were 85 mathematics questions with answers. It was a daunting task to select 25 questions to be answered in 90 minutes and ensure that it would emulate the original TIMSS questionnaire. This was because the original tests were set out in nine booklets and the questions in each booklet were not identical. Also the booklets contained a mixture of mathematics and science questions. Thus it was a difficult task to choose questions

correctly varied and at the same time ensure the reliability of creating a test as close to the real test as possible.
http://www.enc.org/topics/assessment/timss/online/test/

To assist in the process, a website, Edinformatics, which gave a full set of 25 mathematics questions closely simulating the TIMSS test was found. On investigation this test used mathematics questions reliably similar to the format of the tests used in the original TIMSS. The site was:
http://www.edinformatics.com/timss/advmth.htm

The author of this set of questions Dr Marvin Rich used this test as an equivalent TIMSS test. He had used TIMSS mathematics questions and answers from the Internet to formulate the test and the marking and answers were as close as possible to that of the original TIMSS. The selection of questions was also very well balanced with the division of questions into numbers, algebra, measurement and data handling being consistent with that used in the TIMSS. The test could be done on line and marked right away.

Thus this set of TIMSS equivalent mathematics questions was used to test the entire group of grade eight learners, as this would be a link between the TIMSS student questionnaire, and the school mathematics achievements of each student. The top achiever group and the bottom failure group of students were selected, as the study group for the interviews.

3.5 THE RESEARCH PROCESS

3.5.1 The TIMSS mathematics equivalent test:

The TIMSS mathematics equivalent test (see appendix A) was used to answer the following question: How do grade 8 students in one school perform on a TIMSS equivalent test, that is: what is their location in relation to national and international benchmarks?

Permission from Dr. Marvin Rich for the use of his test was granted. The questionnaire was downloaded and two hundred copies for Ross High School grade eight learners were made. With the headmaster's approval, a date was set for the mathematics staff at the high school to do the testing. This took place in the three large testing venues. The grade 8's were split alphabetically into three groups of approximately 70 students each.

The staff members gave their permission for the mathematics department to use two consecutive one-hour lessons for the testing of the entire group of grade 8 students. This required

assistance from ten educators who should have been teaching the grade eights at that time, taking over the classes of the mathematics teachers who would then be involved in the testing venues. I greatly appreciate the help I was given on this occasion. I was not present at the testing venues to ensure consistency in administration of the test.

As it turned out, 186 students wrote the test in May 2004. Each student was given his/her school registration number as a reference number on the test paper, so that marking would be done using student numbers only.

The answered questionnaires were then, one by one, uploaded onto Rich's website. Each questionnaire was marked as the final answer was uploaded and the mark recorded on the answered questionnaire. Rich then helped analyse the results by producing a bar graph of the total results, this is detailed in chapter four.

From the test scores the high performing six students and the lowest performing six students were chosen and their reference numbers sent to Rich, who then organised the bar graphs of those quantitative analyses (See Chapter 4).

3.5.2 The life stories:

The life stories set out to answer the question: what are the personal and home backgrounds of a selected group of high performing and low performing grade 8 students, who wrote the TIMSS equivalent test?

The High Performing Students are: Nkosi Gumede, Asanda Zondi, Eric Govender, Carol Els, Phili Ngcobo and Siphiwe Mkhize[5].

The Low Performing Students are: Sabelo Lambethe, Phila Ngonyama, Sina Nthedi, Nqobile Mafunda, Siyathemba Msabala and Nomvula Ndawonde.

These twelve students were approached and a meeting was organised with them. At this meeting a detailed explanation was given to them as to what the interviews were to be about and what would be required of them. Their permission to proceed was then obtained. They all agreed to take part in the research.

A letter was sent to each of the students' families requesting permission to interview their son or daughter. In the letter confidentiality was assured, an explanation of the research project was outlined and the parent(s)/ guardian(s) of each child

[5] All names in the study have been changed to ensure confidentiality.

confidentiality was assured, an explanation of the research project was outlined and the parent(s)/ guardian(s) of each child were asked to sign the letter, giving their permission to proceed with the interviews. (Appendix C). While waiting for the replies from the parents, permission was received from Dr Reddy to use the original student questionnaire from TIMSS (Appendix B), as the initial questionnaire in finding out about the students' home lives.

Having received permission from all the parents, I met with the twelve students, during a school break, and administered the student questionnaire. This was answered immediately and handed back to me. Their answers on the student questionnaire were used as the focal points for the interviews, together with certain questions selected from Rich's TIMSS equivalent mathematics questionnaire and questions singled out by Howie (1999) (Appendix D). The questions in the student questionnaires (Appendix B) were thus expanded upon during the interviews. Questions were asked, dealing in detail with the students' personal and home backgrounds and their performance in specific mathematics items from TIMSS and the TIMSS equivalent test (Appendix D), to find out in greater depth about each students' home life, interests and achievements in mathematics. This is written up in chapter five and analysed in chapter six.

Family and home life, books in the home, students' backgrounds, opinions and attitudes to mathematics and their activities in and out of school as stressed by Howie (1999), as well as statements on these issues made by Robitaille and Beaton (2002), were also focused upon, to see if they were verified by this research. Family issues, such as the early life of the students, which had not been closely evaluated in the questionnaire, were also queried to see if they showed any significance.

A private interview date with each student, to be held during school in a classroom, was arranged. Each interview was taped, thus ensuring verbatim transcription and analysis. It took six months to complete the interviews, because of many problems. Students could only be interviewed during school hours as they have to leave school at the end of lessons due to transport difficulties and home responsibilities. Often the students were absent on the dates set for their interviews and it would take a week, sometimes longer, to find them and arrange new interview dates. Another problem was trying to match free time together so that no lessons were affected by the interviews. In many instances the noise of the students in the school was so great that we were unable to proceed with the interviews and had to postpone the meetings until quieter times could be found. On the whole, the interviews went off smoothly and all the information was obtained in one sitting with each student. However, there was

a problem with Nqobile Mafunda, who broke down in tears during the interview and so her interview took place over two consecutive days.

Copies were made of the students' grade 7 report cards, as well as copies of their grade 8 report cards for each term. Extra information on the parents was obtained from the students' school registration forms, which helped to provide a clearer picture of each student's parental and family structure as well as information on any problems requiring sensitivity.

All the data for each student was then analysed to see, firstly, whether they supported the statements made by Howie (1999), Robitaille and Beaton (2002), and whether any other factors of real value, which should be considered in future studies, could be discerned. This data was then represented as a life history for each student as found in chapter five, the factors in each student's home environment were scrutinised as to their value, when a) assessing the student, and b) when judging their progress and performance in mathematics thus exploring the relationship between the mathematics performance of the high and low performing groups and their personal and home backgrounds.

3.6 VALIDITY and RELIABILITY

The validity and reliability of the TIMSS equivalent test have been evaluated many times on Rich's website.

The validity and reliability of the student questionnaire is also acceptable, as Howie and Hughes (1998), as well as Robitaille, Beaton and Plomp, (2000), have utilized this nationally and internationally.

The validity of the narrative approach with its emphasis on using the interplay between interviewer and interviewee to actively construct life histories is described by Miller (1999) as quoted by Cohen, Manion and Morrison, (2001). Cohen, Manion and Morrison (2001) go on to recommend "in exploring the appropriateness of life history techniques to a particular research project, it is useful to distinguish life histories by type and by mode of presentation."

Triangulation using multiple data sources such as interviews, report cards, school entrance forms, school mathematics tests, the TIMSS equivalent test and student questionnaires validate and ensure reliability of the findings.

The type of life history used, is contemporaneous life history, which is defined as a description of an individual's daily life in progress here and now. The mode used is the interpreted and

edited life history where the researcher's influence is most marked in his/her version of a subject's life story which the researcher has sifted, distilled, edited and interpreted. Their use in this project is validated by Cohen, Manion and Morrison (2001) and supported by their descriptions.

The reliability of the case histories in this study is supported by Miller (1999), as cited by Cohen, Manion and Morrison, (2001), who demonstrates that biographical research is a distinctive way of understanding social activity.

3.7 LIMITATIONS OF THE STUDY

This study had many limitations:

There was the difficulty encountered in arranging and meeting with the interviewees. The interviews could not be done after school as most of the students had too far to travel and their responsibilities at home required that they reach home at the normal time. Also the students travelled on student season tickets and these are not valid at rush hour. Most of the students at Ross High School leave school at half past two in order to ensure that they travel on the special buses which have been organized to ensure they arrive home safely. This was particularly so for those students interviewed, who live in Umlazi and Kwa Mashu .

Many of the students' home situations have changed since the mathematics test was done. This was true for Asanda who lost her mother in 2004, six months after her interview. As only one interview was done and the study took so long to complete, others lives were also changed and their mathematics also possibly affected by the change. Nkosi Gumede left Ross High School at the end of 2004 and the changes to his home life may have created changes in his mathematics achievement too.

The TIMSS equivalent test used was not an original test. Especially the fact that science and mathematics questions were mixed in the original TIMSS questionnaires would have affected the results of those students who wrote that test. Thus the results achieved by the students of this study although closely resembling that achieved in the TIMSS studies would not have been affected in this way.

The fact that I am an educator at the school and also taught some of the interviewees could have intimidated them. As a result the students may have censored or not revealed facts that they may have been ashamed of. Also as I could not communicate with the interviewees in Zulu they were placed at a disadvantage in explaining their home and personal backgrounds in English. Thus

they would have been able to describe if interviewed in their home language.

The students may have felt shy or awkward telling about a poor home situation, especially as I am white and male and they may have felt that I would judge them. They also made it very clear to me that it was not safe for me to visit their homes. However they may not have wanted me to visit them at home for fear of judgment. The students' reports about their home background and environment may have been embellished to hide facts they did not want known.

Many of the students may not have known important factors that impact on their lives and which may affect their relationships within their families and thus their self-confidence. The stories were told from a child's perspective which would limit understanding of the total effect of home environment.

What has been taken as data, are the students' reported accounts as indications and descriptions of their home backgrounds, triangulated with school records rather than actual home visits. This however allows the students' voice and perspective to be respected in this study.

The students could have been questioned as to what they were thinking whilst answering the mathematics questions as well as the interview questions. This may have created some very useful data not achieved in this study as it is.

There are certain problems related to the use of Rich's results in that not all the information is available about this test, such as: age of respondents, and the validity and reliability measure used.

3.8 CONCLUSION

In this chapter explanations on the research methodology and procedures have been given. The data collection instrument, questionnaires and procedures for data collection were thoroughly dealt with. Finally the chapter concluded with a consideration of the validity, the reliability and some limitations of the study.

CHAPTER FOUR

THE MATHEMATICS PERFORMANCE OF GRADE 8 STUDENTS ATTENDING ONE SCHOOL

4.1 INTRODUCTION

This chapter addresses the first key question describing the Ross High School students' performance in mathematics. The instruments are the TIMSS equivalent test and their school mathematics performance. It also provides a means for the selection of students to be interviewed for an in depth exploration of their backgrounds.

The TIMSS questions and thus the TIMSS equivalent test questions required a lot of reading and were mainly multiple-choice. This is a format, which is unfamiliar in mathematics assessments to most South African students, including the Ross High students, and is infrequently used in teaching and testing.

The Ross High School students are more familiar with the questioning approach used in South African schools and examinations where problems are stated directly and word problems are done as a special section. The types of question most frequently used in the school are:
Calculate: $2\frac{1}{2}$ of $(4\frac{3}{4} - 1\frac{5}{8}) \div \frac{1}{8}$
Simplify: $2x^2y - x^3y^2\ x - 2xy$
Add: $5 + x - 2x^2$; $2x - 3 + 4x^2$ and $x^2 - 4x + 1$
Subtract: $3x^2 + 4y^2 - 3xy$ from $4x^2 - 7xy - 7y^2$

Geometry forms a large part of the grade 8 curriculum in South Africa, whereas there were very few familiar geometry questions in the TIMSS equivalent test. The grade eights cope better with geometry in their school curriculum, than they do in algebra, and often improve their achieved results when answering geometry questions. The format of the geometry questions, as measurement in the TIMSS equivalent test, being unfamiliar and wordy, created problems for the students thus, their ability to use what they knew to answer the questions and display their knowledge was compromised.

Although the TIMSS equivalent test was an unfamiliar format for most of the students at Ross High School, it was an international test and the TIMSS research had looked at home environment as one of its main criteria for achievements or lack thereof. Thus there was a level of comparison, which was useful for this research.

The students' TIMSS equivalent test mathematics achievement, would be useful as a means of comparison, as the South African

students on the whole appear to cope with mathematics when the questions are done in a familiar format, and the students at Ross High are no exception. Thus a comparison between the two types of testing would create a link with the students at Ross High School, their home environments and those of the national and international students who wrote the original TIMSS test.

4.2 TWO INSTRUMENTS TO SHOW THE ACHIEVEMENTS AND DIFFERENCES IN MATHEMATICS RESULTS

A: THE TIMSS EQUIVALENT TEST RESULTS

Altogether 186 grade eight students from five classes at a High School in Durban wrote Rich's TIMSS equivalent test. Below is a table of their results:

The Number Of Students Who Wrote The Test And The Percentage Results Achieved:

%	90	80	70	60	50	40	30	20	10
Number of students	0	0	2	2	6	20	48	83	25

The average percentage achieved was 29%. This is very close to the South African average score achieved in the actual TIMSS tests. Four students were absent from the test and thus there are no results for them. The format of this test was mainly multiple-choice and the questions were phrased as word problems. Having to read a map and graphs, interpret long wordy questions and unfamiliar diagrams, was a new and unfamiliar way of approaching mathematics for most of these students. Thus causing them to struggle not only with the mathematics but with language of the questions and interpretation of the complex wording which was unfamiliar to them.

B: THE ROSS HIGH SCHOOL MATHEMATICS END OF YEAR RESULTS.

The same 186 grade 8 students in 2004 achieved an end of year average for mathematics at Ross High School of 49%. The table below shows their percentages achieved.

The Number Of Students Who Wrote The Test And The Percentage Results Achieved:

%	90	80	70	60	50	40	30	20	10
Number of students	0	2	12	19	46	69	28	10	0

Their June average for 2005 was 47%. Thus the grade eights appear to have achieved a far higher result when doing mathematics where the questions are set out using terminology familiar to them, such as solve, determine, calculate, followed by the problem written in numbers and mathematical symbols only. They had practiced this format in the classroom over and over again. Also in these tests there was a considerable amount of geometry. The students are used to answering geometry questions where they just repeat a theorem learnt by rote. Also the geometry was tested simply using diagrams and letters representing angles. The students had to find the measure of the angle using a protractor, or by comparing the angle with another given angle find the measure of the unknown angle and give a reason for their answer based on theorems learnt. (This is a subject worth exploring in another paper). These differences could be one major cause for the discrepancy in the achieved results of the two types of tests.

Below is an analysis of the mathematics questions asked in the TIMSS equivalent test supported by a graphical analysis as well as comments from the students who were interviewed.

4.3 ANALYSIS OF THE TIMSS MATHEMATICS EQUIVALENT TEST (See Appendix A for the questions)

The TIMSS equivalent test was analysed to answer the questions: How do grade 8 students in one school perform on a TIMSS equivalent test? How do their results in the TIMSS equivalent test compare with those they obtain in their school tests and what factors in the questions were problematic? What questions were similar to those offered in the school tests? Was language/concept competence a problem?

There were 25 questions in the TIMSS mathematics equivalent test, which was answered in two hours and 15 minutes. This gave the students five minutes for each question and ten minutes to read the paper.

The answers of each student's paper were uploaded and marked on the Internet, the scores were recorded by Rich, and presented in the form of a graph (see Graph 2 at the end of this chapter). Rich included a graph (see Graph 1) which represented the achievements of those students who had answered his paper online on the Internet. This group is demographically unknown but as Rich's test is freely available online the students are certainly international. As the numbers in this graph are large it gives a good benchmark with which to compare the Ross High students' achievements. The graphs have an anomaly which Rich could not remove. There is a discrepancy in the numbers where

the computer added an extra number to each column in the bar graphs, this must be taken into account when reading the graphs.

The questions were set out in an outcomes based format and can thus be analysed under four content areas, namely: Fractions and Number Sense, Algebra, Measurement, and Data Handling.

The results of the 1995 analysis reveal that countries that did well on the mathematics test overall did well in each of the content areas. It was found that data representation, analysis and probability were the least difficult area for the grade 8's while proportionality was the most difficult (Howie, 1997).

Here below is an analysis of the TIMSS equivalent mathematics test using the same content areas.

4.3.1 FRACTIONS AND NUMBER SENSE.

For this topic Howie (1999) found 61 items relating to fractions and number sense included in the TIMSS-R mathematics assessment. South African pupils achieved significantly lower scores (300) than all the other countries. The two other African countries that wrote the test achieved higher results, Tunisia (443) and Morocco (335). The top countries were Singapore (608), The Netherlands (545), Canada (533), Malaysia (532). The international average was 487 out of a possible 800, way above the South African achievement.

The importance of arithmetic and the stress traditionally placed upon it meant that many items were thought appropriate for all students. Questions 2 and 3 below were thought to be two such questions. However it was found that in the actual TIMSS there were significant differences in the emphasis given to teaching fractions and operations on them (Robitaille and Beaton, 2002).

Question 3 below tested an understanding of the magnitude of the result of the division, an appreciation of which is particularly valuable for calculator use. This question tested the position of the comma as well as division. The international average on this item was 44% while the South African students scored 23% (Cronje, 1998). The range of percentage correct responses of grade 8 students was great: Japan 71% and France 70% to England's 18.6% and the Netherlands 34.4% (Robitaille and Beaton, 2002).

QUESTION 2:

Divide 8/35 ÷ 4/15

Answers: A) 1/2 B) 6/7 C) 32/525 D 7/6

QUESTION 3:

Divide 0.004 | 24.56

No multiple - choice answers were given for this question

Of Rich's international group approximately 70% answered question two correctly and approximately 50% answered question three correctly. From the Ross High grade 8 whole group graph approximately 25% of the students answered question three correctly and 35% answered question two correctly. Of the interview group all of the top group answered question three correctly. Three of them answered question two correctly. From the bottom group none of the students answered questions two and three correctly. Yet both these questions contain primary school work and a familiar format.

Questions two and three were of the format the students were used to, straightforward problems to be calculated. However on questioning them Sabelo, Phila, Asanda, Carol, Sina, Nqobile, Siyathemba and Nomvula all admitted that they did not know how to do long division (question three). They also admitted to finding fractions difficult to read and conceptualise (question two). This was also found to be an international problem (Cronje, 1998). They do not see the numerator and denominator as different, nor do they see the division line of the fraction as having any significance. They thus just see numbers in a row. All the students in the low performing group were able to demonstrate an understanding of the concept of fractions when asked to cut a cake or a loaf of bread. However when presented with a written fraction such as ¼ they did not see this as a fourth part of a whole, instead they saw the number one and the number four as separate numbers. This was supported by Howie(1999) who states "that there is a misconception that the smaller the denominator the smaller the fraction".

Given the multiple-choice answers in question two the low performing group found it easier to guess the answer. Sabelo, when asked, "How did you answer this mathematics question?" answered, "It was hard, I didn't even think, I just guessed." Phila also stated that he just guessed the answer, that he read the question but did not understand the fractions. Neither student used any method in guessing the answers, which were, selected

randomly. Cronje (1998) also found that many students guessed the answers to the multiple-choice questions. The problem of fractions is one frequently encountered amongst the Ross High School students.

QUESTION 6:

Two groups of tourists each have 60people. If 3/4 of the first group and 2/3 of the second group board buses to travel to a museum, how many more people in the first group board buses than in the second group? The correct answer is 5.

The graph (Graph 4) incorrectly shows that one of the low performing group answered this question correctly, this was a result of the problem Rich encountered when producing the graphs. This question was a wordy calculation question with no multiple choices. It also involved fractions, reading and interpretation as well as calculation. When questioned in the interviews none of the students in the low achieving group understood the question and none could answer it even after some in depth explanation. Nomvula wrote the following when asked during the interview to answer this question: ¾ = 19 ⅔ = 26 60 – 4 60 – 18 = 42 42 – 26 = 16. Thus she gave the answer as 16.Only Carol from the top group incorrectly answered this question. She gave the answer as 10. She did not understand the question and was unable to understand what was required from the fractions. In Rich's group less than 50% were able to answer this question, while in the Ross High group 34% answered it correctly.

QUESTION 10:

What is the ratio of the length of a side of a square to its perimeter?

A) 1:1
B) 1:2
C) 1:3
D) 1:4

Question 10 is a simple ratio question. 57% of Marvin's group answered this question correctly, 43% from the Ross High group also did so. Carol was the only student from the high performing group who answered the question incorrectly. "I just kind of like remember previously when I did homework and class work, these seemed a bit more difficult and complicated." From the low performing group Sabelo and Siyathemba answered this question correctly. In the interview Sabelo admitted to guessing the answers to the multiple choice questions as he says, "They (the

questions) were hard I didn't even think." Siyathemba understood the question and answered it correctly.

QUESTION 17:

In a bag of cards 1/6 are green, 1/12 are yellow, 1/2 are white and 1/4 are blue. If someone takes a card from the bag without looking, which color is it most likely to be?

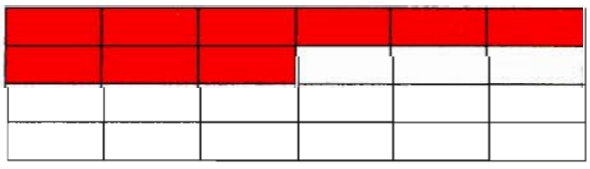
Answers: A) White B) Blue C) Green D) Yellow

This is also a fraction question, which required students to read the question carefully and then choose the colour based on frequency. Thus they had to correctly deduce which fraction of cards was the largest.

Of Marvin's international group approximately 60% answered this question correctly. Of the Ross High School grade 8's, approximately 40% answered it correctly. From the high performing group all the students answered this question correctly, however from the low performing group none of the students did. They just looked at the fractions and to most of them 1/12 is the largest fraction so they chose yellow as the answer. Thus they do not understand the fraction as it is written. To them 12 is the largest number and the fact that it is a denominator is not conceptualised. They do not see the numerator and denominator as having special significance. They ignore the division line and read the numbers as if following one after the other. Thus Phila read the fractions as a list of numbers "1, 6, 1, 12, 1, 2, 1, 4." This was found to be true for many South African students (Howie, 1999).

I took a question from Howie's book TIMSS – R 1999 page 29 on fractions and numbers sense, which states: **Shade in 3/8 of the unit square in the grid**, and gave it to my interviewees to answer to test their conceptions of fractions practically.

The correct answer is as illustrated below:



This item required students to shade squares in the grid to represent the given fraction.

Of the high performing group Nkosi, Asanda and Eric could answer the question. Carol could find half the squares but she

could not shade in 3/8's. Phili shaded in three squares only as she read the 3 and took no cognisance of the eight. Siphiwe stated: "counts one, two three, four, five, six, no ish, one, two, three, four rows and there are six blocks".

None of the low performing group could answer this question. Sabelo said, "Shade in ....I must shade eight or three?" Sina coloured in three squares as did Nqobile. Nomvula stated, "3/8's I really don't know".

On further exploration the students had a problem understanding what 3/8 actually meant, even with a concrete diagram to fill in. Those who could not answer the question did not know to count the blocks and to work out how many constituted three eighths. Those who could answer the question knew what the fraction meant, were able to work out how many blocks made one eighth and then to multiply by three to find out the number of squares to fill in.

Howie (1999) states that 49% of international students could answer this question, which corresponds to the statistics achieved by the high performing group. Only 9% of South African students could answer this question, which is very similar to the result achieved by the low performing group. 44% shaded three squares only (using only the numerator) this was also the most common response amongst the low performing students. Howie (1999) in her analysis found that 8% shaded 11 squares (they added the numerator and denominator together).

The question had to be clearly explained to all the students in the selected group before they could answer it. The word "grid" had to be demonstrated and clarified, this was also found to be so by Howie (1999).

Multiple-choice questions 15, 21, 24 and 25 are also number questions of varying difficulty which required a great deal of reading and understanding. They were all well answered by the high performers and Rich's group. The Ross High School group fared badly in answering these questions and this is reflected in their poor overall TIMSS score. Thus there is an indication here that reading and language interpretation created problems for the students when trying to answer these questions. This is especially so in view of the fact that when given number calculations directly, the students cope with the numeracy. This being reflected in their higher school mathematics achievements. Again the question arises: Is it the poor literacy, which affects the mathematics results? These questions indicate that the answer to this question is, yes.

Generally internationally as well as in South Africa the performance on items requiring a bit of number sense was poor (Cronje, 1998).

4.3.2 ALGEBRA

QUESTION 14:

Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has?

A) 5 – 3n
B) 3n
C) n – 5
D) 3n – 5
E) 3(n – 5)

On the whole this question was poorly answered although all the high achieving students were able to answer it correctly. From the low performing group Sabelo and Sina chose B as their answer. In the interviews it was unclear why they did so. Nqobile, Siyathemba and Nomvula selected A as the answer. They followed the numbers and letter as set out in the question, 5 then 3 then n. 41% of Rich's group were able to answer this question correctly. 17% of the Ross High School group answered this question correctly.

This is a word problem and for most of the Ross High School learners too complicated. They had never dealt with this type of word problem in their school lessons. At the time of answering this test this type of question was taught for the first time in grade 10.

QUESTION 16:

Which of these is equal to y^3?

A) y + y + y
B) y x y x y
C) 3y
D) y^2 + y

Four students from the high performing group were able to answer this question. Carol and Sabelo chose A as the answer. They read the three as a number and not as an exponent. Rich's group found this question difficult to answer, only 57% answered it correctly. The majority of Ross High School students did not answer this algebra question correctly. None of the low performing group could answer this question. Sabelo, Phili and

Nomvula also chose A as the answer. Sina and Nqobile chose C as their answer by reading the exponent as a number and interpreting the cube to mean 3 multiplied by y.

Table representing the percentage number of students who answered each question correctly.

	Rich's Group	Ross High School Group	High Performing Group	Low Performing Group
Question 11	50%	54%	66,6%	0|%
Question 12	40%	20%	16,6%	0%
Question 13	37%	34%	33,3%	0%

Questions 11, 12 and 13 are also algebra questions.

Question 11 used complex words like "represents" and "equivalent" which confused the students, as the students should have recognised the connection between m+m+m+m and the multiple-choice answer B (4m). This is a question they have seen many times before in question papers set by the educators at Ross High School.

Question 12 required students' understanding of the term "consecutive whole number". They then had to connect this to the letter n. Finally they had to read the four answers, understand them and connect this understanding to what they understand about n in the question. The low percentage achievers in Rich's group, the Ross High School group and the high performing group indicate the high level of difficulty this question posed for most of the students. As Carol states, "..these ones seemed a bit more difficult (compared to the school questions), complicated" yet she was the only student from the high performing group who answered question 12 correctly.

Question 13 was also difficult. Robitaille and Beaton (2002) felt this question was poorly worded, but not untypical of what can be found in texts and tests. Not only did it require algebra understanding, but the student had to find the relationship between x and y from the table given and then find the missing y value. The Ross High School students had never studied algebra in this way and thus the question posed a major problem for most of them as seen by the low number of students able to answer this question correctly.

This begs the question: Is this a reflection of algebra understanding in general or were the words in the TIMSS

equivalent test too complicated? From the interviews it appears that the wordiness of the questions was a major problem. Sabelo felt the way the questions were asked was a problem, he says, "...these are tricky questions which a person like me wouldn't understand".

4.3.3 MEASUREMENT

QUESTION 4:

One centimetre on the map represents 8 kilometers on the land.

(The map can be seen in the question paper in appendix A).

About how far apart are Oxford and Smithville on the land?

Answers: A) 4km B) 16km C) 35km D) 50km

Question 4 was well answered by Rich's group and the high achieving group, however it was poorly answered by the majority of the Ross High School group, who had not previously encountered map reading either in mathematics or geography. There was no evidence to show that names of the two towns were a problem in the interpretation of the question. The students did not connect this map with reality and thus to them the names of the towns could have been in South Africa.

QUESTION 7:

A quadrilateral MUST be a parallelogram if it has

A) one pair of adjacent sides equal.
B) one pair of parallel sides.
C) a diagonal as axis of symmetry.
D) two adjacent angles equal.
E) two pairs of parallel sides.

Question 7 is a geometry question. Sina was the only student from the low performing group who answered this question correctly although this work had been studied quite recently. Five students from the high performing group knew the answer. 50% of Marvin's group answered this question correctly, while 48% of the Ross High School students were able to answer this question. Geometry appears to be fairly well understood by most Ross High School students but the wordiness of this question was an unfamiliar format for most of them. They are more familiar with geometry questions using a diagram to demonstrate what a parallelogram is. It was noticeable internationally that this

question required maturity, the Netherlands students had not been prepared for a question of this nature (Robitaille and Beaton, 2002).

Questions 9, 19, 20, 22 and 23 are measurement questions. These questions were poorly answered by a large majority of Rich's students and the Ross High School students.

Table representing the percentage number of students who answered each question correctly.

	Rich's Group	Ross High School Group	High Performing Group	Low Performing Group
9	44%	16%	100%	0%
19	32%	9%	100%	0%
20	61%	50%	100%	0%
22	35%	24%	66,6%	0%
23	32%	4%	0%	0%

In question nine the word "trapezoid" was unfamiliar to many students as indicated by Sabelo in his interview. Also the complexity of this question, which required students both to rotate and reflect triangles mentally, proved too much for many (Robitaille and Beaton, 2002). In A similar question from the TIMSS 1998 the international average was 75% correct while South African grade 8 students achieved 20% success. The ability to see the triangles in the trapezoid is a difficulty for many students in South Africa.

Question 19 had to be calculated. The students also had to change the litres to millilitres which has been found to be a problem for many of the Ross High School students in answering similar school based questions.

Question 20 required the interpretation of a diagram and interpreting the lines on the clock face, as well as identifying that it was from the diagram that the weight had to be read. Thus it required skills which the students from Ross High School would not have dealt with in mathematics. Cronje(1998) states that this level of mathematics is not normally associated with grade8 mathematics. The international performance for this question was 87% and for the South African students 52%, very close to that achieved by the Ross High School students.

In question 22 Eric and Carol only measured the length of the pencil next to the ruler, they did not take into account the sharpened point of the pencil. Thus they did not understand that the whole pencil had to be measured.

Although practical measurement is not dealt with in the grade 8 South African mathematics syllabus at present and the students may have been placed at a disadvantage here, the fact that the high performing group did extremely well in all but question 23 indicates that they were able to interpret the questions clearly and that their retention of work on measurement done in the lower grades was shown. An explanation of Rich's results would have to be further explored as most of his students were American and their backgrounds are unknown.

QUESTION 23:

The length of a rectangle is 6cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimetres?

Question 23 was a word problem. The answer had to be found doing two calculations. The students had to interpret the facts they were given, find the breadth of the rectangle using the formula for perimeter. Then calculate the area using the given length, the calculated breadth and the formula for area. None of high achievers or the low performers answered this question correctly. There were no multiple–choice answers for the students to use as guides. In the interviews understanding and recall of the terms perimeter, area and the equations required were not known or remembered by the students, thus their inability to do this question. Calculation questions requiring multiple operations appear to confuse the students and affects their showing of mathematics ability.

In a similar question analysed by Howie (1999) 43% of international students answered correctly, while just 4% of South African students answered correctly. Thus Howie (1999) felt that South African students had problems with the conception of area and 91% made calculation mistakes and provided wrong answers. In contrast 83% of Singapore's students gave the correct answer.

4.3.4 DATA REPRESENTATION, ANALYSIS AND PROBABILITY

QUESTION 1:

Prabhu had $5 to buy milk, bread and eggs. When he got to the shop he found that the prices were those shown below:

Milk: $1,50 Eggs: $1,29 Bread: $1,44

At which of these times would it make sense to use estimates rather than exact numbers?

A) When the clerk counted Prabhu's change.

B) When the clerk entered each amount into the cash register
C) When Prabhu was told how much he owed
D) When Prabhu tried to decide whether $5 was enough money

This is a multi-step word problem involving decimals, requiring students to read the question thoroughly, estimate and select relevant information. This was a difficult question for a first question.

However 70% of Rich's group of students answered this question correctly. 50% of the Ross High School grade 8 students answered it correctly. Thus this question, which is practical and applies to a real life situation with which the students are very familiar, they were able to do. Four of the six high performing students were able to answer this question. The two who were unable to do so were Nkosi and Siphiwe. Nkosi felt that Prabhu could also have had to do an estimation when he found out how much he owed to ensure that he had enough funds. He did not see that the next answer more clearly stated this. Siphiwe's problem was difficulty with reading so much wordiness. None of the low performers were able to answer this question. They had difficulty in reading wordy English questions. When Sabelo was asked what he found difficult about the questions his answer was, "the way they asked". This too was a problem for Phili. The use of the dollar sign instead of the Rand sign was not a problem for the students. They recognised that the figures were monetary and they were all familiar with dollars from the magazines they read.

Another analysing, calculating and approximating problem was question five.

QUESTION 5:

Last year there were 1172 students at Beaton High School. This year there are 15 percent more students than last year. Approximately how many students are at Beaton High School this year?

Answers:
A) 1800
B) 1600
C) 1500
D) 1400
E) 1200

43% of Rich's students were able to answer this question. 50% of the high performing group were able to answer this question correctly. However none of the low performing group could do

so. The reading and interpreting of the question was too difficult for those students who are weak in English. Thus this question was exceedingly difficult for most students. The way the question was stated could have been a problem. This question required a calculation of 15% and then an approximation. The students' found this dual step to be beyond their understanding. They had to understand percentage and the term "approximately". They had to first calculate percentage and this was difficult as they had little experience using percentage in grade 8.

Howie describes a similar question in the TIMSS-R 1999 study on page 34. Only 24% of the South African students were able to answer the complex question.

QUESTION 8:

Which of the following are most likely to be the co-ordinates of point P?

(The graph drawn here can be seen in the question paper see appendix B.)

A) (8, 12)
B) (8, 8)
C) (12, 8)
D) (12, 12)

Most countries now seem to place considerable emphasis on helping students to exhibit data graphically and to interpret data represented in this way. The major problem here is when to introduce such work and to what extent students will simply pick up the rudiments of the topic in other curricula or from the media. Robitaille and Beaton (2002) found that the results appear to indicate that understanding comes as much from increased maturity and an increased exposure to outside influences, as from teaching.

All the students in the high achieving group answered this question correctly, while none of the low performers could do so. 56% of Rich's group and 44% of the Ross High School students answered this question correctly. This was an interesting result as only one class at Ross High School had studied graph questions of this type and five of the high performing group were in that class while none of the low performing group were. Thus it is important that the curriculum is taken into account when test questions are given to students to answer.

Question 18 also asks for the reading and interpretation of a graph. The graph is further complicated as it is parabolic and not a straight line. This type of graph is totally unfamiliar to the

Ross High grade 8 students who had dealt only with straight-line graphs. The question also required the students to read from the graph after extending the line on the graph which they would not have known to do.

38% of Rich's group and 30% of the Ross High School group answered the question correctly. Only Eric was able to answer the question from those interviewed. He extends himself with extra mathematics and works constantly from the textbook, doing a great deal more than is required of him. Thus he had studied this type of question in his exploration.

Howie (1999) concluded that the overall performance of South African students in mathematics appears dismal. She goes on to state that the evidence is overwhelming concerning students' ability to communicate their answers in the language of the test and their lack of basic mathematics knowledge expected at the Grade 8 level.

4.4 GRAPHS OF THE TIMSS MATHEMATICS EQUIVALENT TEST RESULTS (See below)

Graph 1 shows the overall results achieved by those who wrote Rich's test on line. They come from many states in the USA and from other countries.

Graph 2 shows the overall achievements in each question of the grade 8 Ross High School group. The disparity in the numbers in each graph is due to the fact that the students did not answer all the questions, and the computer programme inserted an extra result into each column, which could not be corrected.

Graph 3 is the graph showing the achievements of the high performers selected to be interviewed. The extra number in the totals is due to the problem encountered when the graphs were drawn.

Graph 4 shows the achievements of the low performing group chosen for the interviews. As can be seen from this graph these individuals answered very few questions correctly although they all gave answers to the questions. The extra number in the totals is due to the problem encountered when the graphs were drawn.

As can be seen from graphs 1 and 2 the general trend of the international student group showed a fairly consistent 50% in most questions, whereas the Ross High students do badly in most questions. The blue bars showing the successes and the red bars showing the failure to answer correctly. The number of responses indicates the number of students who either answered correctly (next to the blue bars), or incorrectly (next to the red bars). As

was previously explained each response has a discrepancy of one due to the error when these graphs were created and which was impossible to eradicate.

Graphs 3 and 4 show the enormous discrepancy between the successes (large number of tall blue bars) of the high achieving group and the failures (large number of tall red bars) of the low performing group.

The graph of the low achievers has a discrepancy of one and even two in the failure columns while the negative numbers are also incorrect and should be subtracted from the failure numbers as well.

The graphs have been added here to show pictorially the achievements of each group analysed as well as the strengths of weaknesses of each question in Rich's TIMSS equivalent mathematics test.

GRAPH 1 OF MARVIN'S GROUP:

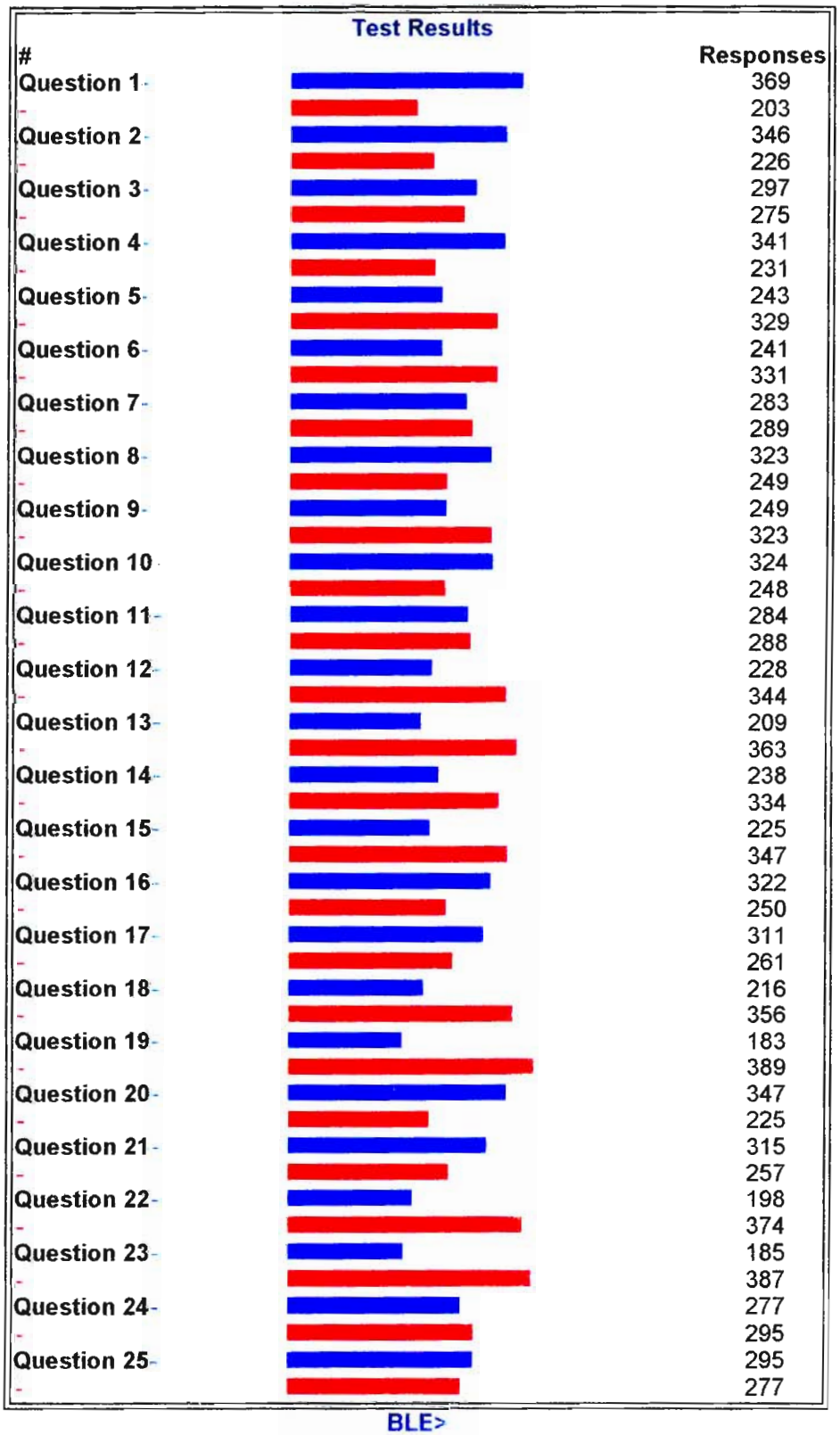
Graph 1 shows the results achieved overall by those who wrote Rich's test on line. They come from many states in the USA and from other countries. The actual demographics is not known.

Graph Log

You must press reload (or refresh) to update the data

Correct = Blue

Incorrect = Red



BLE>

GRAPH 2, OF OVERALL ROSS HIGH GROUP'S RESULTS:

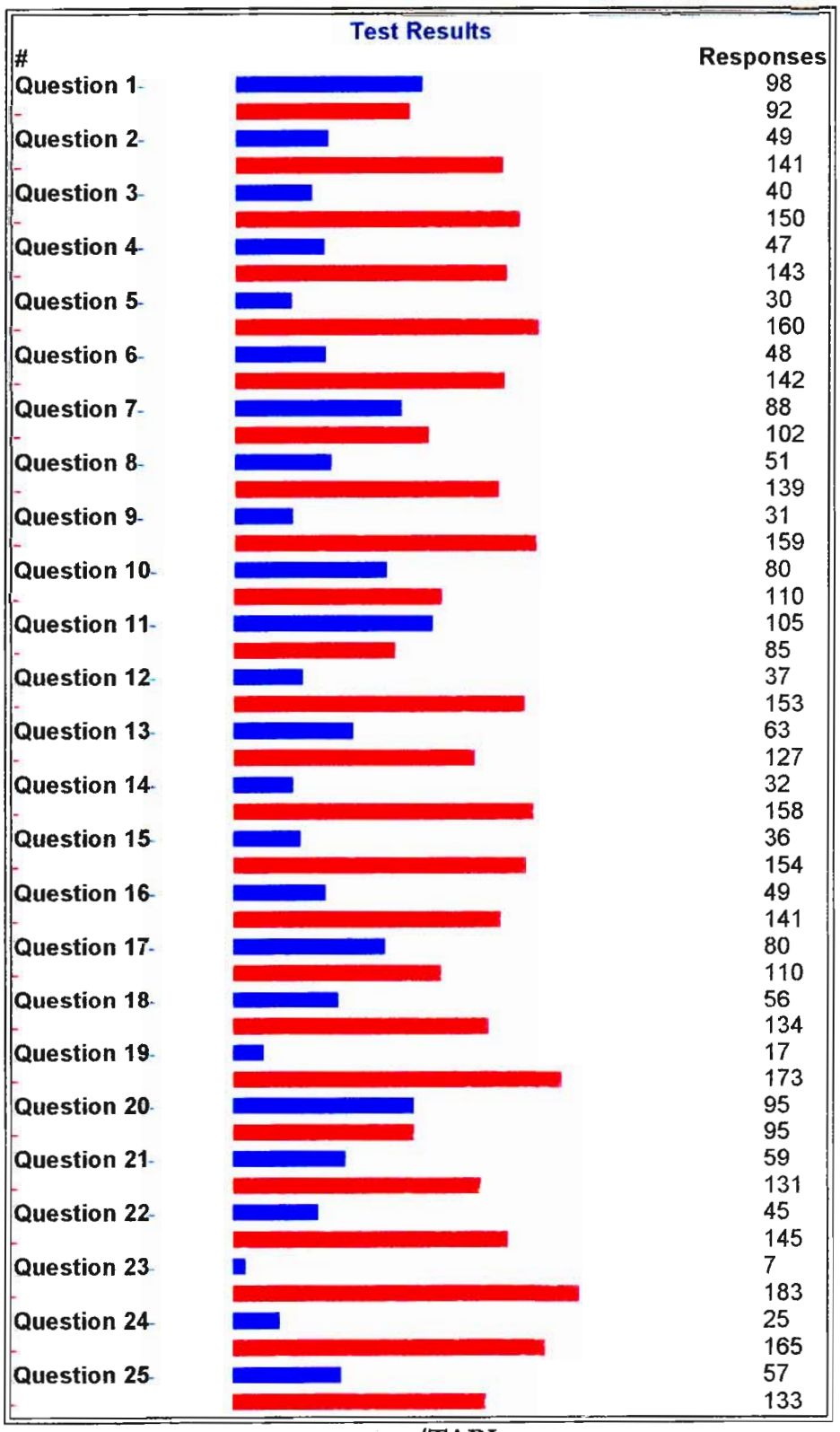
Graph 2 shows the overall achievements in each question of 186 grade 8 Ross High School students.

Graph Log

You must press reload (or refresh) to update the data

Correct = Blue

Incorrect = Red



1>19 </TABL

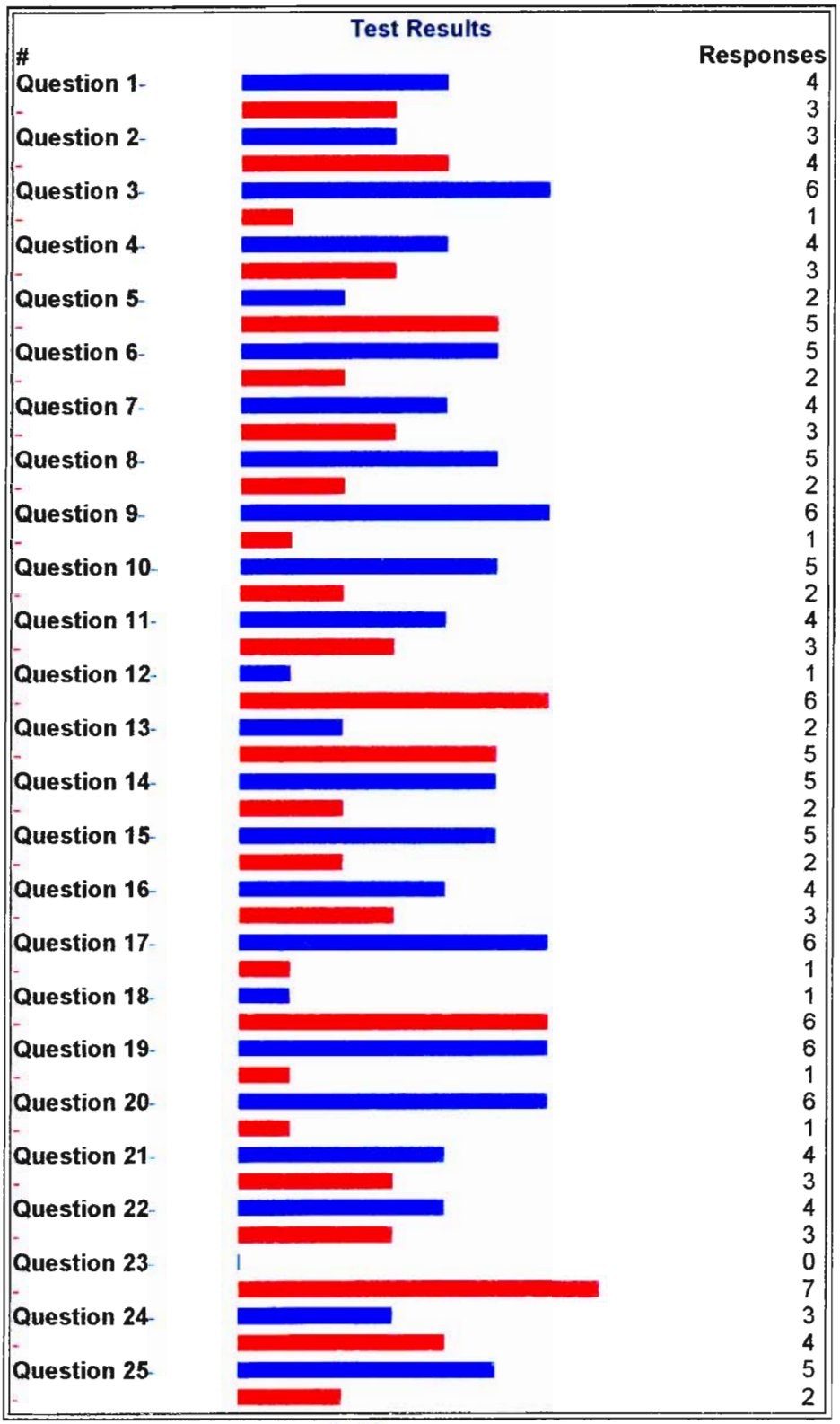
GRAPH 3 SHOWING THE RESULTS OF THE SIX HIGH PERFORMING STUDENTS SELECTED FOR THE STUDY:

Graph Log

You must press reload (or refresh) to update the data

Correct = Blue

Incorrect = Red



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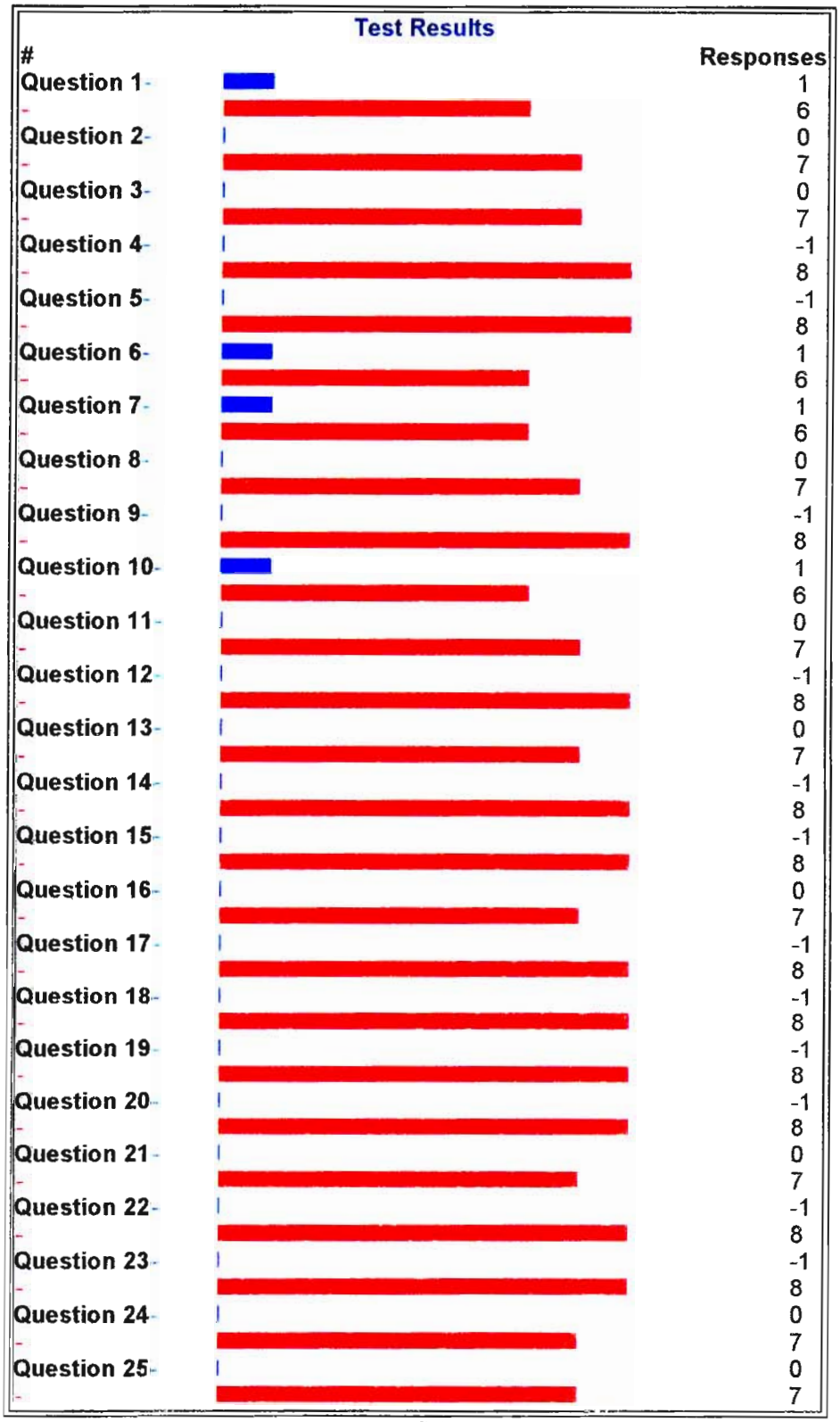
GRAPH 4, REPRESENTS THE RESULTS OF THE SIX LOW PERFORMING STUDENTS SELECTED FOR THE STUDY:

Graph Log

You must press reload (or refresh) to update the data

Correct = Blue

Incorrect = Red



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4.5 STUDENT SELECTION

Having decided that the group to be interviewed should comprise a group of high performing students and a group of low performing students, I looked at the Ross High School results achieved. Six students who had all achieved the low score of eight percent were selected. Then the six highest achieving students were chosen for the rest of the group to be interviewed. Of the top students, two had achieved 76 percent, one 72 percent, two 60 percent, and the last one had achieved 56 percent. Although the spread in the high performing set of results is much greater than that of the low performing set of results, here was a group I could work with in terms of achievement in mathematics. There was a distinct middle group but as it was so large, it was not viable for this research, as it would have taken too long to do all the interviews required.

4.6 CONCLUSION

From this chapter many questions could be posed about the validity of the South African achievements in the TIMSS testing as it is clear from the above that the high performing students from the Ross High School grade 8 sample are very capable and could well compete mathematically with the international community. The questions need to be more in line with the curriculum studied by the students. The format should be familiar and the language clearer and easier to understand.

The graphs show which questions were well answered by the four groups, and which questions were poorly answered.

The high performers did not have a problem reading the wordy questions and understanding them. The most problematical questions were 5, 12, 13, 19 and 23. These were all complex questions requiring more than one cognitive step as well as factors which had not been studied by these students in their school curriculum.

The low performing group had a problem with the language used and the way the questions were asked. The multiple-choice format allowed them to guess answers when they did not know how to calculate them. Their poor reading skills posed a problem as well. The way the questions were asked put these students into a discomfit zone which also affected their ability to do the mathematics.

The selection of the interview group, although very small, was done so as to ensure enough time to interview all the students in depth.

CHAPTER FIVE

STUDENT BACKGROUNDS AND LIFE STORIES

5.1 INTRODUCTION

This chapter presents the life stories of the high performing and low performing students interviewed. The life stories are descriptive accounts that provide an opportunity for an in depth analysis of student backgrounds.

The data sources are taped one on one interviews and school records.

The question: "What are the personal and home backgrounds of a selected group of high performing and low performing grade 8 students, who wrote the TIMSS equivalent test?" is answered in this chapter.

The life stories are presented with respect to a number of categories. Some of these were identified in the student questionnaire of the TIMSS study, others were the factors, found by Howie and Hughes (1998) and Robitaille, Beaton and Plomp (2000), as relevant in an analysis of their effect on the achievements of students in mathematics.

Each story begins with a description of a day in the life of the student, thus setting the picture of each student in context showing what factors are important in their lives and how these factors determine what a student can achieve in a day with respect to school work.

This is followed by the personal and home backgrounds which explain the family dynamics and living conditions of each student. Who they live with, what their home environment is like and thus indicating the effect on the student's attitude to schoolwork and ability to achieve. The early childhood and school education enlarges this view of each students learning.

Books, reading and language extend this information completed by the mathematics education, performance and analysis.

5.2 THE HIGH PERFORMING STUDENTS

The students in this group listed from highest to lowest achieving are:

5.2.1 Nkosi Gumede
5.2.2 Asanda Zondi
5.2.3 Eric Govender
5.2.4 Carol Els

5.2.5 Phili Ngcobo
5.2.6 Siphiwe Mkhize

5.2.1 NKOSI GUMEDE

A day in the Life of Nkosi

At 05:15 every day, after she has had her bath, Nkosi's sister wakes him up. He baths, gets dressed and catches the bus to school at 06:30. Occasionally the two children eat cereal for breakfast. However usually they do not have any breakfast and their mother does not insist on this, although she makes them sandwiches for school lunch.

After school Nkosi returns home on the special Umlazi bus. He eats lunch and then does his homework. The domestic worker is always home to let him in and frequently his mother is home in the afternoons. After completing his homework, which he states takes him about one hour a day, he spends the rest of the afternoon cleaning the garden at home and socialising with friends. He watches television in the early evenings. His favourite programmes are "Generations" and "Backstage". He plays soccer with other boys in a field near his home about twice a week. The boys make up teams and play against each other. On Saturdays he plays soccer and on Sundays he goes to church. He goes to bed at about 21.00.

Personal and Home Background

Nkosi was born on the 20th April 1990.He lives in Umlazi with his mother - Hlengiwe, father - Sunrise, and younger sister. The domestic worker also lives in with the family.

Nkosi is small in stature but very confident. He is serious in demeanour and clearly understands English very well.

His home consists of three bedrooms, a sitting room, dining room, kitchen and bathroom with toilet. His home language is Zulu. However Nkosi's father does try to speak English with his children occasionally, particularly when watching television.

Nkosi's mother is a qualified primary school teacher, she has her matric and a diploma in education, and she teaches at a primary school in Umlazi. His father is a dispatch clerk. Nkosi thinks his father has his matric and a further diploma.

In the home they have all the mod-cons such as a television set, radio, CD player, video recorder, telephone, mother has a cell phone and father has a motor car. Nkosi has his own bedroom furnished with a bed, a study desk, and wardrobes. Approximately

once a month his uncle (father's brother) comes to stay and then he shares Nkosi's bedroom. There is no computer at home. Nkosi does not have a dictionary of any kind at home, nor does he own a bicycle.

His grandparents live in a rural area and he visits them in the holidays. He enjoys these visits. Cultural knowledge is encouraged in his family and he learns cultural dancing.

Nkosi's parents are happy together and his home life appears secure and loving.

Early Childhood and Education

His toys were mainly cars. However his mother did jigsaw puzzles with him. He was never read to as a young child. All reading and learning has taken place in school.

Nkosi went to an English medium primary school in Umbogintwini. The teachers' general comments stated that he has great potential to be excellent. He came 3rd in his class and 7th in the grade. His class teacher's comment was that he is responsible and hard working.

He was class representative in grade 8 at Ross High School. The general consensus amongst his teachers is that he is responsible, hard working and a pleasure to teach. He produces outstanding work, works consistently, has a good work ethic and is helpful and kind.

Nkosi has a very positive attitude to school and his teachers. He has no social problems at school. Although he had his pencil case stolen at the beginning of grade 8 he does not hold a grudge and saw that as an insignificant event.

He uses a computer at school. Thus he has some knowledge of computer usage, however it is limited to what is taught in the classroom.

His present hobbies are soccer, listening to music and cultural dancing. In primary school he took part in cricket, soccer, swimming and drama.

Nkosi is ambitious and hopes to study for a higher second degree in the future. He wishes to study to be an electrical engineer after high school. He fully understands what electrical engineers do and we discussed Escom as a good place where he would like to get a job one day. Nkosi feels sure that electrical engineers and electricians use mathematics for their work.

Books, Reading and Language

There are very few books in the home. The parents never read a book as they seem to relax watching television. Nkosi reads occasionally. He takes books from the Isipingo Library. However this is a very infrequent occurrence. At the interview he admitted that he had not taken out books for at least two months. When he does read he enjoys true-life stories.

Language Results:

English First Language:
Grade 7:
Achieved a level 3; approximately 60-70%.

Grade 8: Term1: 47%. Term2: 88%. Term3: 77%. Year mark: 68%.

Zulu Second Language:
Grade 7:
Achieved a level 3; approximately 60 – 70%.

Grade 8: Term1: 88%. Term2: 70%. Term3: 75%. Year Mark: 78%.

These results support his teachers' assessment of his ability and English proficiency.

Mathematics Education, Performance and Analysis

Mathematics Results:

TIMSS: 76%. 19 correct answers.

Grade7 results:
Achieved a level 3, approximately 60 – 70%.

Grade 8 results:
Term1: 68%. Term2: 73%. Term3: 77%. Year mark: 73%.

Nkosi appears to have maintained a high level in mathematics and is equally happy with word questions and pure number questions. He feels confident about his mathematics ability. He has an interest in the subject and enjoys doing it. He considers the subject important for his future. He would like mathematics in his career.

He does mathematics homework three to four times a week for about half an hour per day. He has never had extra tuition in mathematics.

Nkosi was unsure when asked to read co-ordinates off a graph. He said he had never learnt to do this. When asked to colour in 3/8 of 24 unit squares, he did so rapidly and correctly, fully understanding the question, the concept of 3/8 and what was required of him. He easily identified the smallest fraction from a group of fractions, having no trouble understanding the concept of fractions. When asked to estimate, he again had no problem with the English language or the fact that it was a wordy question, which he instantly understood and rapidly answered having given the problem a moments thought.

He has very clear thinking ability and his thoughts are precise and clear. He works through a question, understands the process of problem solving and can put it into practice.

5.2.2 ASANDA ZONDI

A day in the Life of Asanda:

She gets up at 05.00, baths, gets dressed, listens to morning radio or television while getting her school lunch organised and preparing for school. She has breakfast every morning and catches the bus to school at 05:55.

When she gets home from school she spends about an hour per day doing her homework or studying, sitting at the dining room table. She watches some television too.

The television is in the same room and often as it plays she finds it interferes with her studies. However in all sincerity, she so appreciates the fact that she has a home and a place to study that she never complains.

Occasionally she socialises with friends in the neighbourhood.

She often has a sleep in the afternoons. She watches evening television in total about four hours a day. She helps in the home when required to. She goes to bed after reading the Bible and praying. When not studying she reads a great deal and can spend many hours doing so.

Personal and Home Background

Asanda was born on the 4th October 1990. At the time of the interview she was 13 years old. Her family are all South African. Her home language is Zulu, however she is fluent in English,

which she often uses in the home. She is able to communicate fairly well in Afrikaans, Sotho and Xhosa. Asanda enjoys speaking in different languages and is proud of her ability to do so.

Asanda lives with her maternal grandparents in Umlazi, together with her mother's sister and the sister's son. Asanda's maternal grandmother is her guardian. She too completed matric. She sews clothing, curtains and duvets for a living. She is also a consultant for Wanda and Tupperware.

They have all the mod - cons at home. However Asanda does not have a private place to study nor does she have access to a computer at home. Asanda shares a bedroom with her aunt and cousin. Her grandparents sleep in separate rooms. Asanda's grandmother has her sewing machines in her bedroom and does her sewing whenever she cannot sleep.

As a small child Asanda lived in Umlazi, with her great grandmother and grandfather who is a policeman. Her mother moved in to this home when the old lady had a stroke. She took care of them until the great grandmother died. Asanda then moved in with her maternal grandparents but her mother stayed to look after the "grandfather".

Asanda's mother, who passed away on the 17th August 2004, completed her matric and had a tertiary qualification from UNISA. She worked as a Chief Administration Official for Metrorail at Durban Station. She took care of all Asanda's financial needs, paying for her clothing, education and upkeep. Asanda's mother had her own motorcar and often visited her. She misses her a great deal.

Asanda's father lives in Umlazi, with his father, brother and cousins. His home is within walking distance of her present home and he too visits her frequently, and often takes her out. Occasionally she visits him at his home. She is very close to her father.Her father also completed matric, has no further qualification and is presently unemployed. He does jobs wherever he can and is at present looking for work in Johannesburg. He gives Asanda pocket money and spoils her whenever possible.

Asanda's greatest wish was to live with both her parents and I sensed sadness when she mentioned this.

Asanda is socially well adjusted. She has had excellent role models in her approach to work and takes full responsibility for her life. However her need to escape from reality and to sleep in the afternoons could indicate depression and should be assessed.

Early Childhood and Education

As a small child she remembers having a doll and a tea set. She also had a number of teddy bears and at a very young age learnt to make clothes for them. Although no one read to her as a young child, she does remember spending time copying the alphabet until by the age of 5 she knew all the letters well.

She first learnt to colour in and do jigsaw puzzles at primary school, after which her mother bought her puzzles to do at home.

Asanda attended an English language Primary School in Durban. Zulu was not taught at the school, so she had to study Afrikaans. The learners at the school were about 50% Coloured and 50% Zulu. Teacher's comment: Asanda has great potential, did not work hard enough. A pleasure to teach! Interests: Reading, television, music, cultural dancing, tennis and netball.

High school teacher's comment: A diligent student, does outstanding work, commendable, excellent, well done. Asanda uses a computer at school to type and draw. She occasionally plays games on the computer at a friend's house. She has never used a computer for educational purposes.

Asanda likes school and feels teachers are caring and want students to do well. However she feels that her contemporaries do not try their best. Asanda hopes to study for as high a degree as she can.

Books, Reading and Language

She reads mainly fiction, taking books from the school library. I lent her six books during the July school holidays. She read them all and could clearly articulate all that she had read. She enjoys writing, in her own words, summaries of the stories that she has read.

She has read from an early age mainly in English, although she has a few Zulu storybooks at home, which she enjoys. She loves to imagine herself having the adventures in the books, enjoying the escapism into other lives and adventures. One of her reading preferences is to read books about those worse off than herself. In this way she tries very hard to appreciate what she has in life.

There are approximately 25 books at home. Most of them are textbooks from her mother's studies at UNISA.

Language Results:

Grade 7

English First Language: Achieved a level 4, over 80%(outstanding). Comment: Excellent.
Afrikaans Second Language: Achieved a level 3. 60 – 79%. Comment: Good work, strive to do better.

Grade 8

English Main language:
Term1: 77% Term2: 90% Term3: 70% Year Mark: 80%.

Afrikaans Second language:
Term1: 100% Term2: 98% Term3: 95% Year Mark: 98%.

She does not study Zulu as she has never studied it as a subject at school and feels it would be too difficult.

Mathematics Education, Performance and Analysis.

Mathematics Results:

Grade 7: Achieved level 3. Most skills, values and knowledge demonstrated. 60 – 79%. Comment: Good work.

Grade 8:
Term1: 84% Term2: 96% Term3: 85% Year Mark: 85%.
TIMSS: 76%. 19 correct answers.

She is very confident about her ability to learn mathematics, which she feels is one of her strengths, as are her languages. Asanda has never had extra mathematics lessons and she feels she spends about half an hour a day doing mathematics homework. She enjoys studying mathematics

Asanda did not enjoy doing the multiple-choice questions in TIMSS. She did not enjoy the amount of reading required to interpret the mathematics before doing the calculations. She prefers to be presented with the mathematics and to get straight into the calculation. Asanda was able to understand, interpret and correctly answer all the questions I put to her. She has clear cognitive understanding and her problem solving abilities are well grounded.

She feels that mathematics is essential to her future both for a career and university. She would like to use mathematics in her job but not exclusively. She hopes to have a career she really enjoys.

5.2.3 ERIC GOVENDER

A day in the Life of Eric

He gets up at 06.00 to say goodbye to his father as he leaves for work. He then brushes his teeth, showers, gets dressed and has breakfast, which is made for him by his mother. He has time to watch some television before he goes to school. He usually watches cartoons. He walks to school.

After school, Eric walks home, changes out of his school clothes, watches television and eats lunch. He then does his homework. When his homework is complete he spends the rest of the afternoon reading.

When his father comes home he spends time with him in the garage. They then eat supper together with the family. In the evening he watches some television and then goes to bed. He does not spend any time with friends after school.

Personal and Home Background

Eric was born on the 6th February 1991. He was 13 years old at the interview. His family are Indian South Africans. His home language is English. He is an open, smiling youngster, very self confident and proud. He is socially well adjusted and enjoys school. He thinks that students and teachers try their best, that teachers care for the students and want them to succeed.

Eric lived in Phoenix from birth until 2003, when the family moved into a house in Seaview. He lives with his mother, father, sister, aunt and grandmother. His mother completed grade 9, she is a housewife and has never worked. His father, who is an upholsterer, completed matric and manages an upholstery store. His sister completed matric in 2004. She achieved good results and is planning to study at a tertiary institution.

Eric's home life is very safe, secure and loving. His mother and father work extremely hard and are an excellent example. There is harmony in the home. His parents are extremely supportive. Eric's father takes a great interest in his son's studies, helping whenever he can. He bought Eric a grade 8 mathematics textbook to enable him to do extra mathematics at home. Eric constantly came for extra mathematics work during the year, which his father then supervised at home.

Eric has his own bedroom. He has a desk to work on and a computer in his bedroom. He has every comfort to enable him to concentrate on his schoolwork and succeed. He has all mod-cons at home.

Eric uses a computer both at home and at school. He uses the computer to find information and ideas for mathematics, science and other subjects. He does not use the computer to write reports or analyse data but he has used it to produce projects and assignments for school. He also plays computer games for approximately one hour a day.

Early Childhood and Education

Eric had many toys as a small child. He had lego, cars and puzzles. He had number, animal and alphabet puzzles. His mother often read to him when he was little. Even now, when she finds something interesting she reads it to him. Eric is very fortunate that there is a good deal of sharing and time spent with his family.

Eric attended a primary school in Phoenix. All education was done through the medium of English. His second language was Afrikaans. He was head prefect in grade 7. The Principal's comments were that Eric displayed exemplary leadership, excellent conduct and responsibility in the execution of his duties. His academic potential and ability is outstanding, he applies himself diligently, has a positive attitude and consistently works hard. He is always courteous and obliging, pleasant, friendly and well liked by his peers.

In sport at primary school he represented his school in cricket, soccer, volleyball, and athletics. He was captain of his cricket team and was trusted and respected by his teammates. He also enjoys fishing and his hobbies are music and computers.

At high school all subjects are taugh in English. He studies English as his main language and Afrikaans as his second language. Teachers' comments: Eric is a pleasant, polite learner who produces good results. Well done, excellent results, maintain this high standard.

Eric does one to two hours homework per day. He would like to study electrical engineering at University.

Books, Reading and Language

Eric has one shelf of books at home. These consist of a few reference books and some reading books. Eric's mother and father read newspapers, magazines and fiction novels. His mother reads a great deal, when she has completed her housework. His father reads infrequently as he is so busy with his work. In Phoenix Eric would frequently take out books from the library. As there is no library in Seaview and he is not allowed to go to the town library, he is limited in his reading material. He gets books from

the town library when he can and otherwise he reads schoolbooks and does homework in his spare time and on weekends. He reads approximately one to two hours per day for enjoyment.

Language results:

Grade 7:
English First Language: 85%
Afrikaans Second Language: 91%

Grade 8:
English First Language:
Term1: 78% Term2: 92% Term3: 78% Year Mark: 83%
Afrikaans Second Language:
Term1: 70% Term2: 68% Term3: 68% Year Mark: 73%

Mathematics Education, Performance and Analysis:

Mathematics results:

Grade 7: 96%

Grade 8: Term1: 80% Term2: 76% Term3: 75% Year Mark: 81%

TIMSS Results: 72%. 18 correct answers.

Eric enjoys doing mathematics. He has never had extra lessons in mathematics. He feels he does well in the subject, as he fully understands it and learns the methods and rules quickly. He feels mathematics is important in his daily life and for his future. He thinks mathematics is necessary for learning other subjects and to get into university. He would like a job which involves mathematics and thus feels he needs to do well in the subject. He studies extra mathematics on his own whenever he has free time.

When writing the TIMSS equivalent mathematics test Eric worked out the answer by reading each question, analysing what was required and then applying the required mathematics from the knowledge he has.

Eric understood and clearly interpreted all the mathematics questions I put to him. The only problems he had with the TIMSS test were with those questions dealing with mathematics that Eric had not yet learnt.

He was comfortable with word problems and those phrased using mathematics.

5.2.4 CAROL ELS

A day in the Life of Carol:

Her grandmother wakes Carol up at 06.00 every morning. She gets up, gets dressed, eats breakfast and walks to school.

After school Carol walks home. She arrives at approximately 15.00 eats lunch and then does her homework until 16.00. Then she does her household chores, which consist of cleaning the kitchen, her bedroom, the toilets and the bathroom. As there is no domestic worker at home Carol and her brother help their grandmother with whatever is required in the home.

Carol does a great deal of homework, which she enjoys doing. She spends about half an hour a day on mathematics homework. Carol does not play any sport. Occasionally she socialises with friends after school. However this usually occupies less than half an hour per day. If there is time she watches television for about half an hour. She spends the rest of her time reading. She reads books for enjoyment and escape. She listens to music a great deal.

Personal and Home Backgrounds

Carol was born on the 10th November 1989. She was 14 years old at the time of the interview. She is a South African of European decent. Her home language is English. She is quiet, shy and very self-effacing. She only speaks when spoken to. However she has a ready smile and appreciates any attention as long as it is positive. She displays uncertainty and is wary of any approach. She is not self-assured, has a poor self-image and appears to be emotionally immature. This was demonstrated in the interview when she described the reason for her lack of friends. "...some of my friends I used to be friends with made me do things, bad things I didn't want to do". She also felt that the kids in her class make fun of her and they leave her out of the group work. "...they just neglect me, they don't let me join in".

As a young child she lived with both her parents. They lived together in many houses. At that time her father had his own shop. Her parents divorced in 1994, when she was five years old.

At present Carol lives in Seaview with her father, his mother (her grandmother), her uncle (32 years old) and her brother of 13 years.

Her mother who lives close by with her boyfriend, completed grade 10 and is a housewife. Her grandmother completed grade 8 and is a pensioner and her guardian.

Soon after the divorce, her father sold his shop and has been battling to find work since then (date unknown). He completed grade 9. He works for a security company whenever he can get work. Carol feels he then needs to use mathematics when he fills in time registers.

Her uncle works for a security company and helps support the family. Her brother is in his last year at primary school.

Carol has her own bedroom, which is furnished with a bed, a dressing table and a wardrobe. She does not have her own desk and studies sitting on her bed. The family have all the usual mod - cons at home.

Carol seldom watches television. In her own words, "It is a waste of time". I could distinctly hear adult influence in this statement.

Carol would like to get a part time job so she can save money, as she realises she will have to pay for any future studies. She hopes to study for a degree one day.

Early Childhood and Education

As a young child she had alphabet blocks and dolls. She did jigsaw puzzles with her mother on weekends, during their visits together. She enjoyed colouring in and did so quite frequently as a young child.

Carol attended an English medium primary school. The teachers' comments state that she was well behaved, polite, had great potential and must strive to achieve her best. She was outstanding at artwork, had good self discipline, poor leadership skills but a good sense of responsibility. Her hobbies were art and swimming.

The high school teachers' comments reflect the same sentiments as those from the primary school. She frequently did not come to school and her high absenteeism hindered her progress. The reasons for this absenteeism were not made clear in the interview. Otherwise she has made good progress, but there is room for improvement and she has potential. She has shown encouraging effort, has a good work ethic and needs to work harder. She no longer does her hobbies.

She likes being at school but thinks that the students do not try their best. Carol feels that the teachers care for the learners and want them to do their best.

Carol is socially inept and has many social problems at school. She had stationery stolen from her at school. She was also made to do things she did not want to do by girls in her class who she

hoped were her friends. This got her into trouble. However she still tries to associate with the girls.

She is made fun of in class but tends to ignore these comments, although they do hurt her. Group work is thus a problem for her as she gets left out during these activities. She has not told the teachers and chooses to battle on her own. This causes a social problem and she feels socially unhappy in the school environment. Thus she chooses to spend her time at school doing homework and reading.

There is no computer at home and Carol never spends any time on a computer out of school. She uses a computer at school, where occasionally she processes data.

Books, Reading and Language

Carol reads profusely. She takes out four books every two weeks from the Hillary library. This is an important form of escapism for her from her sadness. She reads all types of books but her favourites are teenage novels and adventure books.

Language results:

Grade 7:
English First Language: 57%
Zulu Second Language: 19%
Afrikaans Second Language: 47%

Grade 8:
English First Language:
Term1: 62% Term2: 83% Term3: 60% Year Mark: 67%

Afrikaans Second Language:
Term1: 50% Term2: 50% Term3: 58% Year Mark: 53%

Mathematics Education, Performance and Analysis

Mathematics results:

Grade 7: 54%

Grade 8: Term1: 44% Term2: 60% Term3: 38% Year Mark: 46%

TIMSS: 60%. 15 correct answers.

The TIMSS equivalent test result and term two result correlate as the TIMSS was written in that term and Carol was present the entire term and she was positive and focused. In term three and

four she was obviously having problems at home as she was frequently absent and this severely affected her achievements.

Carol enjoys learning mathematics and feels it is not too difficult. She feels she learns it fairly quickly and does fairly well in the subject. She would like to do more mathematics. She acknowledged that sometimes she struggles with mathematical concepts.

She feels mathematics will help her in her daily life and that it is necessary for other subjects. She will need mathematics for her tertiary studies but does not want a job that involves the subject. However she feels it will help her in a career.

Carol listens well in class and stated that she sits on her bed after school and memorises what she is taught. She found the TIMSS equivalent mathematics test reasonably easy as she had memorised the method of answering this type of question and she had practised and studied to do this at home. Having been shown some multiple-choice questions in class in preparation for the test. She thus found the TIMSS questions easier to answer than the mathematics done in school, which cannot be so easily memorised and reproduced. Carol studies by memorising. Thus if she can memorise the work she does very well. However she battles to work problems out. She finds mathematics expressed in mathematical terms complicated. She prefers to read and understand a question. Plain numbers confuse her.

5.2.5 PHILI NGCOBO

A day in the Life of Phili:

She wakes up early, has a bath, gets dressed and eats breakfast. She gets her books needed for school, and then watches some television. She goes to school by car. Her mother owns and drives a Toyota Tazz. Phili does all her homework at school. She shows a remarkable maturity. She is efficient, controlled and organised.

After school she goes home and then immediately goes out to the city library or to an Internet café near her home. Later she goes home, reads a bit, watches television and sometimes takes a nap. She helps at home by washing dishes, taking out the rubbish and cleaning the bath. She helps cook supper at about 18.00, eats, watches more television or reads and then goes to bed.

Personal and Home Background

Phili was born on the 1st February 1990. She was 13 years old at the time of the interview. She bears her mother's surname. Her family are all South African. Her home language is Tswana. Her

father was Sotho. She speaks English at home as her neighbours and her domestic carer do not speak Tswana. She can also speak Zulu and Xhosa, which she has picked up living in Durban, although she feels she is not sufficiently fluent in these two languages. She displays a remarkable fluency in and command of, the English language.

Phili was born in the Eastern Cape. The family then moved to Johannesburg where her father's family live. Her father died about a year after she was born and as her mother does not like his family, she brought Phili to Durban. When she was four years old she lived in Bloemfontein with her mother's family. Then in 1998 she came to live permanently with her mother in Durban.

Phili now lives in a two and a half bedroom apartment in Durban centre, with her mother. She shares a bedroom with her mother. She stated that she does not want her own bedroom (is there some underlying fear there?). She does not have a computer or her own desk. But they have all the mod cons at home.

Phili's mother completed matric. She is a qualified hairdresser and owns a hairdressing salon with Phili's aunt. However her declaration to the school is that she collects a disability pension and has no job. (This raises questions). As far as Phili knows, her mother has joined an investment club and often travels away from home leaving Phili with the domestic carer, who sleeps over in the second bedroom during these times.

This domestic carer has been with Phili since she was six years old and Phili feels safe with her. She feels that this lady really cares for her like a second mother. She speaks Xhosa with the carer. Their relationship is close and loving. Phili feels she is always there for her. Her life does not change although her mother is not home. She can still visit her friends and she continues to run her own life. She feels this is an advantage.

Phili is very self-assured and stated emphatically that her mother works with the investment club and often goes away to give motivational talks in Johannesburg and Bloemfontein.
When Phili's mother is at home the carer goes home to Umlazi. This set up, although complex, is a secure arrangement and Phili feels loved, safe and secure. She is remarkably self confident and happy.

When her mother is not at home the domestic carer has a credit card and they draw money, as they require it. Phili also has pocket money and a savings account at the bank, which she can access. Her mother always ensures there is money in that account. Phili appears to run her own life and enjoys the independence. However she knows that her mother and the domestic carer really

care for her as they check up on her whereabouts all the time and even go so far as to phone the school to make sure she is present.

Phili's grandmother feels she is very spoilt. However Phili feels she has advantages as her mother is a successful businesswoman and Phili respects her and is proud of her. As a result she too believes in herself and feels she can also succeed at whatever she tries to do. Phili feels her mother is very caring and understanding. She gives Phili special times. Nothing interferes with her spoiling Phili on her birthday. Phili as a result feels loved and cherished. She is very self-confident and smiles all the time. She is very independent and self-reliant. However it is clear that she feels very secure and knows she can trust the adults in her life.

Early Childhood and Education

As a small child Phili had toy cars and dolls. She did jigsaw puzzles and coloured in only at school. However her mother read to her when she was small.

She first went to primary school as a boarder in Pietermaritzburg. Then in 1998 she came to live with her mother in Durban where she attended a primary school in Greyville for grades 2 to 7. Teachers' comments: Excellent social attitude and work habits. Works well in a group, exercises self discipline, is co-operative, self motivated, helpful, responsible and punctual. Phili has produced excellent results and is a high achiever. She actively participates in school plays, pageants and poem readings. She plays various sports. Her hobbies were acting, reading, singing, traditional dance, speech and drama.

Phili won a bronze award from AMESA for excellence in the mathematics challenge in September 2003.

She goes to Ross High School where her teachers' comments reflect those of the primary school. Well done, keep up the good work. Commendable effort. Excellent results. Outstanding work.

When she finishes school, Phili wants to study to be a geologist. Her mother wants her to be an accountant or a doctor. However she states emphatically that those courses are not for her. When I questioned her she had an excellent understanding of what geologists do and she shows a great interest in palaeontology, which she described to me with joy and real interest.

At school she has had a pencil case and some money stolen from her. When she first arrived at high school she had some social problems with two of the learners in her class because of

competitiveness. This has now worked out and they are all good friends.

Phili does not have a computer at home. However she uses a computer at school, at the library, at a friend's home and at an Internet café near her home. At the Internet café she writes emails to her friends from primary school, who are at different high schools. She plays computer games and surfs the net for information. Occasionally she looks up information on mathematics or science. She does not process or analyse data on the computer. She is very comfortable with the use of a computer.

Phili likes being at school. She feels that the learners at her school only partly try their best. She likewise feels that the teachers only partly care for the learners but they do want the learners to do their best. Socially she keeps to herself at school. However she has made a few good friends. Phili speaks English and Zulu with her friends. She is socially comfortable with herself, always smiling and confident. She is well liked but quiet in a group.

Books Reading and Language

Phili loves reading. In her own words: "I read all the time." Her mother taught her to read when she was five years old. However her mother still reads to her when they are together. At present Phili reads horror stories and modern novels. She gets a lot of her reading matter from the main city library and on the whole reads widely. She reads fiction and non-fiction and has a bright and open mind. She also buys books whenever she can and most of the books at home belong to her. They have a full bookshelf of books at home. She often prefers reading a book to watching television.

Language Results:

Grade 7: English First Language: 75%
Afrikaans Second Language: 75%

Grade 8:
English First Language:
Term1: 80% Term2: 93% Term3: 77% Year Mark: 82%

Afrikaans Second Language:
Term1: 75% Term2: 70% Term3: 75% Year Mark 76%

Mathematics Education, Performance and Analysis:

Mathematics results:

Grade 7: 86%

Grade 8: Term1: 85% Term2: 64% Term3: 65% Year Mark: 72%

TIMSS: 60%. (15 correct answers)

Phili feels she does well in mathematics. She would like to do more mathematics in school. She finds it easy, enjoys learning the subject and feels she learns things quickly in mathematics.

She feels mathematics helps her in her daily life and that it is necessary for her other school subjects. Phili needs to do well in mathematics to get a place at the university and will need it to get the job she wants. She understands that mathematics is necessary for geology.

She has had extra lessons in mathematics with a friend of her's who is really good at mathematics. In this way Phili has been helped to fully understand the subject. She has homework in mathematics three to four times a week for about half an hour.

She achieved the same mark for TIMSS as she does for school mathematics. When she answered TIMSS she read each question carefully, understood what was being asked, interpreted what was required and then answered the questions. She has excellent thought processes and problem solving skills.

5.2.6 SIPHIWE MKHIZE

A day in the Life of Siphiwe:

Siphiwe wakes at 05.00. He baths, gets dressed, makes his school lunch and leaves for school at 06.30 travelling by bus.

He plays chess during school hours, at school. He plays soccer at school in the afternoon.

Siphiwe then catches a bus home. He fetches the house key from the neighbour and lets himself into the house. He first washes his shirt and socks for school the next day. He then eats something and does his homework. He watches television in the evenings and on weekends. Siphiwe, his father and his uncles share all the cooking and cleaning. This is a unifying factor in the family. His father gets home at 19.00. Siphiwe spends as much time as possible with his father. He respects his father and they are close.

Personal and Home Backgrounds

Siphiwe was born on the 27th June 1988. He was 16 years old at the time of the interview. His family are all South Africans. His home language is Zulu. However he does occasionally speak English at home with his father and with friends. He has no brothers or sisters.

When Siphiwe was little he lived on the family farm with his aunt. His father visited him every Saturday. The farm is in Umzintho near Scottburgh.

Siphiwe lives in Umlazi with his father and two uncles. He shares a bedroom with his younger uncle, who is 30 years old. Thus he does not have his own bedroom, nor his own desk. He studies at the kitchen table. At home there is a television, a refrigerator and running water. The family also have cell phones. There are no other mod cons. There are no books in the home.

Siphiwe does not know to what level his father has studied. His father is a cashier at a parking garage. Siphiwe's parents are divorced and he has lived with his father in Umlazi since he was 10 years old, except for two years (1998 and 1999) when he lived with his mother in Kwa Mashu.

He also has a close relationship with his uncles. One uncle completed matric in 2002 and is currently looking for a job. The other uncle is a security guard. He gets home at 18.00 every day.

Siphiwe does not see himself as deprived and his close relationship with his father and uncles is apparent in his self-confidence.

Siphiwe does not know what level of education his mother achieved. She is a saleslady and is self-employed. It is unclear where Siphiwe's mother lives as he states that she lives near Pietermaritzburg, yet the confidential information in his file shows that she lives in Umlazi.

Siphiwe has contact with his mother as they speak on the telephone every month. He usually contacts her when he needs money. He thus does not see his mother very often. She has another child who lives with her.

Siphiwe says that he watches more than four hours television a day. He has never played computer games. He spends about two to four hours a day playing and talking with friends (usually at school during soccer practice and chess practices).

Early Childhood and Education

He had a bicycle on the farm and when he was very little he had a toy aeroplane. He does not remember what other toys he had. He learnt to do jigsaw puzzles and to colour in only at school.

Siphiwe went to an English medium primary school in Durban. Zulu was not taught at that school, nor was it used as a medium of instruction. Teachers' comments: Siphiwe is likeable, responsible, a good monitor but needs to hand in work timeously. He has shown steady progress, must try to pass all subjects. However his long absence of 22 days in term three because of illness, has made his work suffer. This problem was not recorded and this loss was not sorted out in primary school. Could this be a cause for frustration and weaker results in high school? Siphiwe was a prefect in primary school. He played cricket, swimming, soccer and athletics. He also sang in the choir.

The high school teachers' comments: Siphiwe has made an encouraging effort, satisfactory, commendable. He is a helpful learner, a fair effort. Siphiwe needs to be more punctual at school. He is kind and helpful.

Siphiwe hopes to study at university to be an engineer one day.

He had a calculator and some pens stolen at school. He was made fun of by another pupil at school, but with the teacher's help this was sorted out. He likes being in school and is happy at school. He thinks other students try their best. He also feels that the teachers care about the learners and want them to do their best.

Siphiwe only uses a computer at school. He has very little experience with the computer. He states that he has used a computer elsewhere, however this is unclear. He states in the questionnaire that he has used the computer to look up mathematics and science information but this was not supported during the interview. His hobbies are Zulu dancing and sport (mainly soccer and chess).

Books, Reading and Language

He seldom reads a book. Occasionally he will go with a friend to the Umlazi library and take out a book, which he will then read.

His parents do not read books. His father and uncles watch a lot of television.

Language results:

Grade 7:

English First Language:
Term1: 36% Term2: 42% Term3: 58%

Afrikaans Second Language:
Term1: 26% Term2: 18% Term3: 11%
He appears to have really struggled with Afrikaans.

Grade 8:
English Second Language:
Term1: 30% Term2: 53% Term3: 57% Year Mark: 52%

Zulu First Language:
Term1: 80% Term2: 58% Term3: 58% Year Mark 60%

Mathematics Education, Performance and Analysis

Mathematics Results:

Grade 7: Term1: 49% Term2: 47% Term3: 46%

Grade 8: Term1: 63% Term2: 50% Term3: 51% Year Mark: 54%

TIMSS: 56% (14 correct).

Siphiwe feels that he usually does well in mathematics and would like to do more of it. He finds mathematics easy, enjoys learning the subject, which he feels is one of his strengths. He also thinks he learns mathematics quickly. This is not supported by his results.

Siphiwe has never had any extra mathematics lessons. He does mathematics homework every day for about one hour.

He thinks that mathematics is partially helpful in his daily life. He feels he needs it for his other subjects. He also feels he needs to do well in mathematics in order to get into a tertiary institution. He would like a job involving mathematics and so feels he needs to do well in the subject to get the job he wants.

Siphiwe was very insecure when answering the TIMSS questions. He did not use a calculator but did all the calculations using his knowledge. He correctly answered all the questions I put to him and thus showed an understanding of the mathematical concepts. However he had a problem with some of the English, which I had to clarify for him.

It was clear that although he has always studied mathematics in English he does have an interpretation problem and this is a hindrance.

5.3 LOW PERFORMING STUDENTS:

The students in this group are listed in no particular order:

5.3.1 Sabelo Lambethe
5.3.2 Phila Ngonyama
5.3.3 Sina Nthedi
5.3.4 Nqobile Mafunda
5.3.5 Siyathemba Msabala
5.3.6 Nomvula Ndawonde

5.3.1 SABELO LAMBETHE

A day in the Life of Sabelo:

Sabelo's grandmother wakes him at 05.00. He bathes and gets dressed. He and his sister take it in turns to make breakfast and school lunch for themselves and each other. They usually have eggs for breakfast and sandwiches for school.

He then wakes his uncles, who bath, get dressed and then drive the two children to the sister's school in Clarewood. From there Sabelo takes a taxi to school.

After school he takes a bus home to Umlazi. He and his sister clean the house by sweeping inside and out. He attends to his grandfather and then does his homework. If there is time after that, he visits friends or sits in his room and watches television. He never reads a book for enjoyment. Sabelo does not play any sport at present.

Supper is at 18.00. At 19.00 the family prays together. At 20.00 Sabelo studies for an hour, sitting at the dining room table and then he goes to bed at 21.00.

Personal and Home Background

Sabelo was born on the 5th May 1990. He was 14 years old at our interview. The family only speak Zulu at home; in fact Zulu is his only fluently spoken language. Sabelo only speaks and hears English at school. His understanding of English is limited to school and schoolwork. During the interview he found it difficult to understand all my questions and often struggled to express himself in English.

Sabelo lives in Umlazi, with his maternal grandmother and grandfather, 15 year old sister, his three uncles and the son of one of his uncles (his cousin). The main house consists of four rooms and the outbuildings have four rooms. Sabelo and two of his uncles have their bedrooms in the outbuildings. His

grandparents, sister, cousin and one uncle sleep in the main house. Sabelo has his own bedroom; here he has his own television, radio, CD player, bed, dressing table, wardrobe and study desk.

Sabelo lives with his grandparents so as to take care of his grandfather who is blind and paralysed on his left side (probably had a stroke). The old man is bedridden most of the day and needs assistance with all his daily needs. Sabelo attends to his grandfather the minute he gets home from school. He takes him to the toilet, makes food for him, assists him to eat and generally helps with whatever the old man requires. He also helps sweep the house inside and outside and assists his grandmother, together with his sister, in any other necessary home chores.

Sabelo's parents live together in a house in Umlazi. Their home is within walking distance of Sabelo's home. He sees his parents once or twice a week. He visits his parents but has only slept at their home twice. His parents lived with Sabelo's maternal grandparents until 2003 when they moved into their own four roomed home. His 15-year-old half sister on his father's side lives with his parents. He has three older brothers on his father's side who live with his paternal grandparents.

Sabelo's mother completed matric and is a qualified nurse. She works at a hospital in Durban.

Sabelo thinks his father may have a diploma or a degree and works as an electrical engineer. However on the enrolment form for school it appears that Sabelo's father works as a clerk for a motorcar company.

Early Childhood and Education

As a small child Sabelo had toy cars and guns. He does not remember what other toys he had as a very small child and cannot remember any adult playing with him when he was a young child.

Sabelo attended a Zulu medium Primary School, in Umlazi, from grade 1 to grade 3. There he studied English as a second language. Mathematics was taught in Zulu. Thereafter he attended an English medium Primary School where no Zulu was taught. All subjects were taught through the medium of English, English being the main language and Afrikaans being the second language. Teachers' comments: Can improve, can do better, not working as well as expected. Interests: Soccer and Tennis.

At present he attends an English medium high school. However his main language is Zulu and his second language is English. Teachers' comments: Poor attitude towards schoolwork, poor

attendance with more than 40 days absent during the year. This absenteeism could have been a major contributing factor to poor results yet in his file there is no explanation of the reason for so much absence.

Sabelo enjoys being at school although he feels he is sometimes left out of activities. It transpires that he was left out of activities because of his long absences from school. He likes his teachers.

Sabelo would like to study electrical engineering after he completes school. He enjoys fixing things, especially electrical things. We discussed electrician as an alternative to engineering. Sabelo did not understand the difference between electrical engineering and working as an electrician.

Here too his lack of understanding in English (which was very apparent when I was asking questions during the interview) is probably a major cause for concern, yet it is not even hinted at, as a problem, when his results are commented on.

Sabelo has access to his uncle's computer at home and he is taught computers at school. He occasionally plays games on the computer but has never used it for study purposes or information.

Books, Reading and Language:

There is one bookshelf of books in the home: some reference books and some reading books. All the books are in English. Sabelo's sister enjoys reading. Sabelo occasionally reads the books at home. He does not focus on the titles, thus could not tell me of any books he has read. He states that he prefers picture books and is not really interested in reading stories. He prefers to look at the pictures and illustrations in a book and thus focuses on children's books.

His mother read to him when he was in junior school until about grade four. At Wentworth Primary School he took books out of their library. He does not take books from the library at his high school.

Language results:

Grade 7:

English First Language:	48%
Afrikaans Second Language:	33%

Grade 8:

Zulu Main Language:
Term1: 45% Term2: 50% Term3: 48% Year Mark: 53%

English Second Language:
Term1: 30% Term2: 55% Term3: 45% Year Mark: 45%

Mathematics Education, Performance and Analysis

Mathematics results:

Grade 7: 26%

Grade 8:
Term1: 29% Term2: 40% Term3: 0% Year Mark: 29%

TIMSS Results: 8%. Two questions answered correctly.

Sabelo stated that he guessed all the answers. In the TIMSS equivalent mathematics test he did not even try to read the questions as he found there was too much reading. He found the paper very stressful. The questions were tricky and he did not understand what was being asked of him. He could not interpret the diagrams. Even the long division question was beyond his ability and he stated that he does not understand division.

He finds mathematics tests written using numbers and limited wording easier, though he is happy to study in English.

He has little to no understanding of fractions in mathematics calculations and when given a question with a fraction he chooses not to answer it.

During the interview I felt he did not always understand what I was asking but he never said so. This lack of comprehension showed up both in the questionnaire and the interview as discrepancies, which are glaringly obvious.

Sabelo finds mathematics difficult. He feels insecure about the subject, which he does not understand. He does not understand the teacher's explanations, he feels that he is weak in mathematics and has a poor understanding of the subject. He felt he did well in grade 7 but began to struggle in grade 8. This is not supported by his results. (See above).

He does however know that he gets low marks in mathematics, which he feels is harder for him than for others in his class.

He does mathematics homework three to four times a week for approximately 30 minutes a day. However he considers

mathematics important for his future and would like a job, which includes mathematics.

Sabelo has never had any extra lessons in mathematics. His mother and sister sometimes help him. When he does not understand an explanation he asks a friend for help. He does not let the teacher know he is struggling. He states that he is scared of the teacher. However he asked for aid once in grade 5 and received assistance. He realises he could do with serious intervention but is afraid to ask for help. (Here I felt there was a lack of communication and understanding of the question.)

5.3.2 PHILA NGONYAMA

A day in the Life of Phila:

Phila is woken up every morning by his aunt. He baths, eats breakfast, which usually consists of a cup of tea, then travels to school by bus.

After school he travels home by bus. He gets home at about 15.00, he eats lunch and then does his homework, which he feels only takes him about one hour per day.

At about 16.00 every day he goes to soccer practice at a nearby soccer club, for about two to four hours. He then returns home, baths, eats supper, watches television, reads a while and then goes to bed. He is only allowed to watch one hour of television a day. His mother strictly controls this. He enjoys watching Ricky Lake and Oprah. He feels he spends about one hour a week socialising with friends.

Personal and Home Background

Phila was born in December 1989. He was 15 years old at the time of the interview. Home languages are Zulu and Xhosa. Family members are all South Africans.

He lives in Desai in Mariannehill, in a six - room house, with his mother, two younger brothers, his younger sister, an aunt and uncle. His father lives in Gauteng where he is trying to build up his own company. He comes home one weekend per month and occasionally on holiday.

Phila shares a bedroom with his 13 year old brother. His sister has her own room and the youngest brother sleeps in his mother's room. The television is kept in his mother's room, and is brought into the dining room in the evenings. Phila watches television in the evenings after soccer practice. He does not have his own study desk but studies at the dining room table. The family have

all the mod - cons at home. However they do not own a motorcar. Phila does not have his own bicycle.

His mother completed grade 9. According to the application form for school she is unemployed. According to Phila she is a cleaner for a doctor in Pinetown. When she is happy she will speak English with Phila. However this does not occur very often.

His father's level of education is unknown. He is a senior computer technician and is trying to build up his own business in Gauteng, repairing computers. His uncle is an electrician.

Phila has a serious asthma problem, which causes frequent absences from school.

Early Childhood and Education

As a baby Phila lived in Stanger. No information was available on the early childhood toys he possessed, as he could not remember.

Phila attended an English medium primary school in Marriannhill. Teachers' comments: He is a slow worker in mathematics but has produced satisfactory results. He needs to take his work seriously and he should read widely to improve his vocabulary. (Thus it appears there is a problem, which has not been dealt with.). His Afrikaans teacher also made the remark that he has produced satisfactory results but must take his work more seriously.

The general comment: well-behaved, regular attendance, positive attitude. However he must improve his results in the future. As an educator I find these comments unacceptable as it tells me there is an underlying problem with his ability to produce better work and it is left up to him to do the improving instead of receiving help where there are obvious weaknesses. This is seen in all his results and yet no remedial action is recommended by any of the teachers in his primary education. His hobbies at primary school were gospel music, and watching television. He also does cultural dancing and plays soccer.

In grade 8 he has been absent from school on 46 days. Again the comments of his teachers reflected that of the primary school. He needs to be more serious about his studies; he is weak and must pay more attention. There is room for improvement. He has a poor work ethic. His progress is hampered by frequent absences.

His serious asthma problem has never been brought to the attention of the teachers, although it is written on his entry form. Remedial assistance has not been recommended and he has thus been severely prejudiced, both at high school and at primary

school. Early intervention could possibly have prevented the poor results he displays.

Phila wants to be a computer engineer. He would like to study at a tertiary institution.

During the interview I found that many of his answers did not tally with those in the questionnaire. I felt there was a major comprehension problem both with the reading of the questions in the questionnaire and with my verbal questions. However he was unable to state his confusion. Thus his statement that he speaks English with his mother is questionable and may have been said for my benefit.

He is happy to be at school. He likes school, especially excursions. He enjoys learning arts and culture, but does not enjoy mathematics. He feels that both teachers and learners try their best. He also thinks that the teachers want the learners to do well.

He is socially well adjusted. However he has had some problems at school. He has had money stolen from him and some of his classmates have made fun of the darkness of his skin. His mother is dealing with this problem.

Phila has access to his mother's computer at home. He uses it to play computer games. He also uses a computer at school and at a friend's house. He has used the computer to look up ideas and information in mathematics and science.

Books, Reading and Language:

There are about 10 books at home. They consist of a dictionary, some reference books and children's books in English. He enjoys reading the children's books, which he looks at occasionally when he returns from soccer practice.

Language results:

Grade 7: English First Language: 50%
Afrikaans Second Language: 49%

Grade 8:
English Second Language:
Term1: 25% Term2: 43% Term3: 15% Year Mark: 33%

Zulu Main Language:
Term1: 18% Term2: 40% Term3: 28% Year Mark: 32%

Mathematics Education, Performance and Analysis

Mathematics results:

Grade 7: 50%

Grade 8: Term1: 36% Term2: 0% Term3: 28% Year Mark: 27%

TIMSS results: 8% (two correct answers).

He gets mathematics homework about three to four times a week. It takes him about 15 minutes a day to do the mathematics homework when he can do it. However sometimes he finds it too difficult and then he leaves it. He feels that he thinks too slowly.

He finds mathematics in grade 8 difficult. He feels he was able to cope in grade 7. This feeling is supported by his results. He feels that mathematics is not one of his strengths, but it is not a weakness either. He does not feel that it is any more difficult for him than for his classmates. He feels that mathematics will benefit him in his life and in his future, both for his studies and for a job.

Phila first stated that he has never had extra mathematics lessons. However when questioned further it transpires that his grandmother, who was a teacher of mathematics and science, has given him extra mathematics lessons, when she has visited him in the school holidays. She lives in the Eastern Cape.

In the TIMSS equivalent mathematics test Phila stated that he guessed all the answers. He did not understand any of the questions. Although he has received all his education through the medium of English, he struggles to understand explanations and questions. He does all his work by rote. When I tested him during the interview it became obvious that he does not know any of the multiplication tables. He cannot do simple subtraction and does not understand the concept of negative numbers at all. He does not understand what a number line is, although he has been taught this in both primary and high school. He has no understanding of fractions and when asked to estimate he did not understand what to do. He did not understand what the word estimate meant nor was he able to do estimation after I had explained the meaning of the word to him.

5.3.3 SINA NTHEDI

A day in the Life of Sina:

Sina wakes early, washes her face or takes a bath, brushes her teeth and then has breakfast. She makes her school lunch and then gets dressed. She then goes to school. Sina leaves home at 05.45,

and travels one hour to get to school. She takes two buses, one to the oil refinery and then one to school.

After school, Sina returns home, changes out of her school uniform, which she washes for the next day. She has lunch, and then she washes the dishes, sweeps the floor and generally tidies up around the house. She then studies and does her homework and then she watches television at 17.00. After supper she watches more television usually "Generations" at 20.00. She goes to sleep at 20.30.
I have no information about Sina's school records, as the file has been lost at school. Sina left Ross High School at the end of 2004.

Personal and Home Background

Sina was born in April 1991. She was 13 years old at the time of the interview. Her home language is Zulu, but occasionally she tries to speak English at home, with her mother and brother. She demonstrates a good understanding and control of the English language.

Sina lives in a three-bedroom house in Newlands East with her mother, brother and female cousin of 26 years. Sina shares a bedroom with her 10-year-old brother. She does not have her own desk. She usually studies in the lounge. She finds time to study only when she is not doing housework.

Sina's mother completed matric and studied for a nursing diploma. She is a nurse at a Polyclinic in Kwa Mashu.

Sina has no knowledge of her father's level of education. He does not live with her. He is a self-employed electrician and works in Matubatuba, where he lives with his second wife. Sina and her brother visited her father once in December 2002, when she was 11 years old. The visit was not a success. She states that she will never visit him again. It appears her relationship with her father is confusing. They met for the first time in February 2002. He then started to visit them as often as he could (however it is very expensive, so the visits are infrequent). Since the visit in December 2002 she has seen him very rarely. She resents this and stated that she is very angry with her father. She was particularly angry that he did not visit her mother when she broke her leg.

Sina would like to study for a tertiary qualification as a teacher or a social worker.

The family do not own a motorcar and Sina does not own a bicycle, but the family possess all the mod - cons mentioned in the questionnaire.

Friends visit her at home occasionally. These are friends at home. She has acquaintances at school, but no real friends. She does a great deal of homework especially on weekends.

Early Childhood and Education

Sina lived in Kwa Mashu when she was very small. She moved with her mother to Newlands in 1998. Toys: dolls and a teddy bear. Learnt to do jigsaw puzzles and to colour in at primary school. In pre-primary school she learnt to play with dolls and tea sets. No one has ever read to her. Her mother was too busy working.

Sina went to the David Landau Centre for pre-primary school. She was taught in the medium of English. She went to the English medium Sydenham Primary School for grade one and then to an English medium, Indian, primary school in Sea Cow Lake. Even at primary school she found mathematics difficult.

She is at Ross High School for grade 8. Sina enjoys being at school. However next year she is moving to a different high school as Ross High School is too far for her to travel. She will go to a school closer to her home.

Her favourite subjects are English and Economic Management Sciences.

She feels that the learners try their best, and that the teachers care about the learners and want then to do their best. This could have been said to please me.

She has been made fun of in school. She feels the reason was because she is on the plump side, however she says this does not bother her. (I am not sure this is true). She has often been left out of group activities as well. She finds group work a real problem. It appears that socially she does not fit in to the school milieu. She has spoken to her teacher but nothing has been done to help her in this regard. She feels helpless and so does nothing but accept the situation.

There is no computer at home. Sina uses a computer at school only. She has never used a computer for any purpose other than that which she learns at school.

Books, Reading and Language:

There are between 25 and 100 books at home. The books are mainly reference books from her mother's studies. However there are some Zulu and English novels. She occasionally reads books for enjoyment. She reads series novels which she takes from the

school library. Example: "Sweet Valley High". She uses books for projects and assignments. She occasionally uses reference books and will go and sit in the library and get the information if she cannot take the book out.

Education Results:

UNKNOWN due to the loss of her academic record.

TIMSS Results: 8% (two correct answers.)

Mathematics Education, Performance and Analysis:

Sina feels she does not do well in mathematics and she thinks it is not one of her strengths. She struggles with the mathematics rules and methodology and finds it all very confusing. She has no confidence in doing mathematics calculations, but fears them.

She would not like to do extra mathematics; she feels that mathematics is more difficult for her than for other learners. She easily gives up when she does not understand an explanation, as she feels she will never understand the subject. However she states that she enjoys learning mathematics. This contradiction could be because again she was trying to please me with this statement.

She does however feel that mathematics helps her in her daily life. She also feels she needs mathematics for her other subjects as well as to get into a tertiary institution, and to get a good job. She has always battled with the subject and would not like a job that requires knowledge of mathematics.

She has never had extra lessons in mathematics. She gets mathematics homework two to three times a week for about 15 to 30 minutes a time.

In the TIMSS equivalent mathematics test Sina worked out some of the answers. For others, she just chose an answer from the multiple choices. She has never done graphs and so was unable to answer those questions. She does not understand fractions, chose a half as the smallest fraction and could not colour in 3/8ths of 24 squares. She understood that to estimate one had to round off a number but she only understands rounding down not up.

5.3.4 NQOBILE MAFUNDA

A day in the Life of Nqobile:

Nqobile is woken by her mother's cell phone at 05.00. She baths and puts on her school uniform. She catches a bus to school at 06.00. She does not eat breakfast. She arrives at school at 07.00. Nqobile takes sandwiches to school and buys a juice or cool drink from the tuck shop for school lunch, which she eats at 11.00.

After school she catches the Umlazi bus home. There she takes off her school uniform and washes her skirt, socks and shirt ready for the next day. She then eats lunch, helps her mother with other jobs in the house, and then she watches television, her favourite programme being "Backstage". She usually helps with the housework on the weekends.

Nqobile does her homework after supper. She does her homework and studying sitting on her bed or at the dining room table. She spends less that one hour a day doing homework. She usually goes to bed early.

She occasionally spends some time with her friends during the afternoon. (Possibly while waiting for the bus.)

Personal and Home Backgrounds:

Nqobile was born on the 19th January 1991. Her family are all Zulu, South Africans. Her home language is Zulu. She states that she occasionally speaks English at Home with her mother, brothers and aunt. However as we went through the interview it was obvious that her understanding of conversational English is weak. I found that at times we were not speaking about the same thing. At other times she battled to express herself and many times the answers did not correspond to the questions.

During the interview Nqobile broke down and cried. We had to postpone the interview for a day. She appeared frightened as if telling me private information was a problem for her. I felt that she was worried that I would judge her. There was a possible problem that my being " a teacher at the school as well as white and male" could have caused her some stress. During the first interview she appeared sad and stressed. I felt she wanted to please me but feared my opinions. She was far more relaxed at the second interview.

I got the impression that her family are very poor and that this is a problem for her.

Nqobile lives with her mother in Umlazi. They live in a three-bedroom house. The outhouse has four bedrooms. However on her school record sheet it is stated that she lives with her father in Bellair. This was done I suspect to ensure her place in the school. The address in Bellair belongs to her aunt.

Nqobile shares a bedroom with her mother. She does not have her own desk. Nqobile's mother's sister and her son share a second bedroom. Her grandmother lives with them as do Nqobile's mother's four brothers. Here there is a discrepancy about the brothers and I was unable to ascertain exactly who was who in the family. However there are three "brothers". The 19 year old is in grade 11, the 13 year old is at Durban Academy, and the 7 year old is in grade 2. There is a "sister" in pre-primary school. It appears the younger two children are the aunt's children. However it was clear that Nqobile and I have different understandings of "brother" and "sister".

The television is kept in the dining room. They do not have a CD player or a computer. However there is a family car. They have most of the other mod-cons mentioned in the questionnaire.

Nqobile's parents are divorced and have different surnames.

Nqobile's mother stays at home, she has no occupation and she does not work. Nqobile thinks she completed grade 9.

Nqobile's father's occupation is confusing. The school record shows that he works as a manager at a Motor repair workshop in Durban. However Nqobile states that he completed matric and now owns a number of taxis and cars and drives one of the taxis between Johannesburg and Durban. She states that he lives mainly in Johannesburg with his brothers and when in Durban stays at her aunt's house in Bellair.

Her grandparents live on a farm in Eshowe. She visits them in school holidays.

Early Childhood and Education

Nqobile had dolls, balls and a teddy bear. She learnt to do jigsaw puzzles and to colour in at pre-primary and primary school.

Nqobile went to an English medium primary school in Wentworth. Teacher' comments from primary school: Languages: weak, must work harder, could do better. "Satisfactory" for a poor mathematics result. Nqobile does not meet the requirements but is allowed to proceed to grade 8. Has to work harder.

Thus she received a condoned pass into grade 8, with some very weak results. No remedial intervention was proposed and Nqobile thus arrived in Grade 8 with a severe handicap.

High school teachers' comments: A consistent worker, fair effort, weak, must pay attention. Has made satisfactory progress but needs to work harder at weak subjects. Weak, inattentive, could do better, room for improvement, needs a more determined approach to her weak subjects.

Most of her subjects are weak and again no remediation occurs even though it is obvious that she needs help. The educators did not know she was a condoned student, that she was already handicapped when she entered high school and her weaknesses were not due to laziness or lack of effort yet the comments reflect little understanding of her problems. Here the system failed this learner.

Nqobile would like to study for a tertiary qualification after school.

Nqobile likes being at school and she thinks all learners do their best. She also feels that the teachers care about the learners and want them to do their best. She does not appear to have any social problems at school. She has friends and feels safe at school. She plays netball at home and at school. At home she plays with a group at a local youth centre.

She uses a computer at school. She uses the computer to type and to play games. She has used the computer to look up information for a science project.

Books, Reading and Language:

The family have approximately 11 to 25 books at home, most of them reference books used by her mother and aunt in their studies. However there are a few novels in English and Zulu, which belong to the children in the home.

Nqobile reads for enjoyment. She prefers reading library books and could not describe any of the books in the home. Nqobile says she reads 2 books a week from the Umlazi library. She walks to the library from her home. She enjoys children's books like "Little Red Riding Hood" or "The Little Mermaid". At the time of the interview she was reading a poetry book from the school library.

Language results:

Grade 7: English First Language: 42%

Afrikaans Second Language: 48%
Zulu Second Language: 76%

Grade 8:
English Second Language:
Term1: 35% Term2: 60% Term3: 55% Year Mark: 49%
Zulu Main Language:
Term1: 53% Term2: 32% Term3: 48% Year Mark: 47%

Mathematics Education, Performance and Analysis

Mathematics results:

Grade 7: 52%

Grade 8: Term1: 48% Term2: 40% Term3: 23% Year Mark: 39%

TIMSS: 8% (two correct answers.)

Nqobile does not feel she does particularly well in mathematics. She would like to do more mathematics at school, although she states that she does not really enjoy learning mathematics. She feels that mathematics is more difficult for her than for other learners. When she does not initially understand an explanation she believes she will eventually. She knows that she does not learn quickly in mathematics and thus has ambivalence to the subject.

Her weakness in school is possibly due to a severe learning backlog from primary school and should be noted here.

Nqobile has had some extra lessons in mathematics, however it is unclear from whom. She receives mathematics homework 1 to 2 times a week of approximately 30minutes duration.

Nqobile feels that mathematics is a help in daily life, but that the subject is only partially necessary for her other subjects. She believes she will need mathematics to get into a tertiary institution. She also feels that she needs mathematics for her future career.

Nqobile guessed the answers in the TIMSS test. She found the English difficult to read and did not enjoy doing so much reading to find out the mathematics. She stated that she prefers doing the mathematics when the question is phrased using mathematics instead of long wordy questions. Also the multiple-choice format was a problem: she found it difficult to interpret compared to just doing the calculations from a set problem.

She was unable to answer the graph question, as she has never learnt graphs. She does not understand fractions, not as to their meaning nor how to interpret what a fraction of something is. When asked to estimate she did not understand what was required but she did know to round off a number to do the calculation. However she only knew to round down numbers, not up.

5.3.5 SIYATHEMBA MSABALA

A day in the Life of Siyathemba:

She wakes up to an alarm every morning at 05.00, baths and then eats a breakfast of cereal. She then gets dressed and gets to school on the Umlazi bus. She usually takes sandwiches for school lunch but occasionally buys lunch at the tuck-shop at school.

After school she travels home on the Umlazi school bus. She immediately changes out of her school uniform and washes her uniform ready for the next day. She bathes and then settles down to her homework. She feels that she does many hours of homework each day. If she completes her homework in time she reads a book. She seldom watches television but enjoys listening to music on the radio. Here there is a contradiction as in her questionnaire she states that she watches more than four hours of television a day. I feel that she was trying to impress me in the interview and felt I would not approve of so much television watching.

Her aunt looks after the home when the family are at work and she is there when the boys get home. She leaves when Siyathemba gets home. Siyathemba then looks after her brothers until her mother gets home. She used to play with friends in the afternoons but now she has no time as she has too much homework and finds it difficult to do. She helps her mother in the house by washing dishes, cleaning the house and cooking.

She goes to bed at any time.

Personal and Home Background

Siyathemba was born on the 3rd December 1989. She was 14 years old at the time of the interview. Her home language is Zulu. The family are all Zulu South Africans. She seldom speaks English at home. When they do speak English it is only for fun. She started trying to speak English when she was in grade 6.

Siyathemba lives with her mother, stepfather and two younger brothers in Umlazi. She has her own bedroom, but does not have her own desk. The family have three bedrooms. When she studies

or does her homework she sits on her bed. The family have all the mod - cons but they do not have a motorcar.

Her mother completed matric and has a nursing degree. She is a staff nurse. Her mother works all day and returns home at 18.00.

Her stepfather is a policeman in Durban. His level of education is unknown. He gets home at 20.00 every evening.

Her brothers are five and eight years old. They are both at primary school.

Her own father lives with his sister in Umlazi. She sees him quite frequently. She lived with him when she was one year old. She does not know what he does for a living. He sometimes gives her spending money.

Her grandparents also live in Umlazi.

The family has a computer at home. It is kept in the sitting room. She uses it occasionally to play games and to listen to music. She uses a computer at school, for typing and painting. She has used the computer to look up ideas in science and to write reports. She does not play computer games.

Early Childhood and Education

She had toy cars, guns and aeroplanes. Her mother taught her to draw and colour in when she was little. Her mother also read to her when she was little.

Siyathemba has done all her schooling at English medium schools.

Teachers' comments from primary school: Siyathemba is self-disciplined, responsible, co-operative, neat, completes tasks, and does her homework. However not once does any teacher comment on her poor results or suggest she get help with her studying. This is a cause for concern.

Teachers' comments from high school: Weak, must pay attention, could do better, needs to work harder in weak areas. Lacks commitment, needs a more determined approach in weaker areas. However these comments do not take into account that Siyathemba entered the school with a distinct learning disadvantage, that she needed remediation immediately. Their assumptions that she needs to work harder do not take into account that maybe she cannot do this on her own. Yet nowhere do the comments give the parents the correct advice nor does the

learner receive the necessary intervention. This then perpetuates her difficulties.

During our discussion I felt that she had a problem understanding my questions and battled to communicate her information in a clear and concise manner. This just reinforces my queries as to her readiness for the education she is at present receiving.

She missed 10 days of school in term two and 19 days in term three. This could be a cause for concern. She wishes to complete a post matric qualification, and hopes to become a doctor.

Siyathemba likes school, she thinks the learners try their best, that the teachers care about the learners and want them to do their best. She is socially well adjusted in school. Her hobbies are television and music and she plays netball.

Books, Reading and Language:

There are no books at home. However she takes books out of the library in Umlazi on Fridays. She walks to the library. At the time of the interview she was reading an English novel from the library. She enjoys reading teenage books. She says she reads about three books a week during the school holidays and enjoys reading.

Language results:

Grade 7: English First Language: 59%
Afrikaans Second Language: 35%

Grade 8:
English Second Language:
Term1: 20% Term2: 50% Term3:18% Year Mark: 33%

Zulu Main Language:
T1: 73% T2: 87% T3:34% T4: 59%

Mathematics Education, Performance and Analysis:

Mathematics results:

Grade 7: 48%

Grade 8: Term1: 37% Term2: 37% Term3: 29% Year Mark: 35%

TIMSS Results: 8%. Two correct answers.

Siyathemba does not feel she does well in mathematics and she would like to do more of it in school. She feels that mathematics

is more difficult for her than for other learners and when she does not understand something in the subject she feels she will never understand, this reinforces her need for assistance and intervention. Thus she only partially enjoys learning mathematics. She gets lost during the lessons and gets so far behind that she is confused.

Siyathemba thinks that mathematics helps in her daily life and that she needs it for her other subjects. She understands that she needs to do well in mathematics for tertiary education and for the job she wants to do one day, however she does not want mathematics in her future career.

Friends have helped her when she does not understand but she has never had any formal extra lessons. She has mathematics homework every day and it takes her more than 90 minutes a day to complete the work.

In the TIMSS equivalent mathematics test paper she guessed the answers. She tried to work out some of the questions but found the English too difficult to understand. She was unable to do the mathematics questions I asked her to do. She did not understand fractions at all, could not estimate and did not understand graphs.

5.3.6 NOMVULA NDAWONDE

A day in the Life of Nomvula:

Nomvula gets up at 05.00. She fixes her hair and boils a kettle of water. She then opens the gate, goes to the toilet and when the water has boiled she baths and brushes her teeth. It appears there is no hot running water in the home. She gets dressed and leaves home at 06.00. She never has breakfast. She travels to school by bus and arrives at 07.00.

After school she goes home on the special Kwa Mashu school bus. When she gets home at 16.30, she eats lunch, polishes her shoes and does her homework. She then cooks supper and goes to bath. The family then eat together, after which she washes the dishes and then goes to bed.

Nomvula spends one to two hours a day helping with the housework at home. Nomvula does not watch television except on weekends, nor does she play sport after school. She also has little time for socialising with her friends after school.

Personal and Home Background

Nomvula was born on the 31st August 1990. She was 14 years old at the time of the interview. Her home language is Zulu. Her

family are all South Africans. She also speaks Xhosa and English. She occasionally speaks English with her cousin and her uncle. Nomvula speaks English well and with great confidence. It is clear she has a fair command of the language. She understood and was able to answer fluently all of the questions put to her.

Nomvula lives in Kwa Mashu with her grandmother, uncle and female cousin. She shares a bedroom with her cousin. She does not have her own desk. She has lived with her grandmother for three years. Having previously lived in the Eastern Cape with her grandmother's sister.
However here I have a discrepancy as she also states that she returned to Kwa Mashu in grade 3. I have been unable to ascertain the exact facts on this matter.

The family does not have a motorcar but they have all the other mod - cons mentioned in the questionnaire.

Nomvula is an asthmatic but seldom if ever misses school.

Nomvula's mother has a diploma in nursing and is a professional nurse; she works for Discovery Health in Johannesburg. Her mother has remarried and has a five-month-old baby daughter. Nomvula visited her mother in December 2003 and hoped to visit her in July 2004. Her mother supplies all her basic financial needs. She speaks to her mother two to three times a week on the telephone.

Nomvula does not know what level of qualification her father has. She thinks he once had a taxi and fixes cars. Her grandmother told her he has a factory somewhere. She feels he has money. She has very little contact with him. She has his phone number and contacts him when she needs money. He never contacts her and she usually has to beg him for financial assistance.

Her grandmother is Xhosa, but her grandfather was Zulu. Her grandmother was also a nurse as is her aunt. Her cousin is studying to be a doctor. It thus appears that the women in the family are ambitious and career orientated.

Early Childhood and Education

When Nomvula was very small she lived with her mother and grandmother in Kwa Mashu. She went to live with her grandmother's sister in the Eastern Cape when she was five years old. She started school there. As a small child she had a pink teddy bear, a cooking set and a ball. She only learnt to do jigsaw puzzles and to colour in at primary school.

Nomvula attended an English medium primary school in Durban from grade 3. The teachers' comments were that she had made satisfactory progress.

At present she attends an English medium high school. Her teachers' comments: Has made good progress, pleasant to have in class, congratulations on fine results. Although her results are in the mid sixties and upper fifties, she came first in her class. Other comments: In Zulu, room for improvement, weak, inattentive. For mathematics praiseworthy performance, good work ethic, commendable effort, and a motivated learner. In general a diligent learner who has approached her studies with interest.

Nomvula would like to complete a first degree. She would like to be a model or a nurse. She would also like to be a pilot. I feel that Nomvula lives in a dream world rather than facing the harsh realities of her own life.

Nomvula only partly enjoys being at school. However she feels that the learners try their best. She believes that the teachers do not really care about the learners as they shout so much and do not appear to understand her needs in class. She also feels the teachers only partly want learners to do their best. Thus she has a fairly negative attitude to school, and to her teachers. Here is a student who it appears has potential but with a lack of rapid comprehension has often been left behind in the learning process and feels helpless.

She has been made fun of in school by both learners and a teacher because she wears glasses. They call her "aunt Caroline" after the rice advert. This she finds very hurtful and increases her sense of negativity to schooling. She would like to play rugby at school and resents the fact that girls at her school are not allowed to play rugby.

She spends one to two hours a day doing homework.

The family does not have a computer at home. Nomvula uses a computer at school to paint and draw. She does not play computer games or use the Internet.

Books, Reading and Language:

There are very few books at home. Nomvula takes books from the Kwa Mashu public library. She enjoys reading comedies and long stories in English. She does not read Zulu books. She started reading in grade 3 when she had to do book reviews. She finds little time to read but does occasionally read books for enjoyment.

Language results:

Grade 7: English Main Language: 69%
Afrikaans Second Language: 54%

Grade 8:
English Second Language:
Term1: 55% Term2: 68% Term3: 70% Year Mark: 66%

Zulu Main Language:
Term1: 53% Term2: 43% Term3: 30% Year Mark: 47%

Mathematics Education, Performance and Analysis:

Mathematics results:

Grade 7: 68%

Grade 8: Term1: 78% Term2: 59% Term3: 81% Year Mark: 69%

TIMSS Results: 8% (two correct answers.)

There is an enormous discrepancy in Nomvula's mathematics results. They fluctuate with her examination marks being a lot lower than the results achieved in class tests and term work. This disparity was difficult to explain as in all my questions Nomvula was unable to give me the correct answers. When I began to question her about the mathematics I found that she had a problem understanding English terminology. Although in the interview she tried to impress me by showing astonishment at her failure to correctly answer the TIMSS equivalent test questions.

She stated that her mathematics teacher uses both English and Zulu in her explanations and she said she finds this confusing. Thus creating confusion in her mathematics understanding. She would prefer that the explanations were always in English stating, "I prefer English because I always learnt maths in English". However the discrepancy in her mathematics results, from 69% average in school to 8% in the TIMSS equivalent test, could be, that in fact the explanations in Zulu help her understanding and ability to achieve in the school mathematics.

The new format of the TIMSS equivalent test questions and English terminology not familiarly used in her mathematics classroom would have affected her ability to answer these questions. The terminology not having been explained in Zulu. Even though Nomvula stated that she has always learnt mathematics in English and feels that she is comfortable with this, the fact that the grade 8 school mathematics is often also explained in Zulu may be an important cause for the enormous

discrepancy shown between her school results and her TIMSS equivalent test result.

She could not find the co-ordinates on a graph although she remembers the teacher giving that lesson in class. She showed no understanding of fractions, making the same mistakes as most of the other learners in choosing ½ as the smallest fraction because 2 was the smallest number. She did not understand the concept of 3/8 of 24 squares and did not even attempt to answer the question. She did not understand the meaning or application of "estimate" and as with the other learners chose the numbers 60 and 90 thus having no concept of rounding up. This lack of understanding could have been due to the questions being asked in English. Had they been asked in Zulu a different picture may have emerged.

Her problem in answering the TIMSS equivalent test questions correctly was a problem with the terminology and that the questions were phrased in an unfamiliar context. She thought all her answers were correct but when asked to read some of the more complex questions she struggled to interpret and answer the questions. When asked to demonstrate the horizontal axis on the graph in question 18 she was unable to do so.

Nomvula feels that she usually does well in mathematics. However she would not like to take more of it at school, as she does not really enjoy learning the subject. She feels she has no problem understanding the mathematics, she thinks quickly in mathematics but does not feel it is one of her strengths.

Nomvula believes that mathematics helps her in daily life but she is not convinced that she needs it for her other subjects. She does feel that she needs to do well in mathematics to get into university and she may need the subject to get the job she wants although she does not want to work in a job that requires mathematics.

She has never had extra lessons in mathematics. She listens in class and when she has a problem she asks a friend to help her. She receives mathematics homework every day for about 15 to 30 minutes.

5.4 SUMMARY

These life stories are the result of constructed data from the interviews as well as in depth description of each student's mathematics results, language results and TIMSS equivalent mathematics test results. They include family information as provided in the interviews with the students and school records relevant to the study.

They will be analysed in the next chapter into those factors relevant to the study, their relationship to the mathematics achievements of the students, and their relevance in any future curriculum planning in the mathematics education of all students.

CHAPTER SIX

ANALYSIS RELATING STUDENT BACKGROUND TO MATHEMATICS PERFORMANCE

6.1 INTRODUCTION

This chapter is a cross case analysis focusing on the life stories and home backgrounds of the interviewees to draw out the factors that influence mathematics performance. Each factor is discussed with reference to other studies which looked at home background and its effect on mathematics achievement.

First the student's personal background is tabulated and the effect of student age and gender on mathematics performance is established.

The home background is looked at in depth as to the number of books, modern conveniences, private space, study facilities, educational resources and safety in the home. These factors are related to the school results in language and mathematics.

The person and background of the student's caregiver is reflected upon as to the relationship with a student's level of achievement.

Finally the mathematics is analysed relative to literacy, reading, time spent doing homework and attitudes towards mathematics.

Recommendations and implications are made and final conclusions are set out.

6.2 PERSONAL BACKGROUND AND MATHEMATICS PERFORMANCE

Table 1: High Performing Group

	Student Age	Student Gender
Nkosi Gumede	14	Male
Asanda Zondi	13	Female
Eric Govender	13	Male
Carol Els	14	Female
Phili Ngcobo	13	Female
Siphiwe Mkhize	15	Male

Table 2: Low Performing Group

	Student Age	Student Gender
Sabelo Lambethe	14	Male
Phila Ngonyama	14	Male
Sina Nthedi	13	Female

Nqobile Mafunda	**13**	**Female**
Siyathemba Msabala	**14**	**Female**
Nomvula Ndawonde	**14**	**Female**

6.2.1 Student Age

As can be seen from Tables 1 and 2, the student's age is not an important factor as a cause for poor results in TIMSS or achievement in mathematics.

The average age of the students in my study was 13 to 14 years. This was found to be consistent with the 14.4 years, which was found to be the average age of the students from most countries who took part in the TIMSS studies. The South African Students average age was 15.5 years (Howie, 1999).

According to the TIMSS 1998 literacy study, South African students were stated to be "almost the oldest," Howie and Hughes (1998), in their analysis of data on home background supplied by TIMSS student questionnaires, states: "South African pupils were on average much older than the international average." The South African pupils were the oldest pupils in TIMSS-R (Howie, 1999).

Thus my findings appear to contradict that of the findings of Howie and Hughes(1998), as the average age of the students I interviewed was within the range of that of the international average. Thus age is not a factor in affecting achievement levels in mathematics in this small sample.

6.2.2 Student Gender

From the high achieving group (Table 1), it can be seen that gender is not significant. Of the six high performing students, three are male and three are female. The top achievers, namely Asanda and Nkosi are female and male respectively.

However, of the six students in the low performing group (Table 2), two are male and four are female. Thus here there could be some significance as it is often said that boys are "better" at mathematics than girls. The fact that two thirds of this group are female could be regarded as significant but as the group is so small, the significance is not marked and a more intensive look at the low achievers would be necessary. Their school mathematics results show a different picture. In fact these results support Howie's findings in the TIMSS study (Howie, 1999), as the girls all achieved higher results.

Gender was regarded by most countries as significant and was reported on by both Howie(1999) and Robitaille and Beaton

(2002). This difference however amongst the grade eight students was found to be small in all countries.

The gender profile for South Africa, according to Howie (1999) was 53% girls and 47% boys.

However in New Zealand and The Phillippines, girls outperformed boys, though not in significant numbers. Canada, England, Iceland, the Netherlands, Korea, Japan, Iran and Denmark reported that boys outperformed girls, though again not in significant numbers. (Robitaille and Beaton, 2002).

In this study, gender did not appear to be significant relative to the students' mathematics achievements.

6.3 HOME BACKGROUND AND MATHEMATICS PERFORMANCE

Tables 3 to 6 create a picture of the home background of each student, as well as their language and mathematics achievements as extracted from the interviews and school records. This is then analysed and interpreted below.

Table 3: High Performing Group

	Number of books	Study Facilities	Electricity and other modern conveniences	Safety and security	Own Bedroom
Nkosi Gumede	<11	Dictionary, Own desk	All	Good	Yes
Asanda Zondi	25	Dictionary	All	Good	No
Eric Govender	25	Dictionary, Own desk, computer	All	Good	Yes
Carol Els	Nil	Dictionary	All	Poor	Yes
Phili Ngcobo	>100	Dictionary	All	Good	No
Siphiwe Mkhize	Nil	Dictionary	All	Good	No

Table 4: Low Performing Group

	Number of books	Study Facilities	Electricity and other modern conveniences	Safety and security	Own Bedroom
Sabelo Lambethe	25	Dictionary, Own desk, computer access	All	Poor	Yes
Phila Ngonyama	10	Dictionary computer access	All	Poor	No
Sina Nthedi	25-100	Dictionary computer access	All	Good	No
Nqobile Mafunda	25	Dictionary	All	Poor	No
Siyathemba Msabala	Nil	Dictionary	All	Good	Yes
Nomvula Ndawonde	Nil	Dictionary	All	Poor	No

Table 5: High Performing Group's End of Year Grade 8 Language and Mathematics Percentage Results.

	English	Zulu	Afrikaans	Mathematics
Nkosi Gumede	68	78		73
Asanda Zondi	80	-	98	85
Eric Govender	83	-	73	81
Carol Els	67	-	53	46
Phili Ngcobo	82	-	76	72
Siphiwe Mkhize	52	60	-	54

Table 6: Low Performing Group's End of Year Grade 8 Language and Mathematics Percentage Results.

	English	Zulu	Afrikaans	Mathematics
Sabelo Lambethe	45	53	-	29
Phila Ngonyama	33	32	-	27
Sina Nthedi	Unknown	Unknown	-	Unknown
Nqobile Mafunda	49	47	-	39
Siyathemba Msabala	33	59	-	35
Nomvula Ndawonde	66	47	-	69

6.3.1 The Number of Books in the Home

It is apparent that reading is not high on the agendas of most of the families of the students interviewed. The books in the homes of the students appear to be mostly reference books from previous studying done by members of their families.

Eric, Sina, Sabelo, Nqobile, Asanda and Phili have more than 25 books at home but fewer than 100 (Table 3 and 4). However only Phili has books that she has bought or been given, and is able to enjoy and read when she so wishes. None of the other students interviewed had many books at home.

The number of books in the home does not appear to be linked to language and mathematics performance. Carol and Siphiwe have no books at home yet they are from the high achieving group (Tables 3 and 5). Sina, Sabelo and Nqobile have 25 books or more at home, yet they achieved very poor results in both English and Mathematics (Tables 4 and 6).

My findings correlate with that of Robitaille and Beaton (2002) who found that no country reported a significant correlation between number of books in the home and mathematics achievement. "Latvian students reported the largest number of books at home, this did not correlate to higher achievement in the international comparison." (Robitaille and Beaton, 2002).

6.3.2 Other Educational Resources in the Home

> "This is particularly relevant, to the South African case, as disparities in resources have pervaded South African society for many years" (Howie and Hughes, 1998).

Howie (1999) focused on three aids in the home, namely a dictionary, a study desk and a computer. It was found that only 5% of pupils in Iran, Moldavia, and Morocco and 8% of pupils in South Africa, Thailand and Turkey have all three aids compared with the international average of 41%. However only in South Africa, was the difference between achievement and having these resources found to be significant.

My findings correlate with that of the international finding and do not agree with that of Howie (1999). Howie (1999) found "South Africa was the only country where these differences equalled or exceeded 150 points between those with all educational aids and those with two or fewer aids".

Although only Nkosi, Eric and Sabelo had their own desks, Sabelo, Phila and Siyathemba had access to a computer, Phili frequently uses a computer at an Internet café near her home in Durban centre and Eric had his own computer at home, this did not have any impact on the interviewees' mathematics achievements (Tables 5 and 6).

Eric, Phili, Phila, Siyathemba and Sabelo frequently use a computer and are comfortable with this educational aid. However all the students interviewed occasionally use computers at school as part of their study curriculum. This computer usage appears to be more a social and game exercise than a positive training exercise in computer usage and thus does not count as training and/or computer literacy per se. None of the students use a computer for study purposes or to improve their computer literacy, thus educationally their computer usage does not help in their mathematics or language usage.

Thus the availability of a dictionary, a desk and a computer at home did not in any way significantly relate to the achievements in mathematics of either the TIMSS equivalent test results or the school achievements of those interviewed (Tables 3,4,5and 6).

It is true that in many South African schools there is still a lack of resources, particularly textbooks and building facilities, but these were not part of the analysis of the TIMSS student questionnaire, nor were they mentioned by Howie and Hughes (1998), thus this was not looked into. However they should be part of a future study in TIMSS as well as any other study on factors affecting student achievements.

6.3.3 Electricity and Modern Conveniences in the Home

Of the students interviewed, all have electricity and most of the modern conveniences as defined in the TIMSS student questionnaire.

Almost all the students spend an average of two to four hours a day watching television. Nomvula is the exception, as she has no time during the week for television. Most of their viewing time is spent watching soapies, children's television or early morning television. Even those that read do not spend as much time reading as they do watching television. Their enjoyment in watching television could be used in developing teaching and learning strategies in mathematics.

6.3.4 Safety and Security in the Home

The freedom from danger, risk, apprehension and injury, the environment to develop confidence are what all homes should offer children.

This was not reported on in the analyses of TIMSS. Yet in the interviews there was a correlation between the feeling of security and safety and achievement levels both in mathematics and language.

From the high achieving group: Asanda, Nkosi, Eric, and Phili experience security and safety as defined above. Thus 66% of the high performing group live a secure, safe life free from adult worries. They know they can trust the adults who care for them and their family lives leave them free to focus on their studies and be children.

Siphiwe has some measure of security as he has three adult men in his life looking after him. Although he carries some adult responsibility for himself he does experience a measure of safety and security in that he knows he has adults he can rely on at all times. Carol does not experience this feeling of security and safety. There is an aura of sadness as she talks and her body language is closed and fearful. Her ability to achieve is aided by her desire to improve her life. She has learnt to rely on herself and she is driven to prove herself in spite of her fears and anxieties.

Of the six students in the low performing group only Siyathemba experiences a secure home environment. Her mother and stepfather give her that care and take an interest in her life. The other students in the group do not experience this. Sabelo in fact carries adult responsibilities, which weigh heavily on his mind. Sabelo looks after his blind and semi-paralysed grandfather whose needs are seen to almost entirely by him. Although Sabelo's parents live close by they do not offer him much care and attention and the level of responsibility he feels for his grandfather and the help he gives his grandmother detract from other responsibilities like schoolwork which are low on his priority list. This is reflected in his low achievement levels in

grade 8. He averaged 49% for Zulu main language, 44% for English second language, 25% for mathematics and 8% in the TIMSS equivalent mathematics test. His answers to many of my questions during the interview showed a lack of comprehension and his need for intervention is obvious if his future is to be of a positive nature.

Thus a safe home environment where the student is free from major adult responsibilities, in order to concentrate on his studies, is not present in many of the homes of the students I interviewed and may be an important cause of their poor levels of achievement in mathematics.

6.3.5 Home Responsibilities, Daily Time Spent Travelling and Time Spent Doing Homework

Home responsibilities and time spent travelling to school in the morning and back home in the afternoon was not researched nor discussed in the TIMSS studies. However as can be seen (Tables 7 and 8) below the low achieving students have many home responsibilities and spend on average one to two hours travelling every day. Sina and Nqobile spend very little time doing homework because they are tired and need to rest after their other exertions. Sabelo and Siyathemba spend many hours doing homework because of their huge responsibilities and long travelling time they are tired and the work takes them much longer. Although they are not given more work than the high performing group who average one hour of homework per day. This could be a cause affecting their language and mathematics results as their focus, on returning home tired from the long time spent travelling, after a full day of classes, are their chores and not the work they have to do for school. The high performing students on average do not spend as much time travelling nor do they have as many chores to do and they all spend on average one hour a day doing homework.

Table 7: High achieving groups responsibilities in the home, daily time spent travelling to school and returning home and time spent on homework

	Responsibility	Daily Travelling Time	Homework per day
Nkosi Gumede	Occasionally cleans the garden	1 hour 20 minutes	1 hour
Asanda Zondi	Helps sometimes in the home	2 hours	1 hour
Eric Govender	None	30 minutes	1 – 2 hours
Carol Els	Cleaning her bedroom, the kitchen, the dishes, toilets and bathroom	30 minutes	1 – 2 hours
Phili Ngcobo	Washes dishes, removing rubbish and cleans the bath	1 hour	All done at school during recess
Siphiwe Mkhize	Washes own shirt and socks, helps with the cooking and all house cleaning.	1 hour 30 minutes	1 hour

Table 8: Low achieving groups responsibilities in the home, daily time spent travelling to school and returning home and time spent on homework

	Responsibility	Daily Travelling Time	Homework
Sabelo Lambethe	Takes care of his blind and partly paralysed grandfather. Makes breakfast or school lunch, wakes uncles, sweeps the house and garden.	2 hours	2 – 3 hours
Phila Ngonyama	None	1 hour	1 hour
Sina Nthedi	Washes school uniform,	2 hours	<1 hour

	washes the dishes, sweeps the floor, and tidies around the house.		
Nqobile Mafunda	**Washes school uniform, helps with all the chores in the home.**	**2hours**	**<1 hour**
Siyathemba Msabala	**Washes school uniform, looks after younger brothers, washes the dishes, cleans the house and cooks.**	**1 hour 20 minutes**	**Many hours**
Nomvula Ndawonde	**Polishes shoes, cooks supper, any chore that needs to be done in the home, washes the dinner dishes.**	**2 hours**	**1 – 2 hours**

6.4 CAREGIVERS AND THEIR BACKGROUNDS

6.4.1 Educational Level of the Main Caregivers

It would appear from my study that one of the main problematic issues in the TIMSS study is the assumption that children live with their parents, who depending on their level of education encourage and demonstrate to their children the importance of achieving in education. However the stories in this study show that the most important parental roles are often left to caregivers, siblings, grandparents and specifically grandmothers. The absence of fathers in many students' lives is also significantly noted. In fact in this study the number of absent mothers was also a problem (Tables 9 and 10).

Parents are often not the caregivers in South Africa. The TIMSS student questionnaire appears to assume that the parents are the main caregivers and that the students live with both parents. However in South Africa many children live with grandparents, relatives or siblings. It is often their role to help students with their homework, problems, finances, school fees and extra activities.

Table 9: High achievers and the caregivers with whom they live.

	Both Parents	Mother	Father	Grandparents
Nkosi Gumede	Yes			
Asanda Zondi				Yes
Eric Govender	Yes			
Carol Els			Yes	Yes
Phili Ngcobo		Yes		
Siphiwe Mkhize			Yes	

Table 10: Low achievers and the caregivers with whom they live.

	Both Parents	Mother	Father	Grandparents
Sabelo Lambethe				Yes
Phila Ngonyama		Yes		
Sina Nthedi		Yes		
Nqobile Mafunda		Yes		Yes
Siyathemba Msabala		Yes		
Nomvula Ndawonde				Yes

In the high performing group, Nkosi and Eric live with both parents, Carol and Siphiwe live with their fathers, only Phili lives with her mother, while Asanda and Carol live with grandparents who are very important as their caregivers (Table 9).

Amongst the low performing group none of the students have fathers living at home, Phila, Sina, Nqobile and Siyathemba live with their mothers. Nqobile also lives with her grandmother. Sabelo not only lives with his grandparents but has a huge responsibility towards the care of his grandfather. He thus has responsibilities but little in the way of parental care as defined

by the TIMSS student questionnaire. Sabelo and Nomvula do not have much contact with either parent and are solely reliant on their grandparents (Table 10).

The TIMSS study linked parental education to the students' achievements. However as can be seen from the analysis above parental educational levels are not the only educational levels affecting the students. Their grandparents' education levels are also important. Yet the TIMSS student questionnaire only asked about parent education levels. Summarised in Table 11 and 12 below are the education levels of all the caregivers as known by the students.

Table 11: Table showing caregiver education levels of high performing group

	Grand Parents	Lower than Matric		Matric		Tertiary	
		Mom	Dad	Mom	Dad	Mom	Dad
Nkosi Gumede					x		x
Asanda Zondi	Matric				x	x	
Eric Govender		x			x		
Carol Els	Grade 8	x	x				
Phili Ngcobo				x			
Siphiwe Mkhize	Unknown						

Table 12: Table showing caregiver education levels of low performing group

	Grand parents	Lower than Matric		Matric		Tertiary	
		Mom	Dad	Mom	Dad	Mom	Dad
Sabelo Lambethe	<Matric					x	x
Phila Ngonyama		x			x		
Sina Nthedi					x	x	
Nqobile Mafunda	unknown	x			x		

Siyathemba Msabala						x	
Nomvula Ndawonde	**Tertiary**					x	

Parental education is often linked to students' achievement. This was reported on by a number of countries, namely Spain, Singapore and Latvia, where the higher the parental education level, the more likely their children were to succeed in school (Robitaille and Beaton, 2002). Holland did not report any significance in parental education levels, but about 30% of the students did not know their parents' education level (Robitaille and Beaton 2002). In Romania, students with parents who have higher levels of education, tended to perform better (Robitaille and Beaton, 2002).

In South Africa only 15% of grade eight students reported that either their mother or their father had finished university (Howie, 1999). Grandparents' education levels were not researched.

Of the high performers (Table 11) Asanda's mother achieved a matriculation certificate and has a tertiary qualification from UNISA. The mothers of Phili and Nkosi achieved their matriculation certificates and Nkosi's mother has a diploma in education and works as a primary school teacher. Eric's mother completed grade 9 and Carol's mother completed grade 10. Simphiwe's mother's level of education is unknown. Thus of my top group, 16% have a mother with a university qualification and 33% have a tertiary qualification, 16% do not know their mother's qualification. This is very close to the results found by Howie (1999).

The fathers of Asanda, Nkosi and Eric received matriculation certificates and Nkosi's father has a tertiary diploma. Carol's father has a grade nine qualification and Phili's father is deceased and his qualifications are unknown. Thus 50% have a matriculation qualification, 16% have a tertiary qualification and 16% unknown.

Asanda's Grandmother completed matric and works as a consultant for Tupperware. Carol's grandmother completed grade 8 and is a pensioner. Yet both these students are in the high achieving group.

Thus of the high performers (Table 11) very few have parents with a higher level of education and my findings do not support the statement "Parental education is often linked to students' achievement" (Robitaille and Beaton, 2002).

The low performing group (Table 12) however show a different picture.

The mothers of Nomvula, Sabelo, Sina and Syathemba all have their matriculation certificates and a tertiary qualification in nursing. Phila's and Nqobile's mothers does not have a qualification and only achieved a grade 9 school-leaving certificate.

While all their fathers' qualification levels are unknown, it appears from the school registration documents that Phila's father works as a computer technician in Johannesburg and Sina's father works as an electrician. Therefore there is a certain level of achievement here that perhaps does not show in the interviews.

Thus 83% have mothers with tertiary qualifications and 100% do not know their fathers' qualifications. Nomvula's grandmother is a qualified nurse and thus has a tertiary qualification, yet Nomvula does not achieve high results.

These findings do not support the statements of either Robitaille and Beaton (2002) or Howie (1999). In this study caregiver qualification level does not appear to be an important factor in the TIMSS equivalent mathematics achievements of the students interviewed.

However, the effect of caregiver interest in the students' studies, and input from a young age, on their TIMSS equivalent mathematics achievements need to be looked at next.

6.4.2 Parental Input During the Formative Years of a Student's Life

The effect of early childhood learning was not looked at by any of the reported studies done on the TIMSS study. As part of my interviews I questioned my 12 students, on what they remember as important in their lives from the age of two to five years. Psychologically these formative years are regarded as important in the development of a child and the establishment of a sound education foundation.

In the high performing group Asanda, Eric, Carol, and Phili all had parental input and attention during their formative years. Asanda and Eric learnt numbers and the alphabet. Asanda's grandmother taught her to sew. Carol played with alphabet blocks. Eric played with Lego, learnt to do puzzles and was encouraged to understand numbers. Phili and Eric learnt the joys of being read to from an early age. Thus they developed a love for the written word, which is obvious in their interest in books,

Phili's love of reading and Eric's enjoyment of extra studying and his ambition to achieve.

In the low performing group only Siyathemba's mother read to her and taught her to draw and use coloured crayons. None of the other parents nor grandparents appear to have spent much quality time with the students during their formative years.

There thus appears to be a relationship between the importance of parental input during a child's formative years and the child's achievements in mathematics and literacy.

6.4.3 Attitudes, Interest and Involvement of the "Parents" in their Children's Education

From the group of students interviewed it was apparent that most of the parents do not involve themselves in their children's education.

The students who do have involved parents however appear to be the high performers, and this involvement could be an important factor in their above average mathematics as well as language achievements.

Eric's father takes a great interest in his son's schooling. He buys him extra textbooks, supervises him in extra mathematics work and helps him wherever he can. Eric also spends time with his father in the early evenings, helping his father in the garage. The family eat supper together and thus spend quality time in each other's company. This could be an important factor in Eric's above average achievements.

Asanda's mother, before her death, visited Asanda constantly, and although they did not live together her mother showed an interest in all she did. Asanda is also very close to her father. He visits her frequently and takes her out. Her grandmother taught her to sew clothes for her dolls when she was very young thus forming a trusting bond between them. This helped Asanda, when her mother passed away, as her loving relationship with her grandmother has given her the security to continue and achieve.

Nkosi's father tries to speak English with his children. He watches television with them and thus has input in their lives. Cultural knowledge is encouraged in the family and Nkosi learns cultural dancing, thus increasing his links to his family.

Siphiwe lives with his father and two uncles. He respects his father and is very close to him. Although the adults arrive home after he does, Siphiwe shares cooking and cleaning chores with his father and uncles and this shared task and their close

relationship is an important factor in developing Siphiwe's self confidence.

Phili has an extremely close relationship with her mother and her domestic carer. She shares a bedroom with her mother, and from the interview, it was obvious that Phili's mother takes her daughter into her confidence in all her life dealings. Phili's carer has been with her since she was six years old and is a trusted and much loved friend, enabling Phili to feel secure even when her mother is not at home. Phili, being an only child living alone with her mother, has developed a very strong bond, which is very obvious in her demeanour and self-confidence. Phili's grandmother feels she is spoilt, but Phili feels she has advantages, as her mother is successful and she is very proud of her mother.

From the above it can be seen that all the students I have mentioned as having close relationships with their parents or significant caregivers, are also the achievers in the high performing group, which speaks volumes for the importance and value of a close, trusting, and involved relationship between child and caregiver, in the ability of that child to succeed and achieve at school. This was supported by the research done by Pollard (1990). Significant caregivers also help students with heir homework and their literacy often affecting the achieved results. It is thus important to focus on the interest a caregiver takes in a student's education rather than their level of education.

By comparison the students from the low performing group do not appear to have this close relationship with their parents/caregivers. All have absent fathers who seldom take an interest in their lives.

Although Siyathemba lives with her mother and stepfather, she does have a close relationship with her father whom she sees frequently.

Sabelo is responsible for the care and well being of his grandfather, he also assists his grandmother with many necessary home chores. Thus his only security is the knowledge that he has a home. Although his parents live close by he has only slept at their home twice in the last three years. He cannot remember any adult showing an interest in his studies.

Phila's father lives in Gauteng and only comes home once a month. His mother is frequently unhappy and does not have much time for him. Sina has no relationship with her father who lives in Matubatuba. Nomvula has no contact with her father and her mother lives in Johannesburg. She has a close and good relationship with her grandmother. Nqobile has a close

relationship with her mother and grandmother but her father is frequently absent from her life and she has little to do with him.

Thus there is very little male influence in the low performing groups' lives which creates a vacuum and sense of loss which is reflected by their poor achievements.

6.5 MATHEMATICS

6.5.1 Relationship between TIMSS Equivalent Test Performance and School Mathematics Performance.

The TIMSS results were affected by the strangeness of the multiple- choice questioning and the format of the paper. This is clearly seen by the results achieved in the TIMSS equivalent test, which were so much poorer when, compared to the results achieved in the written tests in school.

Table 13: Mathematics Performance of High Achieving Group

	TIMSS Equivalent Mathematics Test Result	School Mathematics Year Mark
Nkosi Gumede	76	73
Asanda Zondi	76	85
Eric Govender	72	81
Carol Els	60	46
Phili Ngcobo	60	72
Siphiwe Mkhize	56	54

Table 14: Mathematics Performance of Low Achieving Group

	TIMSS Equivalent Mathematics Test Result	School Mathematics Year Mark
Sabelo Lambethe	8	29
Phila Ngonyama	8	27
Sina Nthedi	8	Unknown
Nqobile Mafunda	8	39
Siyathemba Msabala	8	35
Nomvula Ndawonde	8	69

The high performing group of students TIMSS equivalent test results correlates well with their school results (Table13). Only Phili has a large discrepancy. She found the multiple-choice mode of questioning difficult and prefers less wordy mathematics test questions.

The low performing group achieve far better results in the school mathematics tests and examinations (Table 14). They were familiar with the school tests, mode of questioning and had done a great deal of practice with the type of questions asked. The TIMSS equivalent test questions were in an unfamiliar format and were mainly phrased as word problems, a mode unfamiliar and complicated for these students.

6.5.2 Languages and Mathematical Literacy

The extent to which learners speak the language of instruction and testing was one factor that was of significance in all countries and is reported by all analyses.

> "In South Africa, only 26% of pupils spoke the language of the TIMSS test as their first language and more than 70% did not always speak the language of the test at home" (Howie and Hughes, 1999).

This is supported in the number of students from the low performing group who were unable to answer word problems at all.

Howie in her 1999 analysis of the international TIMSS data stated:

> "there is a trend in Indonesia and Malaysia where pupils who never spoke the language of the test at home. .....still appeared to outperform those who always or sometimes spoke the language of the test at home" (Howie, 1999).

Howie and Hughes (1998) in their analysis determined that in South Africa,

> "There was no relation between the students' use of language at home and their performance in either mathematics or science. For instance, the students in the Northern Cape who <u>sometimes</u> spoke the language of the test at home had better scores in both mathematics literacy and science literacy than the students who <u>always</u> spoke the language at home." (Howie and Hughes 1998).

My findings appear to support these statements, as I found that in the high performing group all the students were fluent in English and could converse freely and had a clear understanding of all the mathematics questions put to them in English.

Although Asanda and Nkosi speak Zulu as their home language, their understanding of English as seen by their grade 8 results in English, namely 80%, and 70% respectively, and the fact that

they study English as a main language show their competence in that language and hence their ability to understand the questions posed in the TIMSS equivalent mathematics test. Their English results also correlate favourably with their mathematics achievements in grade eight which are 88% and 73% respectively. The interesting factor here is that their achievements in school mathematics correlate reasonably closely with their TIMSS equivalent mathematics test achievements.(Asanda: mathematics: 88% and TIMSS: 76%. Nkosi: mathematics: 73% and TIMSS:76%.)

Eric and Carol both speak English as their home language. Eric's achievements also tie up very closely. He achieved 83% for English, 78% for school grade eight mathematics and 72% for TIMSS equivalent mathematics test. Carol however shows a different pattern. She achieved 68% for English, 60% for the TIMSS equivalent mathematics test but only 47% for grade eight mathematics. This discrepancy could be due to her problems with numeracy and not with the language per se.

Phili speaks Tswana as her home language and is thus in a category of her own. However as she states in her interview: "I often speak English at home because I'm half Tswana and half Sotho and most of my neighbours just don't understand Tswana or Sotho, so I speak English with my mother, my friends and my neighbours." Her fluency in English is mirrored in her grade eight results: 83% for English, 71% for school mathematics and 60% for TIMSS.

Siphiwe is the one that stands out in this high performing group, as his spoken English is not as fluent as that of the other students. His English grade 8 achievement of 48% shows a weakness in the language, yet his mathematics scores both for TIMSS and grade 8 is 56%, which puts him as a high scorer in mathematics. Thus his results do appear to support the comments made by Howie and Hughes (1998).

With regard to the low performing group, all of them are weak in English, which they study as a second language. Nqobile and Sabelo achieved a reasonable result in grade eight English of 50% and 44% respectively, however during their interviews it was obvious that their understanding of the spoken and written word in English is extremely weak and could be a factor in their poor mathematics results.

Phila and Siyathemba achieve very poor grade eight English results, namely 29% and 30% respectively. Their mathematics results of 22% and 35% respectively show a poor achievement in mathematics and their achievement in TIMSS of 8% reflects their lack of understanding of the questions.

Nqobile, Sabelo, Sina, Siyathemba and Phila said they guessed the answers in the TIMSS test. They found the English too difficult to read, and did not enjoy reading so much English to find the mathematics. They found the questions tricky and did not understand what was required.

All the students have done most, if not all of their education in the medium of English. These students have all completed primary school and yet in grade eight, having done all their schooling through the medium of English are unable to read, understand and interpret mathematics questions written in English. So what is the level of their language literacy and their mathematics literacy? It appears that the English they experience in school and the English they use at home and in their social lives are so different that their understanding and conceptualisation is limited as described by Zevenbergen (2000), affecting their language and mathematical literacy. It therefore appears that proficiency in English increases a student's chances of achieving a higher result in mathematics.

6.5.3 Relationship between Reading and Mathematics Performance.

Reading has always been regarded as important in education. Mathematics is a new language learnt over 12 years in school, and is linked to language comprehension and interpretation. The development of this comprehension and ability to understand and interpret what is read is developed through reading the written word.

My selected students are predominantly Zulu speaking and thus reading in English is a developed task.

Table 15: High performing students reading, parents reading and the use of the library.

	Reads Books	Parents Read Books	Use the Library
Nkosi Gumede	Occasionally	Unknown	Seldom
Asanda Zondi	Often	Unknown	Frequently
Eric Govender	Often	Mother frequently, Father infrequently	Frequently
Carol Els	Often	Unknown	Frequently
Phili Ngcobo	Often	Frequently	Frequently
Siphiwe Mkhize	Seldom	Seldom	Occasionally

Table 16: Low performing students reading, parents reading and the use of the library.

	Reads Books	Parents Read Books	Use the Library
Sabelo Lambethe	Occasionally	Often	Seldom
Phila Ngonyama	Seldom	Unknown	Seldom
Sina Nthedi	Occasionally	Occasionally	Occasionally
Nqobile Mafunda	Often	Unknown	Frequently
Siyathemba Msabala	Every Friday	Seldom	Every Friday
Nomvula Ndawonde	Occasionally	Unknown	Occasionally

Asanda, Phili, Nqobile, and Carol have developed a love for reading. Phili's mother instilled that love for reading in her daughter from an early age and in Phili's own words "I love reading." The other students seldom read. Few of the students reported their parents as showing an interest in reading. Carol reads profusely. She reads all types of books but her favourites are teenage novels and adventure books. She finds mathematics expressed in mathematical terms complicated and she prefers to read and understand a written question. Plain numbers confuse her. Asanda and Phili too show that reading books has a positive relationship to their literacy; their enjoyment and considerable reading aid their understanding of languages that are not their home languages and their ability to achieve in mathematics and languages (Table 15).

For Asanda and Carol reading is a form of escapism but at the same time has developed for them a love of the written word and the ability to interpret, comprehend and use the written word in other contexts, such as mathematics.

It can be seen that reading helps Carol with understanding a question, however here innumeracy and the conceptualising of number confuses her, and this is probably not linked to reading per se.

Those of the students, who do read, appear to get their reading material from the public library. Asanda, Eric, Carol, Phili, and Siyathemba read frequently and enjoy reading.

Of this group, only Siyathemba is not in the top group and although she reads in the school holidays it is unclear as to her understanding of what she reads. She appears to read at a low

interest level and her topics in books are immature and far below her chronological age. Her language results are weak and thus for her, reading does not appear to have made much impact on her achievements.

Eric's father has bought Eric mathematics textbooks and mathematics computer programmes to help him with his studying. His above average achievements in mathematics: 96% in Grade 7 and an average of close to 80% in Grade 8. His language results of 85% for English and 91% for Afrikaans in Grade 7 and his average of 80% for English and 70% for Afrikaans in Grade 8 appear to show that his enjoyment and reading of books and his use of extra study material from home, definitely assist his achievements.

Sabelo's language achievements: English: Grade 7: 30%, Grade 8: 40% and Zulu: 50%, appear to show that he is weak in languages as well as mathematics and that any reading he does, does not impact much on his studies.

Books by themselves are not important but reading is. Thus there appears to be a correlation between interest in books, reading and a high achievement in mathematics. This correlates with Howie and Hughes (1998) who state: "Pupils with more books and educational aids achieved better results in mathematics."

6.5.3 Extramural Time and Time Spent Doing Homework

On average South African pupils reported spending 1,8 hours per day studying or doing mathematics homework, compared with the international average of 1,1 hours (Howie, 2001).

> "Internationally it would appear as if those spending more time on their studies after school achieved higher scores in mathematics. South African pupils followed the same trend. More than 50% of pupils in Malaysia, Singapore, Tunisia, Morocco, Korea and Romania spend significant time after school on their studies. In contrast, less that 20% of Dutch pupils do." (Robitaille and Beaton, 2002, p142).

However Robitaille and Beaton found "The amount of homework assigned to Grade eight students (in South Africa) was much lower than the international average" (Robitaille and Beaton, 2002).

Robitaille and Beaton also state:

> "Danish Grade seven students .....spent the least time on homework in mathematics (yet they are near the top on

> the achievement list for TIMSS). These students who spent the least time on homework performed the best in mathematics in TIMSS" (Robitaille and Beaton, 2002: p 47).

The high performing students in my selected group, average one hour of school homework per day and approximately half an hour to one hour mathematics homework three to four times a week. This appears low in relation to national and international averages (Table 7).

Homework does not take up a great deal of their time nor do extra-mural activities have much impact on their day.

Only Nkosi and Siphiwe have soccer practice twice a week for about an hour. Siphiwe also plays chess during school and occasionally has chess competitions on Friday afternoons.

Phili spends most afternoons at the library or at an Internet café and her relaxed lifestyle shows in her positive approach to her studies and her ability to achieve.

Siphiwe and Carol help with housework, yet for them this is not a chore and does not affect their daily lives. For Siphiwe it is a positive, unifying factor and thus a positive exercise. For Carol the chores do not appear to be onerous, they do not detract from her other responsibilities and she feels she is helping her grandmother.

The low performing students average one to two hours of homework per day. However they do mathematics homework three to four times a week for approximately half an hour per day (Table 8).

For Phila and Nqobile extra murals do not appear to affect their studies and achievements.

Phila plays soccer every day for between two and four hours. As he has no other responsibilities this does not affect his studying and achievements. Nqobile plays netball at school for about one to two hours per week. This does not appear to have an effect on her studies.

But for the other four students their responsibilities and chores could be factors affecting their achievements. Sabelo has enormous responsibilities at home, where his duties to his grandfather, the need to help his grandmother, and lack of parental guidance and assistance, could be a very strong factor affecting his achievements at school and his mathematics results in particular, as he has little time to devote to his studies.

Siyathemba also has enormous responsibilities, in looking after her younger brothers every afternoon and taking care of housework and cooking. These chores could affect her ability to achieve at school and in mathematics. Nomvula too has big responsibilities. Getting up every day at 05.00, travelling one hour to school every morning and at least an hour on the way home, take their toll on most people and could be an enormous factor in her poor results at school.

Another factor impacting on time spent doing homework is travelling time. Sina leaves home at 05.45 every day and catches two buses to get to school. This is a tiring exercise and could well be part of her problem causing her to underachieve. All the students in my interview group except Eric and Carol spend at least two hours every day travelling to and from school. This appears to have an effect on their energies, (e.g. Asanda's need to sleep in the afternoons, Nqobile's, Sina's, Nomvula's and Nkosi's need to go to bed very early) and thus their ability to give their every effort to their studies.

Travelling time and responsibilities thus appear to affect the students' ability to achieve, and are factors which need far greater research and exploration.

6.5.5 Attitudes Towards Mathematics

The students in the interview group all felt that mathematics is essential for their future; they felt it would help them get into tertiary institutions. Even those who fail mathematics felt that it is important that they attempt the subject. Although not all the students enjoy studying the subject they view mathematics as essential for future advancement.

The concept that without mathematics a student has no future career needs to be researched in far greater detail. This idea puts enormous stresses on those students whose grounding in mathematics and inability to achieve in the subject affects their grades and thus their receipt of matriculation exemption certificates. At present a good mathematics results is also a definite requirement for many tertiary courses and employment.

From the interviews it was found that although the students all look on mathematics as being important they do not all like or enjoy studying the subject.

In the TIMSS study 62% of South African pupils reported being positive towards mathematics (Howie, 1999), as did a large percentage of pupils from Kuwait (Robitaille and Beaton, 2002). Yet the South African students achieved poor results.

However 74% of pupils in Korea and a large percentage in Japan and New Zealand did not enjoy doing mathematics, yet these countries were amongst the most successful in the TIMSS (Robitaille and Beaton, 2002).

South African pupils with more positive attitudes achieved higher scores in mathematics. This same pattern was found internationally, though Japan, which attained the highest standards among the surveyed countries who wrote the TIMSS, was an exception.

"Their high achievement . .....is not reflected in student attitudes towards the subject. Relatively few Japanese students reported liking mathematics.... They do not think mathematics is easy to study, they do not see mathematics as important in their lives and they do not think mathematics will be useful in their future careers" (Robitaille and Beaton, 2002).

Dutch students seemed to have a no-nonsense attitude concerning what is necessary to succeed in mathematics. They reported that good luck and memorising did not help, that natural talent and lots of hard work are the only factors that affect performance (Robitaille and Beaton, 2002).

Six of the twelve students interviewed do not enjoy mathematics.

The six students who do not enjoy mathematics are all from the low performing group. Their inability to understand the basics of mathematics, their poor comprehension of what is required of them in mathematics problems, and their lack of desire and/or willingness to spend time practising mathematics, all contribute to their dislike of the subject.

Here the "language problem" may also play a big part in their negativity towards the subject. However this is a question that requires much more research, as most of these students have only studied mathematics in English and thus their understanding of any mathematics is only in English. However the fact that Nomvula does occasionally have school mathematics explained in Zulu appears to aid her achievements in school mathematics. This needs to be explored in much greater detail.

When we study language we read, comprehend and interpret the subject matter. Thus home language and usage of language being studied is important in comprehension and interpretation. When studying mathematics it is necessary to select the mathematics, execute the calculation and evaluate the result. Language usage is only important in the first step because in order to select the mathematics reading, comprehending and interpreting of the

question has to occur and it is a this point that language is important.

The high performing group all enjoy mathematics and although they too do not spend a great deal of time doing mathematics homework, they are interested and, particularly in Eric's case, willing to put extra effort into understanding and mastering mathematics. Their language understanding, ability to read fluently, comprehend and interpret what they are reading is also a great help towards their mathematics achievement and. thus positive attitude to the subject.

This supports the findings of Howie and Hughes (1998) who state "South African pupils with higher positive attitudes achieved higher scores in mathematics."

6.6 SUMMARY OF WHAT WAS DISCUSSED IN THIS CHAPTER

This chapter has presented the analysis of the home lives and experiences of 12 grade 8 students from a high school in Durban.

As can be seen from the above data the nature of the students home life, a positive relationship with the caregivers, security and safety in their relationships, availability of resources, home language and language of instruction, good reading skills and love of reading, and attitude to mathematics, all have an effect on a student's ability to focus on his/her studies and achieve success.

These factors must therefore be taken into account when judging a student's achievements and abilities both in school and for future advancement at a tertiary level.

6.7 IMPLICATIONS and RECOMMENDATIONS

6.7.1 RECOMMENDATIONS

From the findings analysed here the following recommendations for education policy, school-caregiver interaction, classroom practice, teaching and learning of mathematics are clear:

There appears to be a relationship between interest in books and reading and a high achievement in mathematics. Students need to read and comprehend not only the mathematics, but the written question and the textbook explanations as well. Mathematics reading is also often limited to classroom reading, focusing on the textbook or handed out material only. Students are seldom encouraged to read mathematics for pleasure or to find the mathematics in texts that they read from magazines and

periodicals. Thus students should not only be encouraged to read, but many libraries and facilities should be created to make books more available to the students and the public in general. Reading should be a part of all curricula and time in the school day should be set aside for reading and analysing documents and books and extracting the mathematics from every article.

Availability of resources at home such as a private desks, dictionaries, and personal computers did not appear to be of importance in this study. However personal space to study is important.

South Africa has come a long way in the ten years of democracy and many parents have been able to improve their qualifications and their working environments. My study did not include rural students, however it did show that those students whose caregivers are under- qualified or unemployed produce lower mathematics results.

Parental input both in a child's formative years and as interest in the child and his studies have been shown here to assist a student's achievements. The caregiver even if not the child's parent must spend time with the child, particularly during their most formative and primary school years. Also more education is needed to encourage fathers to take a greater interest in their children and participate in their lives.

Proficiency in the language of instruction is of importance and does affect a student's ability to achieve in mathematics. Literacy and numeracy need to be encouraged.

Gender in this study did not appear to be an important factor. However there were a slightly higher number of girls in the low performing group who wrote the TIMSS equivalent test. Yet these same girls achieved higher results in the school mathematics than the boys in that group. Thus gender does not appear to be the reason for these results.

Time spent on homework in the selected group does not appear to be of any significance in their achievement in mathematics. However travelling time and home responsibilities do appear to affect the students' ability to achieve in the subject. This needs far greater research as its effects are deep and the problem is severe in South Africa.

The high performing group in this research all enjoy mathematics and although they too do not spend a great deal of time doing mathematics homework, they are interested and, particularly in Eric's case, willing to put extra effort into understanding and

mastering mathematics. Thus time spent on homework does not appear to be as relevant to achievement as interest in the subject.

The lack of counselling and social intervention in the lives of students who consistently achieve poor results, throughout their primary school careers, and even into their high school career, is of great concern. This needs to be studied and practical recommendations made to alter this situation and ensure timeous interventions can be accessed to positively deal with the factors causing the poor results.

TIMSS is poor benchmark for international comparisons, the format of the questions, the mixture of mathematics and science in one paper and the actual curricula involved need to be more in line with those of the country writing the test. The use of multiple choice questionnaires for teacher, principal and student input is very limiting and does not offer a true picture of the mathematics situation in each country. TIMSS needs to be complimented with qualitative research and an in depth analysis to see whether the results so frequently quoted are truly a picture of the mathematics achievements and successes in each community. Also if TIMSS is to be a useful benchmark of a country's achievements and assist in exploring students' performance, it must be more in line with what students are comfortable with in their own studies.

6.7.2 IMPLICATIONS FOR FURTHER STUDIES.

Is there a need for well-endowed libraries close to a student's home? Will the books be used and will they help with improved language understanding?

How does the ability to read the language of the text fluently in a mathematics classroom, comprehend what is read and interpret it in order to select the mathematics required affect mathematics achievement?

How important is parental and caregiver interest in their children and participation in their lives, and what is the effect of parental problems and stresses on the students and their ability to achieve?

Is there a need for social and counselling support systems and how can they be put in place to assist students who consistently achieve poor results over many years? What intervention can feasibly occur for students who regularly achieve poor results at an early age? Is there a way to employ extra tutors to help struggling students before their poor results become an insurmountable problem?

The importance of home language study, or the encouragement of a bilingualism in South Africa with English as the language of instruction as it is today the language of business. More research needs to be done in this area, to ascertain what is happening with students who study mathematics for eight years, through the medium of English and yet do not understand the language and are unable to answer simple mathematic questions in that language. Is it the language? Is it the teaching? Is it that there is no link between the subjects? What other factors could actually be affecting the mathematics results?

Much more research needs to be done on interest in mathematics and its genuine importance in a student's future. Most people believe that they could not do mathematics at school yet many have made excellent careers and have succeeded in life. Where did this importance of mathematics arise or is it in fact numeracy and mathematical literacy which are required?

The amount of homework and study that needs to be done, reducing the size of the curriculum and increasing the time spent on actual interaction with mathematics are all very relevant questions and need much greater investigation.

Is the TIMSS a valid benchmark test for international comparisons of mathematics achievements?

Is mathematics study like playing the piano, where practice and repetition make for excellence, as stated by Ellis (1997), cited by Robitaille and Beaton, (2002)? If so, students need to work through mathematics at a pace which enables them to totally internalise mathematics. Are we in South Africa taking this into consideration? Is the curriculum too long and the student's time available for school work too short, thus causing frustration and leaving insufficient time for excellence to be achieved by all? Can all students achieve excellence in mathematics or is mathematics really a specialised subject for the few?

6.8 CONCLUSION

As the researcher and also a teacher I started out questioning the effect of home background on a student's ability to achieve in mathematics. I quoted examples of students whose mathematics results were affected by the home and personal life they experienced and questioned whether this was general and what home factors were really important.

To create a link between home background and mathematics a TIMSS equivalent test was used which together with the TIMSS test itself was found in this investigation to have many problems. However the use of the TIMSS equivalent test did help in

selecting high performing and low performing students. Although on analysis the low performing groups results were not reflected by their school mathematics and language achievements, which were higher in every case. This raises the question of the validity of the TIMSS test as a benchmark of mathematics success.

The group of students' chosen were a good sample reflecting the demographics of South Africa. Their home and personal lives were a fair cameo of many home and personal lives to be found in KwaZulu- Natal.

A safe and secure home was found in this study to be of the utmost importance. Only when a student feels safe is he/she then able to live in the child and focus on the work received in school. The lack of a father at home and in many instances the mother as well was a significant and surprising outcome of the interviews. This aspect changed my approach to the students in the classroom. I have become more empathetic and understanding. My education role as a father figure to most of my students has taken on greater significance, especially for those students who do not have a father at home with whom to relate. The lack of a mother was a major shock, helping me to understand why so many of our students are antagonistic towards adults and authority. From this study it appears to me that the educator's role now is more about teaching students the morals, ethics, and correct behaviour they are not learning from their caregivers, than just the facts of mathematics.

The students behave very immaturely at school and approach their studies in the same manner the reason now is much clearer to me as a result of this case study. The level of responsibility the students carry for their own lives and often their family responsibilities give them little time to be in the child. From a very early age they are being thrust into adult behaviour and responsibility. At school this responsibility can be suspended and the students revert to the child and just relax with their friends. This is reflected in the frustrations they cause the educators as they play, socialise and struggle to engage seriously with their studies.

This discovery has important implications for education policy as well. The student to teacher ratio has to be more practical to allow the educator more time to get to know and understand the students and their problems. School policy which placed counselling in a minor position in schools in South Africa, needs to be changed. Each school needs a dedicated, specialist counsellor on campus at all times to assist students with family and learning problems.

The finding that so many of my interviewees do many home chores and some like Sabelo have enormous responsibilities changed my attitude to the value of homework and the time a student has to focus on studies. In fact, the finding that, with the time spent travelling to and from school and their home responsibilities, helped me realise that few interviewees had time after school to interact effectively with their schoolwork. I feel strongly that the school day should be extended and homework given should be done at school in special homework lessons run on a tutor system.

The curriculum also has to change to bring mathematics learning in line with a student's reality. Thus creating a link between schoolwork and a future in the job market, and a need to focus and internalise what is being learnt. This is being addressed to a limited extent by the O.B.E. and F.E.T. curricula which however, are still too cluttered, leaving insufficient time for real in depth learning to take place.

The modern spoken language and street speak, and its relationship to the language spoken in the classroom is perhaps more significant than the fact that mathematics is taught in English and not the home language. The mathematics curriculum has to be less about studying every aspect of mathematics and more about achievable goals and mathematics vocabulary. More time is required to give students supervised practice time in the classroom.

The awareness I have learnt from doing this study has helped me as I now work in the classroom. I ensure that the interaction with the study material is internalised, work is done but time is now also allowed for play and childish behaviour, even for the Grade 12 students. By allowing the students to live for a short period in the child, they are achieving greater success with the mathematics albeit at a slower pace than is allowed by the curriculum.

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APPENDIX A.

Dr. Marvin Rich's TIMSS Equivalent Mathematics test

Grade 8 TIMSS sample test.

Done by: Edinformics for B.T.Salakoff.

Instructions:

Write your name in full, your class and your student registration number below:

Name: _____

Class: _____

Registration Number: _____

Answer all questions.

To answer the multiple choice questions colour the dot next to the letter of the answer you have chosen. Any answer left out will get a zero mark.

If you want to change a multiple choice answer put a big cross on the wrong answer and colour in the right answer.

To answer the free form questions write your answer in the block provided.

Be careful to read all questions carefully before answering them, take your time you have 5 minutes for each question.

Some questions continue onto the next page make sure you have read the entire question before answering.

EDinformatics
EDUCATION FOR THE INFORMATION AGE

TIMSS Sample Middle School Mathematics Test (Grades 7 and 8)

Instructions

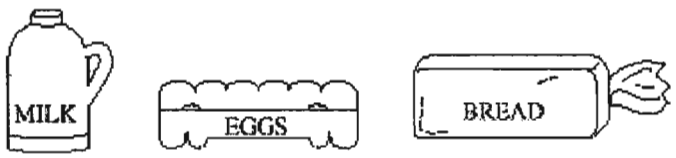
- Please enter an identity code using the following information:
username (or code name), grade, city, state, country

Example: cooljr/grade7/utica/ny/usa

- Click on the circle to answer each multiple choice question.
- To answer the free form questions type in your answer
- Use the scroll down bar to advance to the next question.
- When you have completed all the questions press the "Submit" button at the bottom of the test.
- Your test results and links for assessing your results will appear within seconds.

The bullets in the bottom corner of each problem indicate the question has not been answered. Questions left unaswered will be given a value of nr(no response).

1) Prabhu had $5 to buy milk, bread, and eggs. When he got to the shop he found that the prices were those shown below:



$1.50 $1.29 $1.44

At which of these times would it make sense to use estimates rather than exact numbers?

- O **A)** When the clerk counted Prabhu's change
- O **B)** When the clerk entered each amount into the cash register
- O **C)** When Prabhu was told how much he owed
- O **D)** When Prabhu tried to decide whether $5 was enough money

◉

2) Divide:

$$\frac{8}{35} \div \frac{4}{15} =$$

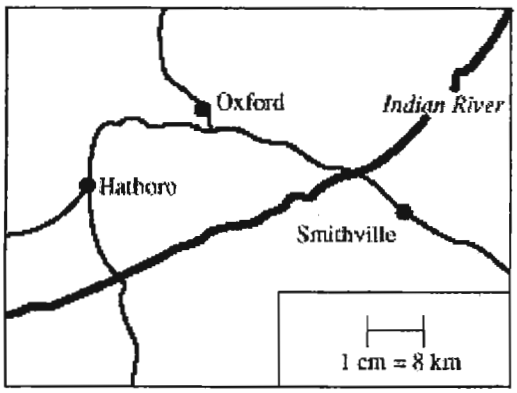
O **A)** 1/2
O **B)** 6/7
O **C)** 32/525
O **D)** 7/6

◉

3) Divide:

$$0.004\overline{)24.56}$$

4) One centimeter on the map represents 8 kilometers on the land.



About how far apart are Oxford and Smithville on the land?

O **A)** 4 km O **B)**16 km O **C)**35 km O **D)**50 km

◉

5) Last year there were 1172 students at Beaton High School. This year there are 15 percent more students than last year. Approximately how many students are at Beaton High School this year?

O **A)**1800
O **B)**1600
O **C)**1500
O **D)**1400
O **E)**1200

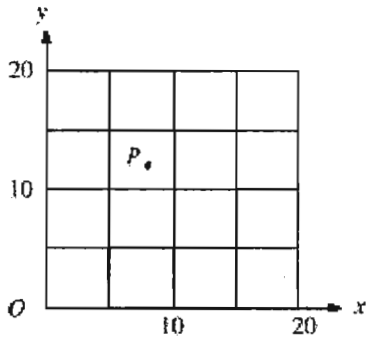
◉

6) Two groups of tourists each have 60 people. If 3/4 of the first group and 2/3 of the second group board buses to travel to a museum, how many more people in the first group board buses than in the second group?

7) A quadrilateral MUST be a parallelogram if it has _____

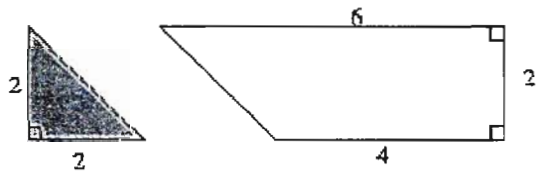
- O **A)** one pair of adjacent sides equal.
- O **B)**one pair of parallel sides.
- O **C)**a diagonal as axis of symmetry .
- O **D)**two adjacent angles equal .
- O **E)** two pairs of parallel sides.

8) Which of the following are most likely to be the coordinates of point P?



- O **A)**(8, 12)
- O **B)**(8, 8)
- O **C)** (12, 8)
- O **D)** (12, 12)

9) How many triangles of the shape and size of the shaded triangle can the trapezoid above be divided into?



- O **A)**Three
- O **B)**Four
- O **C)**Five
- O **D)**Six

10) What is the ratio of the length of a side of a square to its perimeter?

- **A)** 1:1
- **B)** 1:2
- **C)** 1:3
- **D)** 1:4

11) If m represents a positive number, which of these is equivalent to

$$m + m + m + m?$$

- **A)** m +4
- **B)** 4m
- **C)** m x 4
- **D)** 4(m +1)

12) Brad wanted to find three consecutive whole numbers that add up to 81. He wrote the equation

$$(n - 1) + n + (n + 1) = 81$$

What does the n stand for?

- **A)** The least of the three whole numbers.
- **B)** The middle whole number.
- **C)** The greatest of the three whole numbers.
- **D)** The difference between the least and greatest of the three whole numbers.

13) The table represents a relation between x and y. What is the missing number in the table?

x	y
1	1
2	?
4	7
7	13

- **A)** 2
- **B)** 3
- **C)** 4
- **D)** 5

O E)6

14) 14) Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has?

O A)5 -3n
O B)3n
O C) n-5
O D)3n-5
O E) 3(n-5)

15) Which of these is the longest time?

O A)15 000 seconds
O B)1 500 minutes
O C) 10 hours
O D)1 day

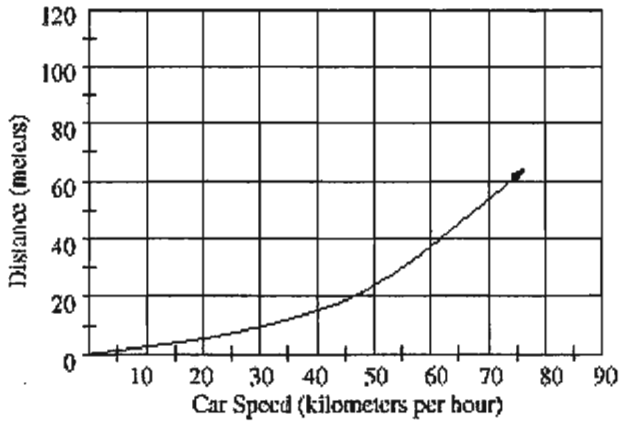
16) Which of these is equal to y^3?

O A) $y + y + y$
O B) $y \times y \times y$
O C) $3y$
O D) $y^2 + y$

17) In a bag of cards 1/6 are green, 1/12 are yellow, 1/2 are white and 1/4 are blue. If someone takes a card from the bag without looking, which color is it most likely to be?

O A)White
O B)Blue
O C) Green
O D)Yellow

18) The graph shows the distance traveled before coming to a stop after the brakes are applied for a typical car traveling at different speeds. A car is traveling 80 km per hour. About how far will the car travel after the brakes are applied?

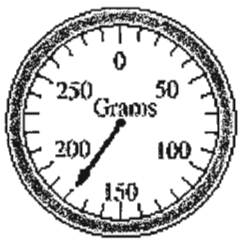


- **A)** 60 m
- **B)** 70 m
- **C)** 85 m
- **D)** 100 m

◉

19) The number of 750 mL bottles that can be filled from 600 L of water is_____?

20) What is the weight (mass) shown on the scale?



- **A)** 153 g
- **B)** 160 g
- **C)** 165 g
- **D)** 180 g

◉

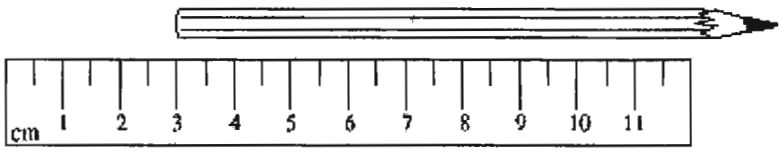
21) A cake is put in the oven at 7:20. If the cake takes three quarters of an hour to bake, at what time should it be taken out of the oven?

- **A)** 8:10
- **B)** 8:05
- **C)** 8:15

O **D)** 7:50

◉

22) Which of these is closest to the length of the pencil in the figure?



O **A)** 9 cm
O **B)**10.5 cm
O **C)**12 cm
O **D)**13.5 cm

◉

23) The length of a rectangle is 6 cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimeters?

[ ] cm.

24) To mix a certain color of paint, Alana combines 5 liters of red paint, 2 liters of blue paint, and 2 liters of yellow paint. What is the ratio of red paint to the total amount of paint?

O **A)** 5:2
O **B)**9:4
O **C)**5:4
O **D)**5:9

◉

25) Three-fifths of the students in a class are girls. If 5 girls and 5 boys are added to the class, which statement is true of the class?

O **A)** There are more girls than boys.
O **B)**There are the same number of girls as there are boys.
O **C)**There are more boys than girls.
O **D)**You cannot tell whether there are more girls or boys from the information given

◉

Did you check the right side bullets to make sure all questions have been answered? All bullets should be clear.

[redacted]

Return to the Edinformatics Homepage

TIMSS EQUIVALENT TEST ANSWERS

1. D	6. 5	11. B	16. B	21. B
2. B	7. E	12. B	17. A	22. D
3. 6140	8. A	13. B	18. B	23. 12
4. C	9. C	14. E	19. 8	24. D
5. D	10. D	15. B	20. D	25. A

Calculations for question 23:

Given: Perimeter = 16 and Length = 6

Perimeter = 2Length + 2Breadth

16 = 2(6) + 2Breadth

16 – 12 = 2Breadth

4 = 2Breadth

Breadth = 2

Area = Length x breadth

Area = 6 x 2

Area = 12

APPENDIX B.

TIMSS Student Questionnaire

The TIMSS Project
HSRC
Directorate: Assessment Technology and
Education Evaluation
Private Bag x41
Pretoria
0001
South Africa

Identification Label

Student ID: _____

Student Name: _____

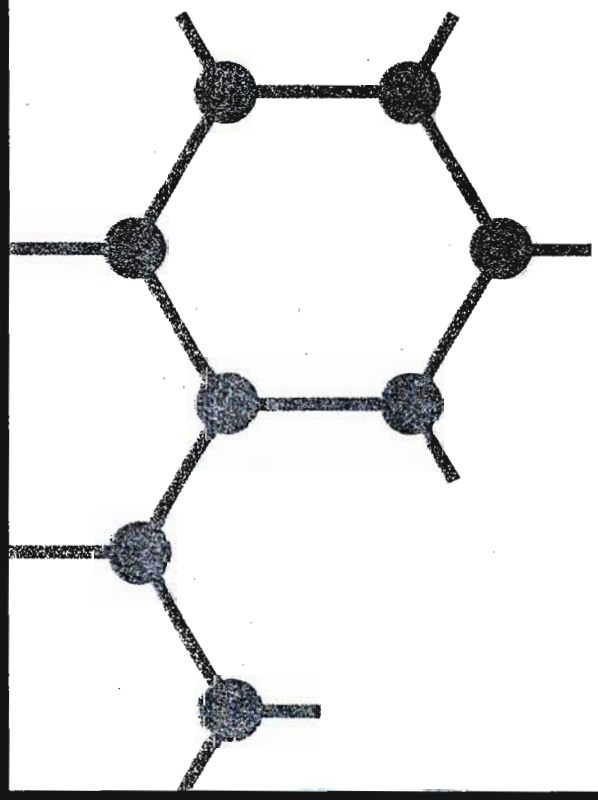
IEA Trends in International Mathematics and Science Study

TIMSS 2003

Main Survey

Student Questionnaire

Grade 8



General Directions

n this booklet, you will find questions about yourself. Some questions ask for facts while ther questions ask for your opinions.

Read each question carefully and respond as accurately as possible. You may ask for elp if you do not understand something or are not sure how to respond.

Some of the questions will be followed by a few possible choices indicated with a circle vith a number in it. For these questions, shade in the circle with the response of your hoice as shown in Examples 1, 2, and 3.

Example 1

Do you go to school?

*Fill in **one** circle only*

Yes ---------- ●

No ---------- ②

Example 2

How often do you do these things?

*Fill in **one** circle for each line*

	Every day	At least once a week	Once or twice a month	A few times a year	Never
a) I listen to music	①	②	●	④	⑤
b) I talk with my friends	●	②	③	④	⑤
c) I play sports	①	●	③	④	⑤

Example 3

Indicate how much you agree with each of these statements.

*Fill in **one** circle for each line*

		Agree a lot	Agree a little	Disagree a little	Disagree a lot
a)	Watching movies is fun	①	●	③	④
b)	I like eating ice cream	●	②	③	④

Read each question carefully, and pick the answer you think is best. Fill in the circle next to or below your answer. If you decide to change your answer, erase your first answer and then fill in the circle next to or under your new answer. Ask for help if you do not understand something or are not sure how to answer.

Thank you for your time, effort, and thought in completing this questionnaire.

About You

1

When were you born?

A. *Fill in the circle next to the year you were born*

Year

① 1985
② 1986
③ 1987
④ 1988
⑤ 1989
⑥ 1990
⑦ 1991
⑧ 1992
⑨ Other

(Specify year)

B. *Fill in the circle next to the month you were born*

Month

① January
② February
③ March
④ April
⑤ May
⑥ June
⑦ July
⑧ August
⑨ September
⑩ October
⑪ November
⑫ December

2

Are you a girl or a boy?

*Fill in **one** circle only*

Girl ---------- ①

Boy ---------- ②

3

How often do you speak English at home?

*Fill in **one** circle only*

Always ---------- ①

Almost always ---------- ②

Sometimes ---------- ③

Never ---------- ④

4

About how many books are there in your home? (Do not count magazines, newspapers, or your school books.)

*Fill in **one** circle only*

None or very few
(0-10 books) ---------- ①

Enough to fill one shelf
(11-25 books) ---------- ②

Enough to fill one bookcase
(26-100 books) ---------- ③

Enough to fill two bookcases
(101-200 books) ---------- ④

Enough to fill three or more bookcases
(more than 200 books) ---------- ⑤

5

Do you have any of these items at your home?

*Fill in **one** circle for each line*

		Yes	No
a)	Calculator	①	②
b)	Computer (do not include PlayStation®, GameCube®, XBox®, or other TV/video game computers)	①	②
c)	Study desk/table for your use	①	②
d)	Dictionary	①	②
e)	Electricity	①	②
f)	Running tap water	①	②
g)	Television	①	②
h)	Video player	①	②
i)	CD player	①	②
j)	Radio	①	②
k)	A bedroom used only by you	①	②
l)	Water flushed toilets	①	②
m)	Motor car	①	②
n)	Your own bicycle	①	②
o)	Telephone	①	②
p)	Fridge	①	②

6

A. What is the highest level of education completed by your mother (or stepmother or female guardian)?

*Fill in **one** circle only*

Did not finish primary school or did not go to school ---------- ①

Completed Grade 7 (Standard 5) ---------- ②

Completed Grade 9 (Standard 7) ---------- ③

Completed Grade 12 (Matric) ---------- ④

Post-matric certificate ---------- ⑤

Diploma or certificate ---------- ⑥

First degree ---------- ⑦

An honours degree or higher ---------- ⑧

I don't know ---------- ⑨

B. What is the highest level of education completed by your father (or stepfather or male guardian)?

*Fill in **one** circle only*

Did not finish primary school or did not go to school ---------- ①

Completed Grade 7 (Standard 5) ---------- ②

Completed Grade 9 (Standard 7) ---------- ③

Completed Grade 12 (Matric) ---------- ④

Post-matric certificate ---------- ⑤

Diploma or certificate ---------- ⑥

First degree ---------- ⑦

An honours degree or higher ---------- ⑧

I don't know ---------- ⑨

7

How far in school do you expect to go?

*Fill in **one** circle only*

Finish Grade 12 (Matric) ---------- ①

Finish post-matric courses ---------- ②

Finish diploma or certificate ---------- ③

Finish first degree ---------- ④

An honours degree or higher ---------- ⑤

I don't know ---------- ⑥

Mathematics in School

8

How much do you agree with these statements about learning mathematics?

*Fill in **one** circle for each line*

		Agree a lot	Agree a little	Disagree a little	Disagree a lot
a)	I usually do well in mathematics	①	②	③	④
b)	I would like to take more mathematics in school	①	②	③	④
c)	Mathematics is more difficult for me than for many of my classmates	①	②	③	④
d)	I enjoy learning mathematics	①	②	③	④
e)	Sometimes, when I do not initially understand a new topic in mathematics, I know that I will never really understand it	①	②	③	④
f)	Mathematics is not one of my strengths	①	②	③	④
g)	I learn things quickly in mathematics	①	②	③	④

9

How much do you agree with these statements about mathematics?

*Fill in **one** circle for each line*

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I think learning mathematics will help me in my daily life	①	②	③	④
b) I need mathematics to learn other school subjects	①	②	③	④
c) I need to do well in mathematics to get into the university of my choice	①	②	③	④
d) I would like a job that involved using mathematics	①	②	③	④
e) I need to do well in mathematics to get the job I want	①	②	③	④

10

How often do you do these things in your mathematics lessons?

*Fill in **one** circle for each line*

	Every or almost every lesson	About half the lessons	Some lessons	Never
a) We practice adding, subtracting, multiplying, and dividing without using a calculator	①	②	③	④
b) We work on fractions and decimals	①	②	③	④
c) We interpret data in tables, charts, or graphs	①	②	③	④
d) We write equations and functions to represent relationships	①	②	③	④
e) We work together in small groups	①	②	③	④
f) We relate what we are learning in mathematics to our daily lives	①	②	③	④
g) We explain our answers	①	②	③	④
h) We decide on our own procedures for solving complex problems	①	②	③	④
i) We review our homework	①	②	③	④
j) We listen to the teacher give a lecture-style lesson	①	②	③	④
k) We work problems on our own	①	②	③	④
l) We begin our homework in class	①	②	③	④
m) We have a quiz or test	①	②	③	④
n) We use calculators	①	②	③	④

11

How much do you agree with these statements about learning science?

*Fill in **one** circle for each line*

		Agree a lot	Agree a little	Disagree a little	Disagree a lot
a)	I usually do well in science	①	②	③	④
b)	I would like to take more science in school	①	②	③	④
c)	Science is more difficult for me than for many of my classmates	①	②	③	④
d)	I enjoy learning science	①	②	③	④
e)	Sometimes, when I do not initially understand a new topic in science, I know that I will never really understand it	①	②	③	④
f)	Science is not one of my strengths	①	②	③	④
g)	I learn things quickly in science	①	②	③	④

.2

How much do you agree with these statements about science?

*Fill in **one** circle for each line*

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I think learning science will help me in my daily life	①	②	③	④
b) I need science to learn other school subjects	①	②	③	④
c) I need to do well in science to get into the university of my choice	①	②	③	④
d) I would like a job that involved using science	①	②	③	④
e) I need to do well in science to get the job I want	①	②	③	④

13

How often do you do these things in your science lessons?

*Fill in **one** circle for each line*

	Every or almost every lesson	About half the lessons	Some lessons	Never
a) We watch the teacher demonstrate an experiment or investigation	①	②	③	④
b) We formulate hypotheses or predictions to be tested	①	②	③	④
c) We design or plan an experiment or investigation	①	②	③	④
d) We conduct an experiment or investigation	①	②	③	④
e) We work in small groups on an experiment or investigation	①	②	③	④
f) We write explanations about what was observed and why it happened	①	②	③	④
g) We study the impact of technology on society	①	②	③	④
h) We relate what we are learning in science to our daily lives	①	②	③	④
i) We present our work to the class	①	②	③	④
j) We review our homework	①	②	③	④
k) We listen to the teacher give a lecture-style presentation	①	②	③	④
l) We work problems on our own	①	②	③	④
m) We begin our homework in class	①	②	③	④
n) We have a quiz or test	①	②	③	④

Computers

14

A. Do you ever use a computer? (Do not include PlayStation®, GameCube®, XBox®, or other TV/video game computers).

	Yes	No
*Fill in **one** circle only*	①	②

*If **No**, please go to question* **15** →

B. Where do you use a computer?

*Fill in **one** circle for each line*

		Yes	No
a)	At home	①	②
b)	At school	①	②
c)	At a library	①	②
d)	At a friend's home	①	②
e)	At an Internet café	①	②
f)	Elsewhere	①	②

C. How often do you do these things with a computer?

*Fill in **one** circle for each line*

		Every day	At least once a week	Once or twice a month	A few times a year	Never
a)	I look up ideas and information for mathematics	①	②	③	④	⑤
b)	I look up ideas and information for science	①	②	③	④	⑤
c)	I write reports for school	①	②	③	④	⑤
d)	I process and analyze data	①	②	③	④	⑤

Your School

15

How much do you agree with these statements about your school?

*Fill in **one** circle for each line*

		Agree a lot	Agree a little	Disagree a little	Disagree a lot
a)	I like being in school	①	②	③	④
b)	I think that students in my school try to do their best	①	②	③	④
c)	I think that teachers in my school care about the students	①	②	③	④
d)	I think that teachers in my school want students to do their best	①	②	③	④

16

<u>In school</u>, did any of these things happen during the <u>last month</u>?

*Fill in **one** circle for each line*

		Yes	No
a)	Something of mine was stolen	①	②
b)	I was hit or hurt by other student(s) (e.g., shoving, hitting, kicking)	①	②
c)	I was made to do things I didn't want to do by other students	①	②
d)	I was made fun of or called names	①	②
e)	I was left out of activities by other students	①	②

Things You Do Outside of School

17

On a normal school day, how much time do you spend before or after school doing each of these things?

*Fill in **one** circle for each line*

		No time	Less than 1 hour	1-2 hours	More than 2 but less than 4 hours	4 or more hours
a)	I watch television and videos	①	②	③	④	⑤
b)	I play computer games	①	②	③	④	⑤
c)	I play or talk with friends	①	②	③	④	⑤
d)	I do jobs at home	①	②	③	④	⑤
e)	I work at a paid job	①	②	③	④	⑤
f)	I play sports	①	②	③	④	⑤
g)	I read a book for enjoyment	①	②	③	④	⑤
h)	I use the internet	①	②	③	④	⑤
i)	I do homework	①	②	③	④	⑤

18

A. During this school year, how often have you had extra lessons or tutoring in <u>mathematics</u> that is not part of your regular class?

*Fill in **one** circle only*

Every or almost every day ---------- ①

Once or twice a week ---------- ②

Sometimes ---------- ③

Never or almost never ---------- ④

B. During this school year, how often have you had extra lessons or tutoring in <u>science</u> that is not part of your regular class?

*Fill in **one** circle only*

Every or almost every day ---------- ①

Once or twice a week ---------- ②

Sometimes ---------- ③

Never or almost never ---------- ④

19

A. How often does your teacher give you homework in mathematics?

*Fill in **one** circle only*

Every day ---------- ①

3 or 4 times a week ---------- ②

1 or 2 times a week ---------- ③

Less than once a week ---------- ④

Never ---------- ⑤

*If **Never**, please go to question **20***

B. When your teacher gives you mathematics homework, about how many minutes are you usually given?

*Fill in **one** circle only*

Fewer than 15 minutes ---------- ①

15–30 minutes ---------- ②

31–60 minutes ---------- ③

61–90 minutes ---------- ④

More than 90 minutes ---------- ⑤

20

A. How often does your teacher give you homework in science?

*Fill in **one** circle only*

Every day ---------- ①

3 or 4 times a week ---------- ②

1 or 2 times a week ---------- ③

Less than once a week ---------- ④

Never ---------- ⑤

*If **Never**, please go to question **21***

B. When your teacher gives you science homework, about how many minutes are you usually given?

*Fill in **one** circle only*

Fewer than 15 minutes ---------- ①

15–30 minutes ---------- ②

31–60 minutes ---------- ③

61–90 minutes ---------- ④

More than 90 minutes ---------- ⑤

More About You

21

Including yourself, how many people live in your home?

*Fill in **one** circle only*

2 ---------- ②

3 ---------- ③

4 ---------- ④

5 ---------- ⑤

6 ---------- ⑥

7 ---------- ⑦

8 or more ---------- ⑧

22

A. Was your mother (or stepmother or female guardian) born in South Africa?

Yes No

*Fill in **one** circle only* ----------①------ ②

B. Was your father (or stepfather or male guardian) born in South Africa?

Yes No

*Fill in **one** circle only* ----------①------ ②

23

A. Were you born in South Africa?

	Yes	No
*Fill in **one** circle only*	①	②

B. If you were not born in South Africa, how old were you when you came to South Africa?

*Fill in **one** circle only*

Older than 10 years old ---------- ①

5 to 10 years old ---------- ②

Younger than 5 years old ---------- ③

24

To which population group do you belong?

(This question is for research purposes only.)

*Fill in **one** circle only*

African ---------- ①

Asian ---------- ②

Coloured ---------- ③

Indian ---------- ④

White ---------- ⑤

25

What language do you speak at home?

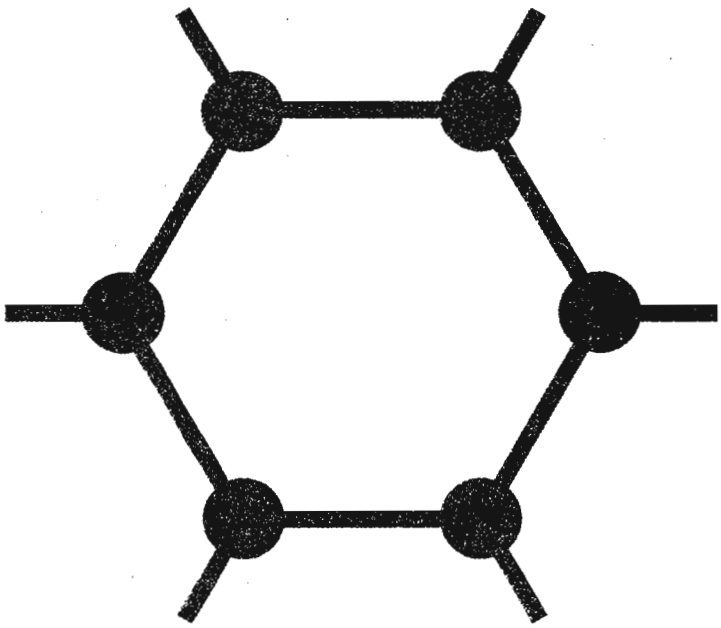
*Fill in **one** circle only*

Afrikaans ---------- ①
English ---------- ②
IsiNdebele ---------- ③
Sepedi (Northern Sotho) ---------- ④
Sesotho (Southern Sotho) ---------- ⑤
Seswati ---------- ⑥
Setswana ---------- ⑦
Tshivenda ---------- ⑧
IsiXhosa ---------- ⑨
IsiZulu ---------- ⑩
Xitsonga ---------- ⑪
Other (Please specify) ---------- ⑫

Thank You

for completing this questionnaire

TIMSS International Study Center
Boston College
Chestnut Hill, MA 02467



APPENDIX C.

Letter to Parents

Ross High School
Seaview
Durban

27th May 2004

Dear .....

I am at present involved in a research project for a Masters Degree in Mathematics Education through the University of KwaZulu - Natal.

I hereby request permission to interview your child .....
of class .....I also request permission to visit your home at a time to be arranged.

The research I am interested in is the influence and effect of the home environment, early childhood experiences and plans for the future, on the mathematics achievements of a learner. My plan is to interview ..... together with 11 other learners. The learners were selected on the strength or weakness of the results they achieved in a test based on an international test, namely the TIMSS (Trends in Mathematics and Science Study) which is written every 4 years by approximately 43 countries.

The learners will answer a questionnaire dealing with home environment. The interviews will be both group interviews and individual interviews. I also hope to be able to pay a visit to some of the students' homes to verify their descriptions.

Names and addresses of students will be confidential and the thesis will describe students by first name only or possibly by a designated student number.

Strict confidentiality will also be maintained with respect to any information gleaned from the students not relevant to the study. That information which is relevant to the study will be described in a manner to ensure the strictest confidentiality of the learners and their families.

The interviews will be taped and I may have a Zulu speaking teacher from Ross High School with me if I feel an interpreter is necessary. This is to ensure the safety, confidentiality and fairness of each interview.

Please could you sign this letter in the space provided below and return it with your child by Monday 31st May 2004.

I thank you in advance most sincerely for your co-operation in this matter.

Yours sincerely,

_____
Mr. B.T.Salakoff

I hereby give permission for the interviews and any home visit:

Signed: _____ at _____ on _____May 2004.

APPENDIX D.

Interview Schedule

`INTERVIEW SCHEDULE

The following questions were asked in conjunction with the answered student questionnaire.

1. How old are you?
2. What is your home language? Do you speak any other languages?
3. Do you speak English at home? With whom do you speak English?
4. How often do you speak English? When do you speak English?
5. How many books are there in your home? What type of books do you have at home?
6. How often and how many books do you read? Do you parents/guardians read books?
7. Where do you get books?
8. Now for your home life: Where do you live?
9. Describe your home.
10. Who do you live with, and who takes care of you?
11. How many people live with you and who are they?
12. What work does your mother do? What level of education does she have? What is your relationship with your mother?
13. What does your father do for a living? What qualification does he have? What is your relationship with your father?
14. Describe the lives of other members of your family.
15. Describe your living and sleeping arrangements.
16. Describe a normal day in your life.
17. What primary school did you go to?
18. Who is at home when you get home from school?
19. Do you do any housework or chores?
20. Where and when do you do homework?
21. How much homework do you get in mathematics? How long does it take you to do?
22. How often do you watch television?
23. What is your favourite television programme?
24. Do you play sport?
25. Do you have friends that you spend time with?
26. What do you want to do when you leave school?
27. How do you usually do in mathematics?
28. Do you enjoy learning mathematics?
29. How did the TIMSS equivalent test compare to your usual tests? How did you answer the questions?
30. Why do you think mathematics will help in your daily life?
31. Do you think you will need mathematics when you get a job one day?
32. Do you have a computer? Have you ever used a computer? If so where and when? What other mod-cons do you have at home?
33. Do you like being at school?

34. What problems have you had at school?
35. Have you ever had extra lessons in mathematics?
36. Lets talk about when you were between the ages of two and five: What toys did you play with? Did you have building blocks, colouring in books, jigsaw puzzles? Did anyone read to you when you were small?

These questions were asked together with the answered TIMSS equivalent test and questions taken from Howie's research (1998).

1. TIMSS equivalent test, Question 8: Can you name the co-ordinates? Have you learnt to read co-ordinates from a graph?
2. The question from Howie (1998) p 29: to shade in 3/8 of a grid of 24 squares: Shade in 3/8 of the squares.
3. Given the question from Howie (1998) p 32:

   Question: Which fraction is the smallest?
   Answers: A: 1/6 B: 2/3 C: 1/3 D: 1/2

   Choose the smallest fraction.

4. Howie (1998) p 31:

   Question:There are 68 rows of cars in a parking lot. Each row has 92 cars. Which of these would give the closest estimate of the total number of cars in the parking lot?
   Answers: A: 60 x 90= 5400
   B: 60 x100= 6000
   C: 70 x 90 = 6300
   D: 70 x100= 7000

   Give the closest estimate of the total number of cars.

5. Question 3 from the TIMSS equivalent test:

   Divide with decimals and long division. Show your working.

6. Question 7 from the TIMSS equivalent test:

   Draw a parallelogram.

7. Copy and draw triangles into the given trapezoid shape. What does trapezoid mean? Now tell me how many triangles can fit into the trapezoid.

8. Show, using a diagram and calculations, how you would answer question 23 from the TIMSS equivalent test.