PUPILS' PERCEPTIONS OF STUDY OF MATHEMATICS AS A SUBJECT FOR THE SENIOR CERTIFICATE EXAMINATION : TWO CASE STUDIES

By

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DEDICATION

This work is dedicated to my wife, Patsy, my children, Kimera and Preanca and to my parents, Mrs. and the late Mr. A.V. Naidoo.

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DECLARATION OF ORIGINALITY

I declare that the whole of this work, unless specifically indicated to the contrary in the text, is my own original work.

This work has not been submitted for a degree in any other university.

S. Appanna .....

Date 10/04/95

Pietermaritzburg.

ABSTRACT

This study was conducted at two Secondary schools in the Pietermaritzburg area which is in the province of Kwazulu - Natal, South Africa. Of the 182 pupils who participated in this investigation, 97 were from a Black High school and 85 from an Indian Secondary school. The aim of this study was to gain insights into pupils' perceptions of Mathematics. The motivation was that such an exploratory investigation could contribute significantly to the understanding of some of the principal underlying factors that have contributed to the current crisis in mathematics education. The knowledge gained could inform future research in Mathematics education and educational strategies aimed at increasing the number of pupils studying Mathematics at matriculation level.

Since there exists a significant racial skewing in favour of White, Coloured and Indian pupils in the percentages of matriculants studying Mathematics for the Senior Certificate Examination, the research focused on the perceptions of Black and Indian pupils. The prevention of further disruptions to the studies of matriculants and the need for a manageable sample necessitated the use of two groups of Standard 9 pupils.

The study therefore acquired the characteristics of the case study method of investigation. Open - ended questionnaires, interviews and written essays were used for the purposes of data collection.

In examining pupils' perceptions, factors such as biographical details, future aspirations, pupils' explanations for studying / not studying Mathematics, their preference for the subject, pupils' views on whether more pupils should study the subject, as well as the status of the examination subjects, were considered. Findings suggested that all pupils - even those not studying Mathematics - had similar perceptions of the importance Mathematics, although their learning experiences had been significantly different. The curricula experiences of pupils appeared to have been influenced by past apartheid policies. However, the classroom experiences on which pupils' perceptions of Mathematics were based appeared to have been directly responsible for the low numbers of pupils studying Mathematics for examination purposes.

Critical theory played an important role in the interpretation of the major findings. These interpretations suggest that the classroom experiences of pupils were crucial in that they influenced pupils' decisions to select or not to select Mathematics as an examination subject. The study concluded with recommendations for classroom practice and research areas in Mathematics education which would improve the existing educational experiences of disadvantaged pupils.

TABLE OF CONTENTS

CHAPTER THREE

THEORETICAL FRAMEWORK AND RESEARCH DESIGN

CHAPTER FOUR

METHODOLOGY

CHAPTER FIVE

RESEARCH SETTING

CHAPTER SIX

ANALYSIS OF DATA

LIST OF ABBREVIATIONS

Acc.	Accounting
Afr.	Afrikaans
ANC	African National Congress
Bio.	Biology
Bus. Eco.	Business Economics
CH	City High
CNE	Christian National Education
CS	Capital Secondary
Eco.	Economics
FT	Fulltime
Geog.	Geography
GNU	Government of National Unity
Hist.	History
HSRC	Human Sciences Research Council
JSP	Junior Secondary Phase (ie. Standards 6 and 7)
Maths	Mathematics
Matric	Matriculation
ME	Matriculation Exemption
Phy. Sc.	Physical Science
PT	Part - time
PTSA	Parent / Teacher / Student Association
SCE	Senior Certificate Examination
SRC	Students' Representative Council
SSP	Senior Secondary Phase (ie Standards 8, 9 and 10)
Std.	Standard

CHAPTER ONE

MATHEMATICS IN SCHOOL AND SOCIETY

1.1 Introduction

This study examined the perceptions of two groups of South African pupils on the study(1) of Mathematics. At a time when Mathematics education finds itself in a crisis situation, this investigation attempted to gain an understanding of what pupils actually think of the subject. It is therefore, a study that examined one of the micro aspects of Mathematics education in the hope that insights gained may impact positively on the crises.

This chapter starts by briefly exploring the nature of Mathematics and its evolution in Western society. Its role in a modern, technological society is then examined and reference is made to the need for Mathematics education in South Africa. Finally, the general research problem as well as the motivation for the nature of the investigation is presented.

1.2 What is Mathematics ?

To different people, Mathematics is viewed as a body of knowledge; a problem solving tool; a perfection of logic or a venture in reason. It is often seen as a series of techniques of use only to the scientist, the engineer, the architect and the accountant.

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1. While the focus of the research was on the study of Mathematics, pupils' responses were often at the level of their perceptions of the subject itself. This will become evident when pupils' responses are analysed.

The assertion that the subject has had a major influence in the shaping of modern civilisation of which it is an integral part, is often greeted with sceptism. However, Kline in his book, Mathematics in Western Culture (1969), presents Mathematics as a significant cultural force in Western civilisation. He sees Mathematics not as a series of dry, technical procedures, but as a shaping and determining influence on life and thought. He supports this assertion by providing evidence supplied by Mathematics for :

1. The belief that natural phenomena are structured and orderly;
2. The significance of Mathematics in the formulation and defense of the theory of planetary motion;
3. The development of perspective by the Renaissance painters through the application of Mathematics;
4. The Mathematical method used by Descartes in his search for truth;
5. The role played by the Mathematical laws of the Newtonian Age in the Age of Reason which led to the renewal of philosophical, religious, ethical, political and economic thought;
6. The impression of non - Euclidean geometry on man's belief in the truth;
7. The contribution of Mathematics to the theory of relativity.

Kline maintains that :

> present-day Western civilisation is distinguished from any other known to history by the extent to which mathematics has influenced contemporary life and thought (1969 : p.12).

In light of the above, it is therefore not surprising that Mathematics occupies such a dominant position in school curricula worldwide. How did this state of affairs materialise?

To relate the answer to the South African situation, it is important to consider the development of school Mathematics in Europe (Behr, 1984). South Africa was initially a colony of European powers which introduced formal education to the country. Therefore, the implementation of European curricula and ideology has had a profound influence on South African education policies.

1.3 Mathematics in Western society

According to Howson et al (1981) schools in Western Europe were initially an extension of the Church. The principal motivating factor of this type of education was the production of an educated cleric and not, as in classical times, a cultivated man of affairs. The curriculum was therefore concerned only with what fell within the Church's interest and doctrines. Interest in Mathematics at this time was basic since it was confined merely to the familiarity of the different kinds of numbers, their shapes and an adequate understanding of astronomy so that the dates of religious feasts could be calculated. This dominant position of the Church went unchallenged for many centuries.

With the growth of urbanisation, education became more secular in nature, with learning being focussed on mastery of the "Three Rs", namely Reading, Writing and Arithmetic.

Differentiation in the schooling system also occurred with the emergence of grammar schools, which concentrated on Latin, and the "common" schools, in which emphasis was placed on the vernacular (Adamson, 1919).

Universities, which appeared in the late twelfth century, continued in the tradition of grammar schools. The use of Latin persisted since it was the language of international scholars and the language in which the important texts of the time were written. This practice resulted in the alienation of the Mathematics of the people from that of the academic community. Thus the grammar schools and universities which reflected the standards of the scholastic world failed to meet the needs of the larger society (Howson et al, 1981).

During the sixteenth century however, the inventions of the compass, gunpowder and printing press resulted in an increase in commercial activities with a subsequent need for more specialised arithmetic. Technology began to play an important role in everyday life. The demand arose for a more utilitarian type of education which the existing system could not provide. For as Bowen notes :

> By then the inadequacy of medieval conceptions became increasingly apparent, and the scholastic emphasis on Aristotelian logic and cosmology proved increasingly barren in the context of the expanding intellectual and geographical horizons of the time (Bowen, 1981 : p.36).

This need was fulfilled mainly by individuals who taught privately and who were Mathematical practitioners or Rechenmeisters. Education changed further with the coming of

the Renaissance and the Reformation. This period of change saw the birth of the study of the ancient civilisations and languages in grammar schools.

The influence of men like Calvin and Luther during the seventeenth century resulted in the Church's traditional hold on education being substantially weakened or eliminated. Education for the masses was viewed as a viable option since it contributed to the prosperity of the cities. Though education was made compulsory in some places (for example, the Weimar Republic) it was to a large extent still under the control of individuals, cities, guilds and parishes (Butts, 1973).

During the eighteenth century, secondary level education emerged in Europe. The curriculum was extended to include : Languages (both vernacular and foreign), Mathematics, science (physics, chemistry and biology) as well as art and sport. According to Howson and Wilson (1986), the Mathematics curriculum was originally developed in Western Europe after the Industrial Revolution. It was framed to cater for a small elite sector which had access to schooling. With colonisation came the exportation and retention of this European curriculum to the colonies. The school Mathematics curriculum is presently almost internationally uniform. What was originally meant for a minority has now been made available to all (Howson and Wilson, 1986).

1.4 Mathematics in a modern, technological society

Societies have increasingly been influenced by modern

technology. It is therefore not surprising that major social institutions such as the school have had to accommodate these changes with educational aims having constantly to be reviewed. Mathematics, which has over the years become an integral part of schooling, has been directly affected by the progress in technology. This is apparent when one examines the new branches of Mathematics that have emerged, the use of new Mathematical techniques and the skills that citizens require to function effectively in society. The change in society's demands, expectations and employment patterns, has also inspired educators to adapt the goals and structures of Mathematics education to meet the demands of a technological society (Churchhouse et al, 1986).

Technological development has had varying effects on the demand for Mathematics in different societies. Rural societies within Third World countries have experienced an increase in the demand for Mathematical skills with the advent of small - scale commercial farming, modern machinery and instruments such as scales and units of measurement. However, in technologically advanced First World countries, there has been a shift in the type of Mathematical skills required to compete effectively in the jobmarket. Traditional Mathematical skills required by the majority of the workforce are no longer necessary due to the functions of the microchip (Fitzgerald, 1981). This is evident in the number of low - skill job opportunities in 1980 and the prediction that such trends would persist for the next quarter of a century (Romberg, 1984). The result has been a decrease in particular

Mathematical skills such as arithmetic and an increase in demand for the appreciation of more generalised Mathematical concepts and ideas, such as statistics, probability, estimation, orders of magnitude, and understanding of the assumptions that underlie a prediction or procedure. Thus the demand for particular Mathematics skills has polarised a workforce that is already divided. Whilst universally unemployment continues to increase alarmingly, there exists "an employed elite on whom greater, and changing, Mathematical demands are placed and who, as a result, are coming to enjoy increasing power" (Howson and Wilson, 1986 : p.3). It is therefore not surprising that for many people Mathematics is the key that opens doors to future enrichment.

In South Africa, technical and vocational education (of which Mathematics is a major component) gained prominence in the educational debate, after the Soweto Riots of 1976. These riots acted as a catalyst in forcing the then government to review education in the country.

The post 1976 period was characterised by increasingly organised student resistance to state education to the extent that by 1981 the crisis in education was endemic (Hartshorne, 1986). This period also saw a crisis in capital accumulation and an increasing demand by the economy for labour above the levels of unskilled and semi - skilled work, and which tended

to indicate the need for the training of Black(2) people for skilled occupations as well. Given the changing situation of the political and economic levels it was not surprising that the Government commissioned the Human Sciences Research Council (HSRC) to set up a committee to conduct an investigation into educational provision in South Africa (named the De Lange Commission after its chairman).

At the end of July 1981, the Commission published a Main Report on a variety of matters including education management, financing, curriculum and technical education. Some of the positions adopted by the report were :

1. Unemployment and falling living standards were blamed on unfair and inappropriate schooling;
2. Education was viewed as a service industry to reproduce and process a skilled, urban, wage labour force;
3. It was the responsibility of schools to shape and adjust students' expectations and aspirations to the occupational realities of the environment;
4. That there was need for schools to cater for the demands of reskilled and upskilled Black labour (Nasson, 1984).

De Lange's recommendations were in line with the manpower approach to educational planning : to shape the economy, the state pays for the type of education and training which will

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2. The term "Black", "Coloured", "Indian", and "White" are used in text. These do not refer to a biological concept of race but to the political system of racial classification that underpinned apartheid education and the school population discussed in the present study (Penny et al, 1993 : p.412).

produce the most desirable (by the economy) manpower in the quantity and quality determined to do this. Consumers pay for anything else that they desire to study.

The importance of science, Mathematics and technology to the development of South Africa received the attention of the majority party in the Government of National Unity (GNU) at the time of writing. In reference to this, a major concern of the African National Congress (ANC), which is the majority party in the GNU, is that :

> Science and mathematics education must be linked to a national science and technology policy framework which maps out the role of science and technology in the social, economic and environmental development of our country (ANC, 1994 : p.83).

The use of indigenous technology through research, technology transfer, innovation and adaptation, is seen as a key factor in promoting development on a national scale. For such an endeavour to be successful, more scientists and technologists are required than are available. Therefore, it is proposed that :

> ... science and mathematics education and training, both school-based and work-based, must be transformed from a focus on abstract theories and principles to a focus on concrete application of theory to practice (ANC, 1994 : p.84).

This can be achieved only if science and Mathematics are linked to the life experiences of the individual and the community.

1.5 The need for Mathematics education in South Africa

Universally, Mathematics has become a central part of

education systems. Given the prominence of Mathematics and the perceived importance of science and technology to the development of a country, one would assume that the majority of South African matriculants study Mathematics as a subject for their Senior Certificate Examination (SCE). A survey conducted by this researcher during 1992 at the eight Indian secondary schools in Pietermaritzburg, revealed a favourable picture as regards the number of pupils studying Mathematics. This is depicted in the following table :

Table 1.1 : Number percentages of pupils studying Mathematics at Indian secondary schools in Pietermaritzburg during 1992 by school enrollment totals.

	Schools							
	A	B	C	D	E	F	G	H
Total(3) enrollment	506	695	373	389	383	723	347	573
No studying Mathematics	435	472	223	290	350	596	208	415
Percentage	86	68	60	75	91	82	60	72

(Appanna, 1992 : p.4)

However, a different scenario was revealed when one examined some pertinent statistics for all racial groups in South Africa. The following table revealed a skewing in favour of Whites, Coloureds and Indians as regards the number of pupils studying Mathematics :

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3. Figures include enrollment for Standards 8, 9 and 10.

Table 1.2 : Percentage of 1992 matriculants studying Mathematics by total enrollment and racial grouping.

Race	No. of matric pupils	% Studying Mathematics
Black	363027	26,6
White	69935	68,3
Coloured	25483	42,2
Indian	14804	72,2

(Strauss et al, 1992 : pp.1,8,9)

Another alarming fact is that in 1980 a greater percentage of pupils studied Mathematics for the SCE. This is evident when one examines the following table :

Table 1.3 : Numbers and percentages of Std 9 and 10 pupils studying Mathematics in 1980 by controlling body.

Controlling body	No. studying Mathematics(4)	% studying Mathematics
Dept. of Internal Affairs (Indian Affairs)	13624	76,5
Dept. of Internal Affairs (Coloured Affairs)(5)	4415	48,8
Dept. of Education and Training	31751	34,5
The four provincial White education departments together	73528	67,5

(HSRC, 1981 : p.18)

Thus, despite the prominence of the subject and its importance to the development of the country and pupils' career prospects, Tables 1.2 and 1.3 reveal that :

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4. The figures do not include the practical course.
5. The figures do not include Std 9 pupils

1. Relatively small numbers of pupils study Mathematics for the SCE.
2. The percentage of pupils studying Mathematics for the SCE has decreased between 1980 and 1992.
3. The distribution pattern of those studying the subject is very seriously racially skewed in favour of White, Coloured and Indian pupils.

Why is this so ? These issues form the crux of the current study.

1.6 The evolution of Mathematics education in South Africa

In order to gain an insight into the problem, an understanding of the historical evolution of Mathematics education in South Africa will prove useful.

Some South African educationists such as Thembela (1986) and Hartshorne (1989) have argued that since the colonisation of South Africa, an attempt has been made to use education as a means of maintaining the social, political and economic control of a minority at the expense of the indigenous inhabitants of the country. Hartshorne (1989) comments that the development of the education system in South Africa can be traced to the colonialist attitudes and actions of the Dutch, who used the Cape for economic gain, as well as British imperialists, who exploited the mineral wealth and potential of the country. The European belief that the natives of Africa had limited educability persisted, thus entrenching the view that they were inferior to the colonists. Therefore, education during this period was not

extended to the indigenous inhabitants since it was a commonly held belief of the time that they would be better off without it. This was convenient since it provided the grounds for justifying the political and economic policies which were implemented.

The status quo altered, however, with the arrival of missionary societies who took it upon themselves to "civilise" the natives of South Africa. This, however, did not suit the government of the time since missionary teachings were often in conflict with the interests of the state. The state then took to providing, or withholding, education for the natives making sure that both political and economic power was retained by the White sector which had control of the state. The policies of this education system may best be depicted in the words of Dr. Dale who in 1886, as Superintendent - General of the Cape for 33 years, wrote :

> It is not the intention to train the whole of the male Bantu youth to become expert tradesmen, but to rather instruct them to use efficaciously the spade and the hoe, the plane and the saw, the mason's trowel and the plumb - line (in Hartshorne, 1989 : p.107).

After the establishment of Union in 1910, the education of Blacks was largely neglected by the state, and became the responsibility of the provinces. This occurred mainly because of the struggle among White groups to obtain state control, the main educational issues of the day being the position of Afrikaans in White schools and the provision of separate schools for the two White groups. The void between Black and White education was entrenched by Act No. 41 of 1925 which

established a fixed grant for Black education from state funds, whilst any excess required was to be financed from the taxes collected from Blacks by the Native Trust Fund. Hartshorne states that :

> The state had therefore determined that the sector of society least capable of generating funds through taxation should be responsible for its own educational development, while white education was to rely on the general financial resources of the country, thus strengthening the position of whites in terms of economic and political power and privilege (Hartshorne, 1989 : p.109).

Curriculum revision during this period reflected the state's position on Black education and the role of Mathematics in it. In the Black schools of Natal, for example, the four main principles underlying this revision, which took place in high schools and intermediate schools in 1919, and in Primary schools in 1920, are summarised in Superintendent Loram's report for 1918(6). The first principle of revision was :

> The exclusion of subjects which could not be shown to have a definite and practical bearing on the lives of the Natives. As a consequence, Algebra (except the use of symbols in the solution of problems), Geometry (except Mensuration), Translation (except as an occasional aid to comprehension) have been dropped (in Harley, 1989 : p.421).

Secondly, subjects included were to be of "practical and demonstrable value". These included Physiology and Hygiene, and Nature Study. The "practical side" of subjects, that is the side associated with menial, manual work of the kind

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6. These changes were not unique to South Africa. Loram studied in the United States of America and was stongly influenced by the Tuskegee Movement.

linked with tribal culture or service to the dominant race, was to be emphasised. Thirdly, Agriculture, Woodwork, Needlework, and Domestic Science were made a compulsory part of teacher training, as the emphasis in Black education was to be on Agriculture and Manual work. For example, it was decided that activity in industrial work comprised ten hours a week. Finally, a vocational course was introduced. Though it did not hinder pupils from following the academic course, it had an industrial and practical bias. Activities included were : training of domestic servants, Domestic Science, Woodwork, Agriculture and Gardening, and Native Crafts. The lack of emphasis on Mathematics education in Black schooling at this time meant that the subject was now associated with positions of power, that is, only those destined to positions of power studied Mathematics.

With the coming to power of the Nationalist Party in 1948, the role of education as a state - controlled mechanism which perpetuated social inequalities was consolidated. Education was to be used as one of the primary mechanisms of state policy to achieve political and social control. For many years thereafter, the ideologies of Christian National Education (CNE) and separate development (apartheid) were to form the cornerstone of Black education. This is aptly summarised in the words of the 1948 document of the Institute of CNE when it states :

> We believe that the calling and the task of White South Africa with regard to the native is to Christianise him and help him on culturally, and that this calling and task has already found its nearer focussing in the principles of trusteeship, no equality and segregation (in Rose and Tunmer, 1975 : p.127).

According to Julie (1992 : p.3) the Bantu Education Act of 1954 formally legalised racially segregated educational facilities for all South Africans. It explicitly politised education within narrow ruling party considerations by keeping tight control over who was taught, what was taught and for what purpose. The role of Mathematics in this changing scenario was poignantly captured in the words of Dr. Vervoed (the then Minister of Education), when he proclaimed :

> What is the use of teaching the Bantu child mathematics when it cannot use it in practice? That is quite absurd (in Harley, 1989 : p.421).

The following words enunciated by Julie appropriately describe the position adopted by the architects of apartheid education as regards Mathematics :

> Apartheid ideologues and its adherents had no intention for black South Africans to dabble in mathematics or any of the sciences. Indeed they argued that black persons had no such capabilities. On the other hand these ideologues realised the importance of mathematics as a selector for social and educational empowerment. Thus, although profound changes were made to subjects such as history, geography and languages to rid them of their primarily British character, mathematics was kept intact. Changes were however made to the context of the applications of mathematics as embedded in word problems. Adherents were urged to work for 'excellence' in mathematics; thus the apartheid-supporting sector of the white community could establish themselves in the economic and technical fields (Julie, 1992 : p.3).

1.7 The general problem and motivation for the study

The preceding discussion reveals that Mathematics education in South Africa has been used as a mechanism to maintain control over the masses by those in power. Sociologically, this picture is in accordance with the theories of reproduction (refer to Chapter 2 were they are dealt with in detail). However, the danger of these macro theories is that they have an over - socialised view of people, and human agency tends to be underplayed (Giroux, 1983).

It is therefore important that we gain a micro perspective of pupils' association with Mathematics. In this regard we need to understand what pupils actually think about the subject. Another factor to influence the nature of the current study is that existing research in this field has often been highly statistical. The instruments of data collection have been predetermined, and the information derived has been rigorously analysed according to accepted methods (see for example : Moodley, 1981; Rech, 1990 ; Tocci, 1991 and Collins, 1992).

It was therefore argued that an exploratory investigation into pupils' perceptions of the study of Mathematics at matriculation level would contribute significantly to the understanding of some of the principal underlying factors that have contributed to the crisis in Mathematics education. With the knowledge of those perceptions, strategies can be worked out to ensure increased numbers of pupils study Mathematics at matriculation level.

In light of the above discussion, the purpose of this study therefore is :

1. To ascertain pupils' perceptions of studying Mathematics at matriculation level.
2. To relate the sources of the identified perceptions in the light of major sociological paradigms.

It was hoped that the findings of the investigation would be of immense significance for the researcher, who has been a teacher of Mathematics at a Secondary school for ten years. It was further hoped that the resulting recommendations would impact positively on Mathematics education in South Africa in the future.

CHAPTER TWO

RESEARCH ISSUES RELEVANT TO THE STUDY

2.1 Introduction

This chapter presents some of the key theoretical issues which inform the current study. These issues are considered since they guided the formulation of the research topic, the theoretical framework and the data gathering instruments used. The discussions that follow encompass the important theoretical issues which have a bearing on pupil self - concept and success in Mathematics. Macro issues such social reproduction and resistance to education are considered. In addition, themes that are relevant to micro - level investigation into Mathematics education in South Africa are examined. The importance of a study on pupils' perceptions as well as the relevance of the symbolic interactionist viewpoint are discussed. These lend weight to the justification for an exploratory micro - level study on Mathematics education.

2.2 Schools as sites of social reproduction and resistance

> The provision of universal state education reflects a resolution of the question of control over the schools in favour of the dominant classes whose interests are articulated in the apparatuses of the state and in their functioning (Sharpe, 1980 : p.117).

The extent of this dominance and its continued existence has been a point of contention amongst sociologists for many years. Functionalist social theorists such as Parsons (1967) considered schools to be socialising institutions which provided pupils with the necessary skills and values in order

to function productively and usefully in society. Functionalists, accordingly tended to leave unanswered questions on the relationship of schools to issues of power, class conflict and social control. During the past two decades the ethical and political innocence attributed to schools by the functionalists has been rejected by critical theorists who have stressed the political nature of schooling. They have done so by pointing to the role that schools play in reproducing the inequalities inherent in the existing society. The economy, state power, culture and resistance are four major themes which have dominated critical theory (Giroux, 1981).

Bowles and Gintis (1976) have posited a "theory of correspondence" in which they argue that education contributes to the reproduction of workers with the kinds of personalities, attitudes and outlooks which will prepare them for their positions in the labour market. The economic role of education is not the reproduction of technical skills nor the grading of individuals according to ability and interests, but rather the personality and consciousness it fosters. Schooling is "organised to meet the requirements of a repressive and exploitative capitalist society" (Gibson, 1986 : p.47).

Althusser (1977), on the other hand, believes that for the relationships of production to continue it is necessary that workers not only acquire skills necessary to cope with the production process but also be instilled with the attitudes,

values and norms that will result in a disciplined workforce. He maintains that the state, through repressive state apparatus (for example, the police force and judiciary) and ideological state apparatus (for example, the school and media), is able to promote and maintain the status quo.

The theory of cultural reproduction as presented by Bourdieu (1977) shows how education is able to reproduce culture and therefore economic inequality. According to this theorist, though schools claim to be fair and neutral, they favour those already favoured and hence cultural inequality is perpetuated. Thus schools teach what those in state power positions already possess, hence their childrens' success in school examinations. Bourdieu (1977) stresses the autonomy of schools which results in their being viewed as neutral -hence the success of transmitting cultural inequalities.

A major flaw in the reproductionist perspective is that they ignore the element of resistance that can be put up by the exploited. They fail to acknowledge that power is never uni - dimensional, that is, there is the power to oppress as well as the power to resist. Thus, theories of reproduction, which have been described as economic reductionism and determinism, fail to consider the important aspect of human agency in their arguments.

The preceding discussion is relevant for the purposes of the current study as it cautions against a simplistic response to the educational crisis in South Africa. In order to derive a proper understanding of prevailing circumstances all factors

that impinge on the learning process must be examined. It is therefore important that pupils' insights are explored as they may provide explanations that will contribute to a realistic understanding of existing educational dilemmas.

An alternative to the above theories of reproduction is that of resistance. Giroux states that :

> resistance is a valuable theoretical and ideological construct that produces an important focus for analysing the relationship between school and the wider society (1983 : p.29).

He is especially concerned to demonstrate that reproduction theories, which posit a rigid socialisation model geared to the labour market, have failed to offer an alternative model for the actual course of educational development. According to reproductionist theorists, the purpose of schools, however unintended, is to prepare pupils for the world of work. Giroux (1983) challenges this view and argues that the classroom can be a space for genuine change and not just a site for reproducing docile workers. His thesis is that resistance is more than a response to the authoritarian curriculum. He argues that the resistance presented by students opens up tiny but significant spaces for new forms of power. Schools are therefore, not only sites of reproduction of the status quo, but also sites of contestation and struggle.

Resistance theory acknowledges the fact that pupils are not passive receptors of knowledge but rather, they actively participate in the educational process. This implies that

they do not always accept what is taught. Giroux (1983) therefore sees the school as a place where clashes between cultures can occur. Education is not determined merely by capitalism and an elite, but rather it is influenced by the on - going struggle between existing groups in society.

Apple (1982) suggests that the fact that education is an aspect of the state and is an active agent in the process of hegemonic control should not cause us to assume that all aspects of curriculum and teaching are reducible to the interests of a dominant class. It has been argued further that schools also provide opportunity for emancipatory teaching, knowledge and social practices.

For the purposes of this study the work of Willis (1977) is of importance since he succinctly demonstrates how resistance actually contributes to reproduction. He rejects the view that there is any simple direct relationship between the economy and education. Education is not simply a socialisation agency that produces false consciousness. State schools and the oppositional culture within them are especially significant in revealing a circle of unintended consequences which act finally to reproduce not only a regional culture but the class structure and the structure of society itself (Willis, 1977). Thus the unintended consequences of education lead to reproduction. This is important because it illustrates that to understand reproduction (which seems to have happened and be happening in South Africa - as established in Chapter One) we need to

understand pupils at a micro - level.

These theories of reproduction and resistance form the main body of the work that is often used to analyse the relationship between the state, the economy, society and education. The complexity of the reproduction / resistance debate in South Africa is well illustrated by the debate between Molteno (1987) and Gilmore (1989). It also highlights the significance of an investigation into pupils' perceptions.

Within the South African context, Molteno (1987) states that an analysis of education using theories of reproduction is insufficient. Though such theories go a long way in accounting for the segregated and discriminatory South African education system, the analysis is incomplete since it does not do justice to the resistance that has been in evidence in South African schools. As such, Molteno (1987), in his report of the boycott by students belonging to schools of the Coloured Education Department in South Africa's Cape Peninsula during 1980, shows how communities by, extending the degree of control they exercise in the arena of schooling make it possible for schooling itself, and its effects within a wider social context, to be in some real measure transformed.

This boycott by the Coloured students in the Cape Peninsula against "gutter education" was a boycott of lessons and not a school stayaway. It started initially in one of the working class townships and thereafter spread throughout the

Peninsula. During the boycott students took control of schools and established / elected their own leaders in the form of Students' Representative Councils (SRC). The prefect system was suspended. Teachers and principals who previously were in positions of control found that they were now powerless. Thus the student / teacher relations that existed prior to the boycott were reconstituted. The Committee of 81 was established to give direction and to co-ordinate the boycott in the various regions of the Cape Province.

During this boycott students also intervened in broader social relations by participating in the Meat Workers' Strike and the Bus Boycott. According to Molteno, these students "had the opportunity not only to extend their struggle beyond the schools but to make a concrete contribution to the workers' wider struggle" (1987 : p.13). They did this by helping to organise the strike, collecting money to help compensate the lost wages of the workers, production and issuing of pamphlets, making parents aware of the situation and participating in marches.

According to Molteno (1987) the 1980 boycott served to illustrate that schools are not totally under the control of the state. The fact that students gained control and were able to transform their schooling, though only for a limited period, highlights this fact. That the transformation was limited points to the fact that prevailing structural constraints hinder any major change. Therefore given constraints, transformation must be expected to be limited.

Molteno states that the boycott served as an illustration that people's intervention in a system should be taken as seriously as historical and structural constraints. He therefore states that :

> ... the complex of structures, processes and agency that is schooling should be approached not from 'the top down' or the 'bottom up' but dialectically as the historically rooted product of structurally located struggles (Molteno, 1987 : p.20).

Gilmore (1989) in his response to Molteno's investigation offers criticisms based on theoretical and methodological considerations as well as commitment. Gilmore (1989) believes that Molteno has erred by ignoring the chronology of the boycotts, treating both the student and teacher bodies as being homogeneous and by not taking into consideration the different political affiliations of the organisations involved in the boycott. According to Gilmore "Molteno's description does not capture these complexities and consequently does not allow for lessons to be learned from the events" (1989 : p.370).

Furthermore Gilmore (1989) offers criticisms on the basis of Molteno's political commitment. Molteno's experience of the 1980 boycott and the fact that he used a network of contacts that he knew leads Gilmore to conclude that an inaccurate picture of the boycott is presented because the study lacks formal representivity in that only contacts known to Molteno were used. This is compounded further by the fact that no triangulation of data took place since the data gather was not verified against other sources. Thus any discrepancies in

the recorded accounts would go unchallenged.

On the basis of these arguments Molteno's case study is critiqued as being incomplete and too general. Gilmore describes the methodology used being "reportage" and states that it is insufficient for theorising as Molteno has done. He therefore suggests that "greater rigor on all levels would have allowed for more valuable insights into the processes and potential outcomes of the students' boycotts" (1989 : p.373).

Notwithstanding the above criticisms offered by Gilmore and taking into consideration the fact that it was a case study, Molteno (1987) does offer us some important insights into the resistance / reproduction debate in an African setting. He has shown how with resistance both the social and schooling environments have changed, even though this was to a limited degree. His article reveals that schools are sites of contestation in which the struggle for control occurs, thus showing that the state does not have total dominance over schooling as the reproduction theorists would have us believe.

Molteno's (1987) investigations clearly reveal that human agency cannot be overlooked when analysing schooling and this is further emphasised by the case study of Ray (1988) who demonstrates that even though resistance may be passive, it does occur in schools and therefore must be considered. Thus an important contribution of Molteno's investigation is that it reveals that even in oppressed societies, there are

opportunities for transformation through resistance.

By extending the reproduction analysis to incorporate resistance, Molteno paints an optimistic picture of the possibilities for societal change. For Molteno schooling is an arena that is determined from above and below. Thus for him there is a perpetual struggle for control over schooling. The central point of his paper is that schools can be and are sites of resistance and not just mere instruments of domination that are wielded by the authorities. This is of significance for the current study as it exposes the need for taking into consideration pupils' construction of reality when implementing changes.

The importance of a micro perspective, as revealed in Molteno's study, requires us to examine some of the relevant themes that are related to an exploration of pupils' perceptions of Mathematics. In the discussions to follow some of the more pertinent micro issues related to the topic are examined. Scrutiny of appropriate literature in the field suggests that the influences of culture, gender, racism and curriculum construction subtly affect Mathematics learning. These issues also play an important role in informing the researcher in the construction of the data - gathering instruments.

2.3 Culture and Mathematics

As the following discussion reveals, the debates on culture and Mathematics have investigated the relationship between

mathematical thinking (cognition), culture and context. These studies have been a source of considerable research internationally. However, in South Africa very little research has been conducted in this field, since educationists have generally concerned themselves with macro issues in the education debate. The discussion that follows reveals the influence of culture and social groups on the mathematical learning of children and adults from different social environments.

2.3.1 The Mathematics of traditional cultures

Mathematical ideas exist within all cultures. Which ideas are stressed, how they are formulated and their context differs amongst cultures. According to Ascher (1991) Mathematics as a category is not found in traditional cultures as it is in western cultures. Therefore, those who study Mathematics in traditional cultures, (for example, Gerdes 1988) refer to the need for interaction across disciplines such as anthropology, archaeology, history, linguistics, ethnology, economics, art, literature and oral tradition.

Recent ethnomathematical research has centered around the activity of counting, the concept of space and the variety in mathematical ideas. Vithal (1993 : p.339) states that of all mathematical ideas that have been studied across cultures, the mathematical activity of counting has received the most attention. Studies have demonstrated that the variations in number words and symbols used as well as the way in which they are organised into systems exist mainly because of the

influence of the culture and the needs of the people. The Yoruba people of Nigeria, who have been urbanised farmers and traders for many centuries, have a complex number system which relies largely upon subtraction to express a number (for example, the number 65 may be expressed as "five from ten from four twenties" or 65 = [20 x 4] - 10 - 5). Other studies on numeration systems in different cultures indicate that there is "a rich variety of counting systems, varying in line with the environmental need, both physical and social" (Bishop, 1988 : p.26).

The concept of space and the way it is organised and modelled in different cultures has also been a subject of research. Pinxten and his colleagues who have studied the spatial concepts of the Navajos of North America, argue that though there exist universal spatial referents, the Navajos' conception of space is different from that of western conception in important ways : process and motion are most important in the Navajo world view; spatial ideas appear not to be hierarchically organised as in the western view; they are dynamic rather than static; and the part / whole distinction, which is fundamental in western thinking, is absent in the Navajo knowledge system (Pinxten et al, 1983). Such investigations into the spatial orientation of traditional societies have led researchers to conclude that the particular features of a spatial environment affect the manner in which space is represented and that the application of certain spatial models is related to the activities specific to an environment or a culture.

Research into the mathematical ideas of traditional cultures reveals that a large variety exists. Investigations, such as those carried out by Ascher (1991) into the concept of sand drawings that exist in three cultures in differing contexts, have shown that cultures may share some ideas and not others. Furthermore, even where the idea is the same or similar, it may be expressed differently and have different contexts.

In as much as some "Western" mathematical ideas are not known to the general population whereas others are, so too in traditional cultures some mathematical ideas are known only to a select few and some to all people. Ascher (1991) states further, that often Western Mathematics concerns itself with individual contributions and includes very little about other members of society, whilst little is known about the individuals of traditional cultures who were inclined towards mathematical ideas. As Vithal (1993) notes, in the South African context :

> ... this is a relatively unexplored area of research. Yet its importance cannot be denied as it demonstrates the vast potential of indigenous mathematical ideas capable of being exploited in mathematics curricula (Vithal, 1993 : p.341).

2.3.2 The Mathematics of different groups in society

According to Vithal (1993) a second area of research centres on the mathematical knowledge that is generated by both adults and children in a variety of contexts outside the classroom. For example the studies of sugar cane farmers (Abreu and Carraher, 1989) and shoppers (Lave 1988) revealed

that people are able to develop and use efficient strategies for solving mathematical problems in everyday situations. Such studies examined the higher rates of achievement, the informal methods constructed and used for daily problem solving and the relationship of such methods to school Mathematics.

The learning of Mathematics by the very young in society has also been the subject of considerable research. According to Song and Ginsburg (1987), children across social class, race and culture display informal Mathematics skills and concepts. Though it has been found that numerical thinking is partly derived from society and culture, investigations have revealed that there is often a lack of congruence between the mathematical understandings that a child acquires outside the formal school environment and those required in the Mathematics classroom (Saxe 1988). Research suggests that the extent of this difference is, in part, related to the extent of the disjuncture between the cultures of the home and school. According to Gay and Cole (1967) this is observed more in situations where children from traditional cultures enter schools based on a Western culture. However this point has also been raised with respect to women and working-class cultures in Western societies (for example, Mellin-Olsen, 1987, and Walkerdine, 1988). Over the last two decades, as Taylor points out:

> ... numerous studies have detailed the disjuncture between Mathematics and out-of-school problem-solving activities across a range of geographical, class and culture boundaries and a variety of Mathematical task situations (1991 : p.107).

An example of such work is that done by Carraher and her colleagues amongst children who sold produce in a market (Carraher et al, 1985). Such investigations revealed that, even though mathematical methods acquired in the classroom make it easier to solve problems, such procedures are poorly learnt and quickly forgotten. Thus the power of classroom learnt methods are lost. Instead children prefer using methods which are self-invented. Though these may prove to be more cumbersome to apply they are understood better and are therefore more powerful.

In the past, according to Vithal (1993), it is likely that any explanations about the differences between school Mathematics and the Mathematics generated in the course of everyday activities would have featured the abstract versus the concrete dichotomy. This, however, is no longer the case. With the progress in our understanding of the informal mathematical knowledge of traditional cultures, and how this differs from or is similar to the Mathematics of the classroom, research has begun to explore the interplay between the two. For example, Saxe (1988) examined the way in which mathematical understandings acquired in one context, either the classroom or the practice of candy selling, were applied to problems that emerged in the other contexts. He was therefore able to provide evidence that there is a gradual integration between the formal Mathematics of the school and that acquired through the practice of candy selling. Saxe states that "children make use of the cognitive form linked to one practice (either school or candy selling)

to accomplish problems in the other"
(1988 : p.174).

The above discussion is significant within the South African context for the majority of the people live in rural environments which may impact on their educational achievement. Vithal (1993) warns however, that the research evidence in this area is not clear cut and more research is needed before any trends or general principles are discernible.

2.4 Racism in Mathematics education

Racism in education has been the focus of recent research. The investigations of Fuller (1980), Wright (1987) as well as Mac an Ghaill (1988) are relevant in this regard. For the Asian boys as well as the African - Caribbean boys and girls interviewed by Mac an Ghaill (1988) the school represented an additional instrument of oppression which marginalised and ridiculed them.

Mac an Ghaill (1988) discovered that resistance to the dominant school culture by African - Caribbean boys took the form of late arrival for lessons, disruptions to classroom activities, with their completing only the minimum of tasks set, and even sleeping during lessons. This was done even by the very intelligent pupils to prevent themselves from being "streamed" into higher ability groups thus creating an elite amongst themselves.

Though African - Caribbean girls were also found to have

anti - school attitudes, their responses, however, were different. Mac an Ghaill (1988) discovered the girls to be pro - education in that though they refused to participate in classroom discussions, arrived late for lessons, submitted homework late and disrupted lessons, they had good attendance, worked hard regularly and generally appeared to be intelligent. This they did mainly because education for them was important and the academic qualifications valuable as this represented a means to avoid the toil of the low - level jobs that often characterises traditional Black female working - class labour. Mac an Ghaill (1988) describe the girls' actions as accommodation within resistance since they did not identify with the school yet, and unlike the boys, they did not openly resist it. These findings are further substantiated by the observations of Fuller (1980) and Wright (1987).

Ensor (1994) argues that though research suggests that gender and ethnic differences are important in that they highlight important problems, the strategies to redress the situation, suggested by such research, are often inappropriate. Such strategies are aimed at teachers, parents, counsellors or to change the classroom interaction since their goal is to change the attitudes of the pupils rather than directly confront the issues that need to be addressed. However, from her study of a group of African - Caribbean girls at a comprehensive school in London, Ensor states that :

> The barriers confronting the girls of my study, I would argue, were not erected by inappropriate attitudes to mathematics, or by being marginalised by teachers in the classroom interaction; they were fundamentally political, relating as they did to the issues of sexism and racism (1994 : p.111).

She therefore suggests that racism and sexism :

> ... together with other forms of social inequality, need to be brought to the forefront and discussed explicitly in classrooms; that we need to seek ways, for example, in which Mathematics as a research tool can be used to interrogate instances of discrimination on the grounds of colour, gender or social class (Ensor, 1994 : p.112).

The studies of Mac an Ghaill (1988) as well as Ensor (1994) may be related to that of Willis (1977). All these researchers have established the effects of pupil resistance on the learning process. They have thus emphasised the importance of the need to understand pupils at the micro level. Too often education reform is implemented with little regard for what is actually happening in the classroom. With this in mind an exploratory study on pupils' perceptions is deemed relevant, especially at a time of major social restructuring, as is currently the case in South Africa.

2.5 The production of the current South African Mathematics curriculum

Related to the above, and of significance to the current study, is the process of Mathematics curriculum construction in South Africa. This is important for it reveals that the content of the Mathematics syllabi is prejudiced to favour the dominant group in South African society. Furthermore, the process of the construction of the Mathematics curriculum effectively excludes other groups from making any meaningful

contributions. Pupils' perceptions of the subject will invariably be affected when faced with a curriculum that is alien to them.

In South Africa, education has manifestly not been a neutral force. Nasson (1984) explains that this is not unique to South Africa since education is an integral part of the capitalist political economy. Indeed the "problem" of state schools is that they have closely mirrored state policy in respect of the "different" population groups. More specifically, in both quantitative and qualitative terms, education for Blacks and Whites has been different in South Africa.

Black education has been inferior with regard to per capita expenditure, provision and resources (Thembela, 1986). Education for Whites tended to allocate Blacks to unskilled and semi - skilled positions (Harley, 1984). In the event of this system failing, however, certain categories of "skilled" jobs were reserved for Whites by law (Hartshorne, 1986). The deliberate impoverishment of the Black population was further achieved by a denial of property rights for all but very few. Thus up to 1980 schooling (and other social and legal institutions) was the process whereby the existing (economic) class structure and the structure of social relationships was legitimated and reproduced at the objective (mainly the skilled and unskilled labour requirements of capital accumulation) and the subjective level (consumers). Thus during this period the process of schooling had the effect of

reinforcing the existing social injustices.

The election of a new South African government during April 1994, will undoubtedly result in significant changes being made to education policies in the future. Such change is already evident in the creation of a single ministry of education with provincial governments charged with the responsibility for meeting the educational needs of the various regions. It should be noted however, that during this early transitional stage, educational practices and policies have yet to change. In the light of this statement it is therefore important to examine the production of the Mathematics curriculum in South Africa just prior to the elections of 1994.

For most teachers the term "curriculum" refers to the prescribed guidelines provided by educational authorities as regards the formal as well as informal activities that pupils must participate in during an academic year. For as Tunmer explains, curriculum refers to the "range of compulsory and optional activities planned for an individual by a school" (1981 : p.114). As such the curriculum is the mechanism which controls the daily activities of both pupils and teachers.

An understanding of the term curriculum is however incomplete if the process of its construction is not taken into consideration. It should be remembered that in most instances, and especially in South Africa, only a select group is responsible for the formulation of the curriculum

(King and van den Berg, 1991). Thus input by teachers, pupils and parents is limited. The curriculum is therefore used as vehicle to promote the interests of a particular group in society. For as Christie notes, "the curriculum can never be neutral or stand outside of patterns of power" (in NEPI, 1992 : p.2).

Thus by using Bourdieu's (1977) concept of "cultural capital" the curriculum may be seen as the official sanctioning of what dominant groups in society consider to be relevant scholastic activities. As such it is based on the experiences of the dominant group and by its exclusion of other forms of knowledge success and failure is legitimated.

In South Africa, the creation of the homelands and the tricameral system of government in 1984 saw the birth of sixteen different education departments. Each of these racially - determined departments was supposedly responsible for the formulation of its own curricula (Committee of Heads of Education Departments, 1991). However, an examination of the construction of the Mathematics curriculum reveals that this did not occur (Julie, 1992).

A Syllabus Revision Committee, made up almost exclusively of experts from the White education departments, was responsible for the initial draft curriculum (King and van den Berg, 1991). The various education departments, universities and state - approved school Mathematics associations then responded by setting up committees which reviewed and offered recommendations on the draft. Thereafter the syllabus

revision committee reviewed the draft in the light of the recommendations and a final core syllabus was presented to the various education departments. The purpose of the core syllabus was to serve as a guide to the various education departments in the construction of their own Mathematics syllabus. Additions to the core syllabus were allowed in order to cater for the needs of a specific culture. According to Julie (1992) however, this rarely occurred in practise mainly because time constraints resulted in these additions placing impractical demands on teachers and pupils for the completion of work during a year. The result was that the syllabus that reached teachers was almost the same for all races, with state ideology built in through the core syllabus. The process of curriculum construction was thus a mystery to teachers who were merely expected to implement a series of aims, goals, methods, and procedures which were presented to them with no explanations as to their origins.

Teacher alienation is further highlighted when one examines the curriculum implementation process and the construction of curriculum materials. School inspectors and subject advisers, who were responsible for the interpretation of the syllabus, secured its correct implementation by providing teachers with workplans which frequently detailed what the teacher had to do during each Mathematics lesson. Inspection of the teacher's classroom activities by these same administrators, together with subject workshops ensured that the desired results were achieved (Julie, 1992).

The above description on the production of the South African Mathematics curriculum highlights the important role that the conception and interpretation of the curriculum play. The alienation of teachers from the curriculum process reduces them to mere technicians who implement other people's ideas. Conception and interpretation of the Mathematics curriculum has therefore played an important role in the dominant ideology which guided education in South Africa and which has been instrumental in creating the void between designers and implementers (Julie, 1992).

CHAPTER THREE

THEORETICAL FRAMEWORK AND RESEARCH DESIGN

3.1 Introduction

In this chapter, the insights gained from a previous research study and which are related to the current investigation are examined. An important micro-issue, that is, the link between pupils' attitudes and achievement in Mathematics is presented, thus lending weight to the argument for a study on pupils' perceptions(1). This is again emphasised when the importance of a study on pupils' perceptions is discussed. Making use of the preceding issues, an integrated, eclectic theoretical framework is presented. This discussion leads to an argument for the use of a qualitative and interpretative research paradigm which advocate the adoption of the case study method of investigation.

3.2 Insights from a previous research study

During 1992 an investigation, which was part of the Bachelor of Education Degree at the University of Natal (Pietermaritzburg), was completed (Appanna, 1992). The insights derived from the study proved to be very relevant to and in many ways motivated the current study. However, it should be noted at the outset that the limited nature of the

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1. Attitudes are not the same as perceptions. According to the World Book Dictionary an attitude is "a way of thinking, acting or feeling; feeling, manner, or behaviour of a person toward a situation or cause ..." (Barnhart and Barnhart, 1990 : p.132). However, Woods refers to perspectives as "... frameworks through which people make sense of the world. It is through these that pupils and teachers construct their realities and define situations" (1983 :p.7).

study was mainly due to time constraints. In addition, the primary objective of the task was to gain experience in conducting research.

The research site, Northdale Secondary School(2) was a public school situated in a predominantly Indian suburb of Pietermaritzburg. In 1992 the enrollment was 908, 120 of whom were Black pupils. There were 47 teachers on the staff (23 female and 24 male). In the Junior Secondary Phase (JSP) the Standard 6 and 7 pupils studied the following subjects : English, Afrikaans, Mathematics, General Science, Accounting, Geography, History and an option of any two from : Technical drawing / Housecraft / Health education / Typing / Business Economics for their examinations. In Standard 8, which was part of the Senior Secondary Phase (SSP), it was compulsory for pupils to study English and Afrikaans as well as four other subjects from the specified subject sets(3) for examination purposes. Pupils continued studying their chosen subjects in Standards 9 and 10, at the end of which they wrote the SCE.

The procedures followed in collecting information involved the preparation and administration of a questionnaire to 96 Standard 9 pupils at Northdale Secondary School. In addition, nine Standard 8 pupils, eight matriculants, the Mathematics and English Heads of Department as well as the

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2. The school's name is fictitious.
3. Refer to Appendix A for a complete list of the various subject sets studied by pupils in the SSP at Northdale Secondary during 1992.

Guidance Counsellor wrote essays on the topic "My views on Mathematics". The questionnaires and essays were analysed individually. Recurring themes were identified and tabulated. The reasons listed below emerged as the most important given by pupils for choosing Mathematics for their SCE. They once again highlight the importance of pupils' perceptions and the need for these to be considered in education policy innovations.

1. Pupils felt that the subject was an important pre-requisite for entry into the labour market. By studying Mathematics, the number of careers that could be pursued was extended. Students also stated that it was essential to study Mathematics if good jobs and high salaries were to be secured. In this regard Mathematics was also considered important for entry into university / college. Another important aspect of the subject, was that it helped a person to cope with the rigours of the technologically - oriented society in which we live.
2. Many pupils also stated that their choice of Mathematics was influenced by family / friends. Parents felt that in order for their children to succeed in life, it was imperative that they study Mathematics.
3. Another factor to influence pupils' choice of Mathematics was that the range of subject sets offered in the SSP was limited. Students stated that the majority of the sets contained Mathematics. Therefore they had no choice but to study Mathematics since the subjects that they wished to study were invariably in a course that contained

Mathematics (refer to Appendix A).

4. An important point to note is the fact that all the Non - Mathematics pupils indicated that their decision not to study Mathematics had been influenced by the difficult nature of the subject material or the Mathematics teacher. This is an important issue, for as Tobias observes :

> Maths anxiety usually begins with failure. Whether this happens while learning word problems, coping with equations, or first confronting calculus, the failure is sudden and frightening. And instead of asking questions or assuming that in a while he will be able to understand the problem, the student decides he can never go further in mathematics (1992 : p.78).

Though the scope of the study was limited, the influence of curriculum structure and content, family and peer pressure, the media, labour market, modern technology, teachers, as well as aspirations for the future, were revealed. These factors emphasise that educators must not treat pupils as mere "empty vessels" or "clean slates" ready to learn whatever is being taught. The construction of pupils' realities should be taken into consideration. It is therefore important to be aware of the factors that influence pupils' perceptions. The relationship between pupils' attitudes and achievement in Mathematics is evidence of this fact.

3.3 The relationship between attitudes and attainment in Mathematics

Among the multitude of research studies and articles relating to the non - intellectual factors influencing learning and achievement, the relevance of attitudes for education features prominently. For as Moodley points out :

> If education is intended to produce behaviour changes in children (Furst, 1958) and behaviour is seen in terms of the three interacting domains including the 'affective domain' (Bloom et al, 1956; Krathwol et al, 1964), then attitudes which are embedded in the affective domain must clearly be relevant to education (1981 : p.65).

Lewis endorses this by stating that :

> ... just as distinctive kinds of abilities exist, and need to be taken into account in the practice of education, so also do several kinds of attitudes ... Thus we may need to take account of pupils' attitudes towards different school subjects (1974 : p.155).

Despite the varying definitions and uses of the term "attitude", Shaw and Wright consider that one characteristic is generally agreed upon :

> Attitude entails an existing predisposition to respond to social objects which in interaction with situational and other dispositional variables, guides and directs the overt behaviour of the individual (1967 : p.2).

It has been argued that since school is a "social object" and mathematical activity an integral part of it, Mathematics may also be regarded as a social object (Moodley, 1981). This view of Mathematics as a social object is in agreement with the distinction made between social and non - social objects by Shaw and Wright who consider social objects to "include interactions with persons and person - produced objects, events and situations" (1967 : p.2).

It is therefore not surprising that there is widespread belief amongst educators in the importance of the development of positive attitudes in the teaching and learning of Mathematics. This is reflected in the following extract from

A National Statement on Mathematics for Australian Schools :

> An important aim of mathematics education is to develop in students positive attitudes towards mathematics and their involvement in it ... The notion of having a positive attitude towards mathematics encompasses both liking mathematics and feeling good about one's own capacity to deal with situations in which mathematics is involved (Australian Education Council and Curriculum Corporation , 1991 : p.31).

Pupils' "attitudes toward Mathematics" has been the subject of a considerable amount of research (see for example Aiken and Dreger, 1961; Anttonen, 1969; Aiken, 1970; Nevin, 1973; Marjoribanks, 1976; Muckerjee, 1978; Solvich et al, 1981; Hernandez et al, 1994).

Many of these investigations had their origin in the debate on whether modern curricula have produced a more favourable attitude towards Mathematics. In order to address and amend negative attitudes, it has been argued that information relating to the following three factors was needed :

1. biological inheritance and home background of the pupil
2. attitudes and training of teachers
3. content, organisation, grades and adaptability of the curriculum (Aiken, 1970 : p.551).

These factors, Moodley believes, resulted in categorisation of the research on attitudes towards Mathematics into the following broad areas :

1. Methods of measuring attitudes towards mathematics
2. Relationship of attitudes to achievement in mathematics
3. Relationship between attitudes towards mathematics and personality and social factors including sex differences
4. Stability of attitudes towards mathematics
5. Teacher characteristics and attitudes
6. Instructional method and curriculum (1981 : p.68).

It should be noted that in recent years researchers have acknowledged that attitudes appears to be multidimensional construct requiring a uni - dimensional measure (Leder, 1987). However, there is some dispute as to which components of attitude, such as anxiety, enjoyment, self - concept and belief in the usefulness or value of Mathematics, provide the best measure of attitude (Relich and Way, 1994).

At the Primary school level, studies have shown that the correlations between attitude and achievement are typically not great (Aiken, 1970; Anttonen, 1969). According to Aiken (1970) the attitude scales used, which require the reading and interpretation of problems, pose a problem for research at this level. At the high school level, Anttonen (1969) reported moderate correlations between attitude scores and Mathematics grade-point averages and standardised test scores. However Aiken and Dreger (1961) discovered substantial relationships between attitudes and achievement in Mathematics. Moodley notes that :

> In general, these studies highlight the importance of attitudes toward mathematics and report low to moderate correlations between attitude and achievement. However, these relationships make no pronouncements on the question of causality (1981 : p.71).

The study of pupils' attitudes toward Mathematics, though important, is in itself not sufficient to understand the relationship that exists between pupils and the subject. As the last sentence of the above quotation notes, too often the factors that influence pupils' construction of reality are overlooked. A study based on pupils' perceptions, which takes

into account these factors, is therefore considered to be important.

3.4 The importance of a study on pupils' perceptions

Most educational research has pupils' capacity to learn as the primary object of study. It is therefore surprising to note that pupils' insights are often a neglected domain of study (Meighan, 1981). Reid (1978) notes that the importance of pupils' perceptions does not correspond with the amount of work done on them. Therefore, despite the importance of pupils' views, "both teachers and researchers seem extremely ignorant of what school life means to pupils" (Furlong, 1976 : p.42). This is rather unfortunate "as there are compelling reasons why teachers and researchers would benefit by greater sensitivity to pupils' views" (Harley, 1988 : p.28). These statements once again highlight the value of the current study which focuses on pupils and their perceptions.

3.5 Theoretical framework

With reference to the above and the micro issues discussed in the previous chapter, it was decided that an integrated, eclectic theoretical framework should be adopted. Such a framework incorporated the principles of symbolic interactionism and certain aspects of Marxism that would suit the current investigation which was based on a qualitative research paradigm. Furthermore, it provides the qualitative researcher the opportunity of examining and establishing links between macro sociological and historical processes on the one hand, and the individual on the other. For the

purposes of this study this is important since it makes it possible not only to examine pupils' perceptions but also the context in which they interact - its structure and dynamics, the opportunities it makes available as well as the constraints that it imposes (Naicker, 1988).

The importance of a study on pupils' perceptions is emphasised when the symbolic interactionist approach to the concept is considered. Symbolic interactionism, which deals with the integration of the self and social interaction is the primary mechanism "by which people are able to form social or joint acts" (Blumer, 1981 : p.153). According to Hewitt (1984) interactionists believe that people are naturally active, endeavouring constantly to adjust themselves to situations or to change circumstances in order to fulfil goals. The situations that people find themselves in are made up of acts and objects. When a situation is defined, people make use of their prior knowledge of the situation to understand and predict the acts of each other. Though symbolic interactionists emphasise the conscious aspects of human behaviour, Hewitt notes that the affective side of human life is also considered since "people do not simply act on the basis of cognition. They get angry, feel joy, express pain, act out of jealously, and display a rather broad range of affective responses" (1984 : p.86). Woods therefore appropriately observes that :

> At the heart of symbolic interactionism is the notion of people as constructors of their own actions and meanings. People live in a physical world, but objects in that world have a "meaning" for them. They are not always the same objects for different people, nor are situations interpreted in the same way (1983 : p.1).

The frameworks through which people make sense of the world are referred to as perceptions. Perceptions therefore provide people the means to construct their realities and interpret situations. Barton and Walker (1981) refer to "perspective" as "a frame of reference or a series of rules by which an individual is able to make sense of complex and puzzling phenomena. Similarly, for Becker the term refers to "a coordinated set of ideas and actions a person uses in dealing with some problematic situation, to refer to person's ordinary way of thinking and feeling about and acting in such a situation" (1961 : p.34). Furthermore, Woods notes that :

> People do not see one objective reality with a universal mental template. Rather, their view of reality is through a screen, or an interpretational code which they employ to understand the world. These perspectives assist in defining the situation, and identifying and locating the "other" (1983 : p.7).

One may therefore deduce from the above that perceptions are inextricably linked to contexts and cultures. People do not exist in a vacuum. Neither are acts performed in an abstract, obscure or mechanical way. Rather, conduct together with expectations and interpretations are based on the understanding of the context of which individuals are an integral part. Hewitt (1984) believes that this is an important element of symbolic interactionism which proposes

that people act in accordance with their definitions on situations. When a situation is familiar and expectations known, individuals organise their own behaviour and their anticipation of others accordingly. Contexts are therefore not merely scenes of action. They have an effect on action that is both determining and enabling since people have to interpret and define the situation. Individuals may observe different elements of a situation or even interpret similar elements differently. Situations are therefore ultimately what people make of them (Woods, 1983).

It is important to note further that perceptions derive from cultures. Through the process of socialisation people are initiated into certain cultures on the basis of social class, occupation, religion or ethnicity. According to Woods, cultures :

> ... develop when people come together for specific purposes, intentionally or unintentionally, willingly or unwillingly. People develop between them distinctive forms of life - ways of doing things and not doing things, forms of talk and speech patterns, subjects of conversation, rules and codes of conduct and behaviour, values and beliefs, arguments and understandings. These will not be formally regulated but heavily implicit (1983 : p.8).

Culture therefore becomes a part of an individual's existence and certain patterns of behaviour are assumed as being part of the natural way of life.

Student culture has been the subject of some educational research. Becker (1961) concluded that student culture was homogeneous in nature, thus implying that pupil perceptions were largely constant. However investigations conducted by

Hargreaves (1975), Furlong (1976), Lacey (1977) and Willis (1977) demonstrated within a dominant school culture the existence of subcultures which are actively created by pupils and teachers.

The above discussion on some pertinent aspects of symbolic interactionism highlights the importance of a study of pupils' perceptions and the influence of contexts and cultures on such perceptions. However, notwithstanding its strengths, symbolic interactionism does have certain weaknesses. Despite taking into consideration the context that individuals find themselves in, symbolic interactionism tends to neglect the effect of the dominant structures in society (Sharp and Green, 1975). Sociologists such as Karabel and Halsey (1976), Young and Whitty (1976) have offered criticisms on the basis that the interactionist perspective does not take into account the constraints on an individual's action that arise from the wider social structures. It is doubtful therefore, whether symbolic interactionism alone would provide the adequate theoretical underpinning for an understanding of pupils' perceptions of Mathematics. It would be more meaningful if pupils' perceptions as well as the interrelationship between these perceptions and the dominant structural features of the society in which they are located were examined. This would provide a more complete base from which the discrepancies in mathematical education can be examined.

A more complete theoretical basis is possible if the

interactionist perspective is used in association with the cultural perspective of Marxism. Naicker states that :

> Although the Marxist perspective emphasises the structural constraints of the larger system of social relationships in which the individual is embedded, this does not mean that the actions of the individual are wholly determined by these objective relationships (1988 : p.29).

Significant for the current investigation is that the Marxist perspective affords the opportunity to examine the structural and material conditions that may influence pupils' perceptions of Mathematics. The cultural studies of Willis (1977) which use a Marxist approach in focusing on the cultural production of meaning have also examined the situations individuals find themselves in, the opportunities and situations available to them, and the constraints which are imposed on individuals.

The proposed theoretical framework used here therefore provides the researcher the opportunity to explore pupils' perceptions as well as to examine the interrelationship between social structures and the individual. As previously stated, not only are investigations on pupils' perceptions lacking in educational research, they are also necessary since they provide educationists with opportunities for understanding pupils' construction of reality. Such insights are essential if credible educational strategies are to be implemented in the future.

3.6 The research design

3.6.1 The use of the qualitative and interpretative research paradigm

The integrated theoretical framework used in this research, necessitated a research paradigm that offered an interpretative understanding of pupils' perceptions. The type of interpretation that was required by this investigation was catered for by the qualitative research paradigm, since it allowed for both the individual and structural factors to be considered.

Strategies such as observation and interviews make it possible for first-hand data to be derived from the research site. It is therefore viable when using qualitative methods to get close to the information, thus permitting it to generate explanations, instead of the researcher imposing his own definitions on the knowledge gained (Lofland, 1971).

Furthermore, the qualitative research paradigm

> ...allows the researcher to gain access to the life-worlds of other individuals, to discover their daily activities, their motives and meanings, their actions and reactions, it is preferred to the quantitative research style whose main concern is to establish particular ways of discovering and verifying things usually identified as positivist science (Naicker, 1988 : p.22).

For positivists there are :

> ...two and only two kinds of meaningful statements. There are, firstly, empirical statements, verifiable through observation. These are the main repository of human knowledge. Secondly, there is a kind of statement sometimes called 'analytic', where truth or falsity can be ascertained by merely reflecting on the meaning of the relevant words (Hanfling, 1981 : p.9).

This statement emphasises the precision of the theory in which subjective statements play no part and are in fact considered meaningless.

It should be noted, however, that human beings, unlike any other species on this planet, are capable of self - reflective thought. This makes human action and behaviour unique and distinctive from other actions in the world around us. When studying object behaviour, for example, it may be sufficient merely to note external behaviour. Where human action is concerned, however, not only is the observation of the physical characteristics of action essential. It is also vital to understand the meanings attached by individuals to their behaviour since each and every person is unique. Though the observed action may be the same, different people may attach varying meanings to their behaviour which is significant only to them. This point is appropriately demonstrated by Kemmis and Carr when they quote A.J. Ayer who describes how the raising and drinking of a glass of wine could be interpreted differently as "an act of self-indulgence, an expression of politeness, a manifestation of loyalty, a gesture of despair, an attempt at suicide or religious communication ..." (1986 : p.88). An interpretation of human action therefore must encompass observed behaviour

as well as the interpretation and meaning that the observer attaches to it.

This is one of the central tenets according to which an interpretative social science operates and which distinguishes it from positivism. An interpretative social science is therefore concerned with subjective knowledge. Through observation it endeavours to reveal patterns of behaviour of certain individuals in particular situations. It therefore presents to individuals alternative ways of interpreting their behaviour and reality. Kemmis and Carr therefore note that :

> It is by so providing individuals with the opportunity to reconsider the beliefs and attitudes inherent in their existing ways of thinking, that interpretative social theory can affect practice (1986 : p.91).

In addition to the above, two other reasons may be advanced for the adoption of a qualitative and interpretative research paradigm. Firstly, by adopting such a method the current study joins a growing list of educational research which has used a similar approach as a basis of investigation. Studies such as those conducted by Keddie (1971) on classroom knowledge; Sharp and Green (1975) on progressive education in Primary schools; Willis (1977) and Naicker (1988) on the transition from school to work; and Spiegel (1986) on rural life, have demonstrated the usefulness of working within a qualitative and interpretative research paradigm.

Secondly, the qualitative and interpretative approach allows flexibility in the investigation process. Since pupils'

perceptions of Mathematics were being examined, it was possible that the research method would have to be altered in the course of the investigation as new information on the subject emerged. Thus the research paradigm used here has a significant advantage over the positivist methodological approach to measuring and quantifying observations that is the usual insistence of the quantitative, positivist paradigm.

3.6.2 The case study approach

The theoretical framework and research paradigm used in this research necessitated a comprehensive examination of pupils' perceptions of Mathematics. Practical constraints such as the limited time available and the requirements of a course - work degree, together with the exploratory nature of the present investigation, required that the field of research be restricted. By taking these two factors into consideration, it was decided that case study approach would be used in the two schools to generate data that would enable comparisons to be made.

Millar offers an insightful definition of an educational case study by stating that :

> The case study is one form of social enquiry. It is an attempt to understand social processes and meanings implicit in some undertaking in a restricted context. Such undertakings and contexts are not created for the purpose of enquiry (though they may be modified by it); they are real ones. An educational case study is one that focuses on educational institutions or on educational processes within other institutions. It is often part of an evaluative study (1983 : p.115).

This definition reveals that case studies fulfil the

requirements advocated by the interpretative social sciences since implicit meanings and unaltered contexts are its major concerns. Such a method of data gathering is therefore well suited for a study of perceptions. This is highlighted further when one considers the following characteristics of a case study as presented by Millar :

1. A concern with "real" events in "real" contexts in "real" time

2. A concern with the meaning of events for the actors in the situation, as opposed to a concern to measure "behaviour" or attitudes

3. A concern with the social processes and wider social functions that provide the context for such personal meanings

4. A concern with the intelligent grasp of engagements in specific contexts rather than with the generation of findings or rules that can be widely generalised. In other words, a case study might produce something of the wisdom derived from good history but not the general rules hoped for by natural scientists

5. Toleration of the capacity to make use of the widest range of techniques for gaining information, including quantitative methods where possible and appropriate

6. Participation to some degree and in some way by the researcher in the social processes he wishes to understand. Case studies can but do not need to be forms of action or participatory research (Millar, 1983 : pp.117-118)

The above characteristics, especially 2 and 3 which emphasise subjectivity and context, reveal that if used properly, the case study offers the researcher certain advantages that may prove to be invaluable. Blum and Foos (1986) present some advantages of the case study. Firstly, it is ideal to use when little is known about the phenomenon being studied, thus catering for an investigation that is exploratory in nature.

Secondly, in a case study often only individuals or groups are studied. This allows for more detailed information to be derived from the data collected. This is in contrast with surveys in which the sample may be too large, thus making it impractical for the researcher to obtain detailed information. Thirdly, case studies allow for flexibility when constructing and implementing data gathering instruments and in analysing the information that is gathered.

Notwithstanding these advantages, Millar (1983) as well as Blum and Foos (1986) take note of certain drawbacks of the case study. They are often criticised because of the highly subjective nature of the study. It is often argued that such an investigation method lacks objectivity. Reliability, is also a problem since the source of information is limited. This means that often the findings of a case study cannot be generalised to the entire population.

Despite the disadvantages, the characteristics of the case study reveal that it is a method well suited for an investigation into pupils' perceptions. The following characteristics of the present study reveal the reasons for such compatibility :

1. This investigation is concerned with the "real" crisis in Mathematics education in which relatively few pupils in the schools studied are currently studying the subject;
2. By examining pupils' perceptions, this study is concerned with the meanings attached by pupils to their actions;
3. Since the context in which such action occurs is also

examined, the influence of social structures is also considered;

4. Taking into account the exploratory nature of the study, it does not attempt to provide rules for remediation, rather an awareness of the problem and of the contributory factors is an objective;
5. For purposes of triangulation and data validation different data gathering instruments are used for gathering information;
6. Participation in the social processes of the investigation is assured since the researcher had been a secondary school mathematics teacher for ten years at the time of the study.

Taking into account the above, and the proposed theoretical framework which advocates a study of perceptions in a small scale micro setting in order to gain insights into the symbolic meanings that pupils attach to their action, the case study method of investigation proved most suitable. It was perceived that greater insights into the self and process would be derived from the gathered data by using this method.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

This chapter begins by examining the research problem and the focus of this investigation. The questions and issues that guided this study are listed. Thereafter, the sample and research instruments are discussed. Finally the research procedures and the limitations of the investigation are presented.

4.2 The research problem

The issue that was investigated in this study was the perceptions of pupils' on the study of Mathematics as a subject for the Senior Certificate Examination. The purpose of the study was to examine the factors that influence pupils' perceptions as well as their choice of Mathematics as an examination subject. This study therefore concerned itself with the status of Mathematics as a school subject. Consequently, it was situated within the wider context of the role of schools as institutions which contribute significantly to fulfilling the needs of the dominant groups in society.

In using case studies for the investigation a micro sociological perspective was adopted as a means of examining the interpretations of groups of pupils and of analysing these interpretations in relation to social factors.

4.3 Focus of this study

Investigations into mathematical capabilities, have revealed

that many adults, though highly educated, are functionally innumerate (Cockcroft, 1982). Everyday activities involving the use of Mathematics (for example, adding up money) prove to be a problem. This phenomenon exists amongst people from all walks of life and is not peculiar to any one particular culture or race. If this was the state of affairs in a first world country such as Britain about twelve years ago, it was not surprising that in a developing country such as South Africa, the same problem existed on a massive scale in 1993. (Marsh, 1993).

At the time of writing Mathematics education in South Africa is in a crisis situation. Spira notes the appalling fact that "of every ten thousand Black children who enter the school system only one emerges eventually with a matriculation exemption in mathematics and [physical] science" (in Marsh, 1993 : p.292). In addition, van Heerden (1991) points out the sad reality that 40% of Black adults are illiterate in their first language, whilst 70% are illiterate in the dominant official language (English or Afrikaans at the time of writing) of the region in which they reside. Marsh correctly suggested that it was "reasonable to assume that people who cannot read and write language are also unable to read and write numerical processes, and can thus be classified as innumerate or mathematically illiterate" (1993 : p.293).

The information contained in Table 1.2 reveals that the number of Black students studying Mathematics at Senior Secondary was drastically low in 1993. Consequently, the

number of Black students studying and succeeding in the mathematical sciences at university level was minuscule (Marsh, 1993). Given the scientific and technological needs of a developing country such as South Africa the deterioration or continuation of the existing conditions would have dire consequences for the future. Marsh therefore suggested that :

> Political, economic, social and educational strategies will have to be developed and implemented as a matter of extreme urgency on a massive scale, in order to bring about the necessary redress and restitution (1993 : p.302).

Faced with this crisis, it was decided that this study should focus on the situational and dispositional factors that guide and direct pupils' reaction to Mathematics. For this reason it was considered that a study of pupils' perceptions would be most appropriate. Confronted with the limited information in this area of research, it was recognised that the study would be exploratory in nature. Based on this the research was structured in terms of questions rather than hypotheses. The following questions formed the basis of the research :

1. What are pupils' perceptions of studying Mathematics as a Senior Certificate Examination subject ?
2. What are the factors that contribute to the formulation of these perceptions ?

Modelled on these questions, the present study sought to investigate pupils' perceptions of Mathematics in terms of the following six aspects :

1. The biographical details of pupils;

2. Pupils' aspirations for the future;
3. Pupils' motivation for selecting / not selecting Mathematics as an examination subject;
4. Pupils' preference of Mathematics over other subjects;
5. Pupils' general perceptions of the importance of Mathematics;
6. The importance of Mathematics in relation to other examination subjects.

These six aspects together with the research questions attempt to achieve a balance between the micro and macro levels of interpretive research.

4.4 The sample

Although a survey of pupils' perceptions in all the education departments was considered, it was decided that only the perceptions of Black and Indian pupils would be investigated. The reasons for this being :

1. The various educational departments would cease to exist in the near future. Since the problem was primarily concerned with Black pupils, an understanding of their perceptions of the study of Mathematics is important for the implementation of future education reforms. In a survey of all pupils the context that Black pupils find themselves might not be examined in the detail that it should be;
2. The diversity of the pupil population. In a comprehensive survey one would have to take into consideration pupils from both English and Afrikaans medium schools; urban and

rural areas; single sex and co - educational schools as well as private and state schools. Given the limited time available for the completion of this research, such a task would be impractical;

3. Indian and Black pupils were considered since they represented the two extremes as regards the percentage of pupils studying Mathematics at matriculation level (refer to Table 1.2).

Only Standard 9 pupils were used in the investigation for the following reasons :

1. They were considered to be mature enough and sufficiently literate to write letters, respond to questionnaires and participate in interviews;
2. Matriculants had already lost a considerable amount of lesson time due to the April elections, and any further disruptions to their study program in the form of this investigation would not have been viewed favourably by pupils, teachers and parents;
3. Standard 9 pupils have already had considerable experience with Mathematics which was offered to them as a choice in Standard 8.

Furthermore, it was decided that in order to gain realistic insights into pupils' perceptions of Mathematics, at least half the sample should consist of pupils who had not chosen the subject for the SCE.

During the course of the investigation, it was suggested by the senior Mathematics teachers of both schools that in order

to minimise disruptions to lessons, entire classes of Mathematics and non - Mathematics should be used in the investigation. Although this was not ideal since it was envisaged that appropriate sampling techniques would be used to select pupils, this suggestion was accepted. The result was that on the days that were agreed upon, the classes that were available were used for data gathering purposes. The participants in this study totaled 182. The details of the sample are provided in the following table :

Table 4.1 : Details of the sample with regard to choice of Mathematics by racial group.

	Black	Indian
Mathmatics pupils	51	46
Non - Mathematics pupils	46	39
Total	97	85

4.5 Research instruments used

In order to cater for the triangulation of data it was decided that the research instruments would consist of a questionnaire, interviews and written essays. Prior to the formulation of the questions on which these instruments were based, ten pupils from each school were asked to compile a list of questions which they felt would be appropriate in eliciting information on the research topic. These pupils were chosen by their Mathematics teachers. Their responses proved to be useful and some were incorporated into the research instruments.

4.5.1 The questionnaire

For the purposes of this investigation , open - ended questionnaires were considered to be most appropriate since they were not limited to the ticking of fixed - choice questions. They were therefore more flexible and provided the opportunity for a more thorough analysis of pupils' responses. Using the questions compiled by pupils and the suggestions of Cohen and Manion (1989) related to the construction of questionnaires, a questionnaire consisting of three interrelated parts was constructed.

The first part dealt with the biographical details and the future aspirations of pupils. Part two was related to Mathematics as an examination subject, and pupils' preference for Mathematics. The final part of the questionnaire was concerned with deriving information on pupils' perceptions of the importance of Mathematics.

A pilot test was conducted in which the draft questionnaire was administered to a group of ten Standard 9 pupils from the school at which the researcher was a teacher. This group was made up of Black and Indian pupils and comprised of Mathematics as well as non - Mathematics pupils. Errors in questions, ambiguity and the time taken for completion were noted. After the appropriate alterations were made the final questionnaire was administered to all the pupils who participated in this study. A copy of the final questionnaire is provided in Appendix B.

4.5.2 The interview

The preliminary reading of the questionnaires revealed that additional information regarding pupils' future aspirations, their reasons for choosing / not choosing Mathematics as an examination subject, pupils' preference for Mathematics and their perceptions of the subject would be useful. It was therefore decided that ten taped interviews with pupils would be conducted. Five randomly chosen pupils from the sample, of which there were two non - Mathematics pupils, were interviewed from each school. When conducting these interviews the suggestions of Miller and Cannell (1988 : pp.457-464) were adhered to.

4.5.3 The essay

In order to supplement the above information and for purposes of triangulation it was decided that ten pupils from each school would write essays on the topic "My views of Mathematics". Of these pupils who were randomly selected from the sample, there were five non - Mathematics pupils from each school.

4.6 Investigation procedures

The selection of the two schools was motivated by two factors. Firstly, in terms of number and racial composition of pupils and staff; the quantity and quality of resources available; and the medium of instruction, they were similar of other schools in their respective departments. Secondly, both schools were closely situated which made frequent visits possible. Furthermore, it was decided that the school

at which the researcher was a teacher would not be used as a research site since biased information could have compromised the study.

Once the research sites had been chosen, the investigation was discussed with the respective principals and their permission to conduct the study was acquired. The relevant education departments(1) were then notified in writing of the intention to conduct research in one of their schools. Whilst waiting for departmental permission, the researcher proceeded with collecting data that were necessary to describe the two research sites. After a protracted delay the researcher was notified that the research proposal complied with departmental regulations and that the investigation could proceed (see Appendix C for copies of the letters pertaining to departmental permission).

Visits to the two schools then resulted in the appropriate arrangements being made to administer the questionnaire. Factors such as double lessons, teacher absence, pupil attendance, number of pupils, courses that pupils were studying, co - operation of teachers whose classrooms and pupils were going to be used and the weather(2) had to be taken into consideration. Once these were satisfactorily met the researcher spent two days at each school administering the questionnaire. In each school the Mathematics pupils were

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1. The various education departments were in existence when this investigation commenced.
2. On rainy days attendance was poor. This prevented the adminstering of questionnaires.

the first to complete the questionnaire.

Pupils were notified a day in advance that they would be participating in a research project. They were reminded to carry their pens or pencils and to be early for their lessons. At both schools the pupils answered the questionnaire during a double lesson. No time constraints were placed on them since this time proved to be sufficient to complete the questionnaires. Before pupils commenced answering the questionnaire they were assured that their responses would be treated in the strictest of confidence. In addition, the questions were read out to them and any difficulties were clarified. The researcher remained with pupils for the entire duration of the double lesson after which the questionnaires were collected and numbered.

As was previously mentioned, the preliminary reading of the questionnaires formed the basis of the interviews. These were conducted on separate days from those on which the questionnaires were administered. The interviews which were tape recorded, took place in specially allocated rooms at both schools. These interviews did not last for more than ten minutes per pupil. During the interviews pupils were given the opportunity to provide detailed explanations for their responses. They were also encouraged at the end of the interview to provide any additional information on their learning experiences or even to question the researcher on related issues.

After the interviews were completed pupils were chosen to

write the essays. They were provided with approximately a week to complete this task. Class monitors were given the responsibility of reminding the pupils concerned of the deadline for the completion of the task(3).

Once all the information had been gathered they were appropriately labelled and then ready for analysis. This analysis resulted in the major findings and the conclusions of the investigation being then reached.

4.7. Limitations of the study

Interpretation of the research findings took into account the following limitations of the study. Firstly, a drawback of this investigation was that the language (English) through which the research was conducted was not the mother tongue of the pupils from City High. This could account for these pupils not answering or misinterpreting questions due to inadequate language comprehension. The fact that the researcher could not communicate in Zulu added to the dilemma. It should noted that the interviews, informal discussions and the writing of essays were attempts to alleviate the problem.

Secondly, it should be noted that although various sampling techniques were considered, these could not be used as

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3. Lesson time could not be used for the writing of essays as pupils had used a double lesson when responding to the questionnaires. Pupils were asked not to provide their names and were told that there was no restriction on the length of their responses. Pupils were also reminded that the researcher would be the only one to read their completed efforts.

circumstances at the schools dictated that only certain classes be used in order to minimise any disturbances to normal classroom activities. The pupils who therefore participated in the investigation did not represent selected samples of their respective school populations. The practice of using whole classes is nevertheless consistent with a case design. These limitations need to be borne in mind when the following interpretations of the research findings are considered.

With reference to these limitations it should be remembered that English was the medium of instruction at both schools and the volume of data collected made it possible for valid comparisons to be made.

CHAPTER FIVE

RESEARCH SETTING

5.1 Introduction

During the process of data accumulation, perceptible differences in the learning environments of City High(1) and Capital Secondary were noted. Some of the major factors contributing to these differences at the two schools were the areas in which the schools were situated, the physical structure and layout of the buildings, the teaching personnel, the pupil population and the curricula activities pupils engaged in.

As the investigation continued and more information became available it was obvious that a description of the research sites was necessary not only for the purpose of locating the sources of information but to highlight as well the importance of the learning environment and the extent to which this shaped pupils' perceptions. This chapter presents pertinent information regarding the two schools.

5.2 Capital Secondary

5.2.1 Area in which the school is situated

Capital Secondary is situated in Northdale, which is a predominantly Indian suburb of Pietermaritzburg. According to the Senior Deputy Principal of this school, the area in which Capital Secondary is situated may be classified as working a class neighbourhood with a few professionals (mainly

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(1) The names of schools that were used in this investigation have been changed.

teachers). The parents of Capital Secondary pupils work mainly in factories, offices and schools. This is also evident when one examines the biographical details of these pupils which are presented in Chapter 6.

The majority of the houses that surround this school were constructed by the Pietermaritzburg City Council as part of a sub - economic housing scheme. However, over the years some of these houses have been altered with additions being made to the existing dwellings. In addition, there are also homes that have been erected by their owners. The Protea Sports Complex is situated approximately two kilometres from Capital Secondary. This well - maintained facility offers the residents of Northdale the opportunity to participate in numerous well - organised codes of sport. After school many pupils converge upon his venue to use the various facilities that are provided.

5.2.2 Physical structure of the school

Capital Secondary, which was built in 1981, has three double - storey buildings and a single - storied administration block and Library Resource Centre. The workshops for Technical Drawing, Metalwork and Woodwork are situated at the far end of the school. During 1990, four new classrooms, a new staffroom and a stockroom were added. Altogether there were 30 classrooms and 20 specialist teaching rooms at the school at the time of the research. It was noticeable that many of these rooms were adorned with informative charts and educational literature related to

specific subjects. Provision was also made for a well - stocked tuckshop which was managed by teachers during the tea and lunch intervals.

The extracurricular facilities at the school consisted of a Regional Hall, swimming pool, cricket practice nets and a sports field. The sports field also had volleyball and netball courts marked on it. The school had a maintenance staff of six members to take care of the buildings, gardens and grounds. The properly maintained buildings, neat gardens and litter - free grounds all contributed to an atmosphere that was conducive to learning.

5.2.3 Teaching staff

The staff of Capital Secondary consisted of 58 teachers of whom 35 were male and 23 female. These teachers were further divided into 11 Management personnel, with the remaining 47 being classified as Level 1 educators. The clerical staff comprised three members, that is, one male and two females.

The entire staff of Capital Secondary was of qualified teachers. There were 27 teachers who had a university degree, whilst 15 were in possession of a post - graduate degree. This became evident when the categorisation of teachers according to teaching qualifications was studied. Table 5.1 has this information :

Table 5.1 : Distribution of teachers at Capital Secondary by category qualification.

Category(2)	C	D	E	F	Tot
Number	10	26	12	10	58

5.2.4 Student body

During 1994, there were 1161 pupils at Capital Secondary. The gender distribution of pupils in the two phases of education, that is the JSP and SSP is depicted in the following table :

Table 5.2 : Distribution of pupils at Capital Secondary by gender and phase of education.

	Boys	Girls	Total
JSP	258	254	512
SSP	296	353	649
Total	554	607	1161

Following the trend of other Indian Secondary schools in Pietermaritzburg, Capital Secondary had attempted to become "integrated" in that there were 80 Black pupils and six Coloured pupils who were part of the pupil population during 1994. The majority of the pupils who attend Capital Secondary School completed their Primary education at five nearby feeder Primary Schools.

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2. The lowest category in Table 5.1 is C. A teacher must have at least a recognised three year teaching diploma to qualify for this category. The requirements of the other categories involve a combination of teaching diplomas, degrees and post graduate degrees.

Capital Secondary had a prefect body made up of Standard 9 pupils who were chosen by the staff. In addition, every class was allowed to elect two representatives who formed part of the SRC. These elected members then elected their own representatives to the Executive Committee of the SRC.

5.2.5 Curricula activities at Capital Secondary

Normally the school day at Capital Secondary consists of nine lessons, each of 35 minutes duration. The first four periods of the day are followed by a 20 minute interval. After the next three lessons there is a half an hour break. The last two lessons are followed by a short Right Living period. This was the situation at the time of the research.

For the Standards 6 and 7 pupils in JSP, it was compulsory that they studied nine subjects for examination purposes. Of these, seven subjects were prescribed whilst two were optional. The prescribed subjects were : English, Afrikaans, Mathematics, General Science, History, Geography and Accounting. Pupils were then required to choose two subjects from : Industrial Arts, Home Economics, Typing and Technical Drawing. In addition to these nine subjects, non - examination subjects such as Computer Literacy, Music, Art, Physical Education, Library Resource Education, Guidance, Art and Music were offered.

In South Africa, it is necessary that at the beginning of Standard 8 pupils make a course selection consisting of six subjects. Once a choice has been made, pupils continue to

study the selected subjects in Standards 9 and 10. Two languages, namely, English and Afrikaans, are the only compulsory subjects. The remaining four subjects are chosen in accordance with the list of subject sets available at the school. The variety of choices that are available to Capital Secondary pupils is evident when one studies the subject sets that are offered. This information is presented in Part 1 of Appendix D. It should be noted however, that Departmental regulations stipulate that the subject sets can be offered provided that economic units are available. Furthermore, the availability of qualified teachers in a specific subject (for example Music) may also restrict pupils' choices.

During 1994 23 different courses were being studied by pupils in the SSP at Capital Secondary. This information is presented in Part 2 of Appendix D. The non - examination subjects that SSP pupils studied included Physical Education, Library Education and Guidance.

In addition to their academic studies, pupils at Capital Secondary were also encouraged to participate in as many extra - curricular activities as possible. Pupils participated in sports such as soccer, tennis, table tennis, cricket, volleyball, badminton, squash, swimming, athletics, netball, softball and chess. In addition, debates, speech contests, subject talks and quizzes, subject clubs and excursions were coordinated by teachers for selected and interested pupils. Most of the above activities were organised on both an inter - class and inter - schools basis.

5.2.6 Additional information on Capital Secondary

Although only thirteen years old, Capital Secondary is considered by pupils, parents and teachers to be one of the top three "Indian" Secondary schools in Pietermaritzburg. In recent years the status of the school has been enhanced by pupils who have featured amongst the top Indian matriculants in the country. In 1993, for example, three pupils from Capital Secondary achieved positions amongst the top 30 matriculants from the former House of Delegates. This was highlighted in the pass rates per Standard for 1993, which are depicted in the following table :

Table 5.4 : Percentage pass rates for 1993 by the pupils in the various standards at Capital Secondary.

Standards	6	7	8	9	10
Percentages	93	97	89	91	94

The high academic status of Capital Secondary is complemented by its achievements in the field of sports. The Senior Deputy Principal of Capital Secondary noted that during 1994 there were not many discipline problems. The Deputy Principal who is also the school's guidance counsellor provides counselling to those pupils in need of it.

The Management staff noted further that the achievements of pupils at Capital Secondary were also due to a large extent to the competence, dedication and motivation displayed by all teachers over the years. Parents also played an active role in the affairs of the school. This was mainly done via the

Parent / Teacher / Student Association (PTSA).

5.3 City High

5.3.1 Area in which the school is situated

City High is situated in a Black township approximately eight kilometres away from the city of Pietermaritzburg. In the early 1920s the influx of Black people into Pietermaritzburg necessitated the creation of a "native village" on the outskirts of the city. In 1927 the first 100 homes were built in this new village. The principal of City High described these houses as :

> ... matchbox double houses ranging from two to four rooms.

The early 1930s saw the construction of another hundred homes, a school, a market and a clinic. The Group Areas Act and the resistance of residents to relocation resulted in no further developments in the township until the 1980s (Learn with Echo, 1994 : p.1).

Although this "village" is more developed and has better services than most other areas in the Edendale Valley (Learn with Echo, 1994 : p.1), the facilities are very inferior when compared with White, Coloured and Indian residential areas. Regarding the recreation facilities available, the City High principal remarked that :

> ... the township has a swimming pool, dilapidated sports field and tennis courts.

At the time of the research there were approximately 20 000 people living in this township, many of whom worked in the

city or in the neighbouring factories. Some of the younger residents are professionally trained. The principal of City High noted that

> ... most families are supported by unemployed fathers and/or mothers.

5.3.2 Physical structure of the school

According to school records, City High was established as a Primary School in 1948. Later in 1982 it achieved High School status. It is the only such school in the township. City High is made up of five blocks of buildings. One of these is a single storied administration building. The other buildings contain the school hall, classrooms, the Typing room and the Home Economics centre. One of the blocks is a three - storey building consisting of classrooms, and the other is a double - storey building with a laboratory on the ground floor. Altogether there were 24 classrooms and only three specialist teaching rooms at City High at the time of this research. The specialist teaching rooms consist of a single laboratory, a Typing room, and a Home Economics centre.

Besides the school hall, facilities for extracurricular activities at City High were nonexistent. The hall was mainly used for meetings between teachers, pupils and parents. Due to the limited space available, City High had no sports field. The only playing area available was the dilapidated township sports field which is situated directly across the main road from City High.

City High had only three maintenance staff available during

1994, a caretaker, a general cleaner and a garden attendant. These people were responsible for the care of the corridors and toilets, administration block and garden.

At City High pupils and teachers are required to clean their classrooms on Friday afternoons. The necessary cleaning equipment is provided by the school. The result is that litter is a problem at City High. Also noticeable was the limited number of educational charts on display and the generally unkempt appearance of classrooms, buildings and school grounds.

5.3.3 Teaching staff

During 1994, the staff at City High comprised of 32 teachers. There were 25 male and seven female teachers. The Management Team was made up of the Principal and four Heads of Department. The Head of Department for Mathematics also performed the duties of Deputy Principal. In addition to the teaching staff there were two female secretaries at City High.

All the teachers at City High were qualified teachers. There were 23 teachers who were in possession of teacher's diplomas, whilst seven teachers had Bachelor's degrees. The remaining two teachers had post - graduate teacher's degrees. The following table depicts the categorisation of teachers according to teaching qualifications :

Table 5.5 : Distribution of teachers at City High by category qualification.

Category	C	D	E	F	Tot
Number	23	0	7	2	32

5.3.4 Student body

There were 1174 pupils at City High. The following table depicts the gender distribution of the pupil population in the two phases of education :

Table 5.6 : Distribution of pupils at City High by gender and phase of education.

	Boys	Girls	Total
JSP	216	366	582
SSP	220	372	592
Total	436	738	1174

All the pupils at City High were Black, the majority of whom had completed their Primary education at the neighbouring Primary School.

The pupils at City High had an elected SRC which liaised with Management. This body which was elected annually has responsibilities which include the organisation of pupil affairs such as concerts, competitions and sporting activities.

5.3.5 Curricula activities at City High

Lessons at City High commence at 7h30 and are of 30 minutes duration. There are 12 such lessons on a normal school day.

The first seven lessons are followed by an hour long lunch break after which the remaining five lessons are completed. During this lunch break pupils are allowed to leave the school premises in order to have their meals at home. Every Tuesday morning the first two periods are used to conduct monthly tests in the various examination subjects. This is done on a rotational basis. On Thursdays, the last two lessons are allocated for extracurricular activities whilst the same lessons on a Friday are used by pupils and teachers to clean their classrooms.

In the JSP at City High, it was compulsory that the Standard 6 and 7 pupils study seven examination subjects. Of these, five subjects form the core which all pupils in the JSP must study. These subjects are English, Zulu, Afrikaans, Mathematics and General Science. In Standards 6 and 7, the remaining two subjects are chosen from any one of four streams or combinations of subjects that are available. This information is depicted in Part 3 of Appendix D. In addition to these seven examination subjects, pupils in all standards are required to study the following four non - examination subjects, that is, Guidance, Religious Education, Library Education and Physical Education.

In the SSP at City High it was compulsory that pupils studied six examination subjects which would eventually lead them to the SCE. Of these subjects, two languages namely, English and Zulu were compulsory for all pupils. Pupils were allowed to choose the remaining four subjects from any one of the four

streams available. The limited choice available to SSP pupils at City High is evident when Part 4 of Appendix D is studied.

Once more, the predominance of Mathematics in the available streams or courses is evident. Although information regarding the number of pupils that has chosen each of the above streams was not available, Part 5 of Appendix D which lists the number of Standard 8 and 9 pupils studying the various subjects, is informative. The table contains data pertinent to this study regarding the popularity of Mathematics at City High in relation to the so - called "knowledge subjects" such as Biology, History and Geography.

In addition to the examination and non - examination subjects that pupils at City High studied, they participated in sports such as soccer, netball, volleyball, karate, rugby and athletics on an inter class and inter school basis. Other curricula - related activities included the cultural groups, scouts, drum majorettes, drama group and debating society.

5.3.6 Additional information on City High

The above discussion reveals that the educational environment at City High is certainly nowhere near an ideal state. The shortage of educational resources such as classrooms, specialist rooms, facilities for extracurricular activities and teachers, together with the restricted academic activities available, contribute to an incomplete and frustrating educational experience.

Pupil indiscipline is an added problem experienced at City

High. Although it was evident during visits to the school that the staff was making earnest efforts in attempting to address irregular attendance and lack of punctuality, a lot has yet to be achieved in this regard. Drug abuse, teenage pregnancies and the absence of a guidance counsellor at City High has compounded the problem of indiscipline even further. Parental involvement in their childrens' schooling is poor. In this regard the principal of City High notes that :

> Parents' interest and participation in school activities is low.

CHAPTER SIX

ANALYSIS OF DATA

6.1 Introduction

In this chapter the data gathered during the course of the investigation are analysed. The method of analysis is discussed with motivation being provided for the preliminary and more intensive analysis. Thereafter, the similarities and differences that emerged between the two groups of Mathematics pupils are presented. A similar presentation is followed for the information derived from the non - Mathematics pupils. It should be noted that the major findings are discussed and interpreted in the next chapter.

6.2 Method of analysis

The volume of data collected necessitated the reduction of information into more manageable proportions so that pupils' perceptions of Mathematics could be identified and analysed. With this in mind it was decided that a preliminary analysis of the data should precede the analysis proper. Such an analytical procedure would be relevant as the preliminary analysis, which as an essential component of qualitative research, often reveals the problems to be pursued as the investigation proceeds.

6.2.1 Preliminary analysis

The questionnaires, field notes, taped interviews and written essays were the subject of the preliminary analysis. During this stage of analysis and wherever possible, the pupils' answers were tabulated and the recurring themes influencing

their perceptions of Mathematics were noted. The significant categories that emerged during the preliminary analysis of the data collected from the research sites were : biographical details of pupils; pupils' aspirations for the future; the status of Mathematics in schools; reasons for pupils selecting or not selecting Mathematics as an examination subject and pupils' perceptions of the importance of Mathematics. The preliminary analysis proved to be very useful in that the dominant themes identified provided the researcher with a broad set of issues around which the structure of the analysis proper was based.

6.2.2 Analysis proper

The themes identified during the preliminary analysis provided the basis for an indepth and systematic analysis of the questionnaires as they were the largest source of collected data. This entailed the counting of frequencies of each of the responses according to the relevant themes and their related issues. For example, when examining pupils' perceptions of the importance of Mathematics, pupils' comments in terms of "the importance of Mathematics for obtaining good jobs"; "the enhancement of one's thinking skills"; "university entrance requirements"; "the importance of Mathematics in daily activities" and "limited structure of courses offered at school" were noted. Having analysed the information in this way, each category was carefully examined in relation to other categories. The information derived from the field notes, taped interviews and written essays was then examined. Significant statements substantiating or refuting

the information derived from the questionnaires were noted. This process eventually resulted in refined and theoretically justifiable categories which formed the structure of the analysis. It was decided that the following four categories would be relevant when discussing the research data :

1. Biographical details of pupils;
2. Pupils' future aspirations;
3. Mathematics as an examination subject;
4. Pupils' perceptions of Mathematics.

During the final stages of the analysis it was apparent that the volume of information necessitated a method of presentation that would convey all the relevant information, yet make reading relatively easy. For these reasons it was decided that the main features of the two schools would be highlighted in accordance with the four categories identified above. In this regard the similarities and differences between the schools would be noted. Furthermore, the figures and data on which these conclusions are based, as well as additional quotations, were listed in the relevant appendices.

Another important issue that emerged from the indepth analysis and related to the presentation of the analysis was that it would be more appropriate to differentiate between Mathematics and non - Mathematics pupils rather than between pupils of the two schools. Such a differentiation which was based on conceptual rather than geographic grounds was

preferred as it reduced the possibility of repetition when discussing the data, and it catered for a more meaningful discussion on the commomalties and differences in Indian and Black pupils' perceptions of Mathematics.

6.3 Mathematics pupils

6.3.1 Biographical details

Of the 97 Mathematics pupils who participated in this research, 46 were from Capital Secondary and 51 from City High. Tables(1) were constructed depicting the biographical details of these Mathematics pupils in terms of age, gender distribution, home language, number of family members currently living with them, educational levels and occupation of parents, Mathematics education of family members and details pertaining to homework. When the data contained in these tables were analysed, the following similarities and differences emerged :

6.3.1.1 Similarities

1. In both schools more male than female respondents studied Mathematics (Table 6.1). These differences were 4 extra malea at Capital Secondary and 11 at City High.

Table 6.1 : Gender distribution by school attended.

	CH	CS
Male	31	25
Female	20	21
Total	51	46

1. In all tables the abbreviations CH and CS represent City High and Capital Secondary respectively.

2. The majority of respondents from Capital Secondary and City High had no family members who had studied Mathematics after matriculating (Tables 6.2a and 6.2b).

Table 6.2a : Responses on family members having studied Maths at Post matric level by school attended.

	CH	CS
Yes	8	9
No	40	36
No response	3	1
Total	51	46

Table 6.2b : Family members with Post matric Maths by school attended.

	CH	CS
Father	0	1
Mother	0	0
Brother	3	5
Sister	3	3
No response	2	0
Total	8	9

3. Patterns regarding homework assistance by family members was similar in both cases (Table 6.3). A few pupils noted that they received assistance "frequently" whilst the remainder indicated in similar numbers that they received assistance "sometimes" or "never".

Table 6.3 : Frequency of homework assistance by family members by school attended.

	CH	CS
frequently(eg.once a week)	9	6
sometimes(eg.once every month)	19	22
never	23	18
Total	51	46

6.3.1.2 Differences

1. Of those pupils who participated in this study, City High

pupils were older (Table 6.4). There were respondents beyond 20 years of age at City High.

Table 6.4 : Respondents age by school attended.

	CH	CS
< 17 years	5	32
17-20 years	38	14
> 20 years	8	0
Total	51	46

2. The home language of all the respondents (Table 6.5) from Capital Secondary was English whilst the majority of City High respondents spoke Zulu at home.

Table 6.5 : Home language by school attended.

	CH	CS
Zulu	50	0
Suthu	1	0
English	0	46
Total	51	46

3. The City High respondents had more family members(2) living with them than those from Capital Secondary. Fifteen pupils from this school noted that there were more than six family members in their household (Table 6.6).

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2. Pupils were told that for the purposes of this research "family members" meant only father, mother, brothers and sisters.

Table 6.6 : Number of family members in household by school attended.

	CH	CS
< 4	10	15
4-6	26	31
> 6	15	0
Total	51	46

4. Most respondents from Capital Secondary had parents who had a high school education with most, fathers occupying semi - skilled or skilled posts in middle management and the mothers being mainly housewives. However, the data provided by City High pupils did not allow for such conclusions to be reached. The reason for this is that a significant number of respondents did not provide information on the educational levels of their parents or on their parents' occupations (Tables 6.7 to 6.9).

Table 6.7 : Parents' level of education by school attended.

	CH		CS	
	Father	Mother	Father	Mother
no school education	2	1	0	0
primary	3	5	0	2
high school	17	30	31	38
college diploma	9	7	8	2
university degree	1	1	2	1
>1 university degree	0	1	2	0
Not sure-don't know	8	4	2	3
No response	11	2	1	0
Total	51	51	46	46

Table 6.8 : Father's occupational category by school attended.

Category(3)	CH	CS
Professional, technical and related worker	4	6
Clerical and related worker	2	7
Service worker	0	1
Production, sales and transport worker	15	31
Unclassified(4)	4	0
No response	23	1
Total(5)	48	46

Table 6.9 : Mother's occupational category by school attended.

Category	CH	CS
Professional, technical and related worker	7	2
Clerical and related worker	2	3
Service worker	9	0
Production, sales and transport worker	9	14
Housewife	1	26
Unclassified	5	0
No response	18	1
Total	51	46

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3. These categories were compiled with reference to the study conducted by Naicker (1988 : p.48).
4. This category related to those responses which indicated that the father's were either unemployed or a pensioner.
5. Three pupils from CH indicated that their fathers were deceased.

5. In contrast to those from Capital Secondary pupils, there were 25 respondents from City High who spent less than two hours a day on all homework (Table 6.10).

Table 6.10 : Hours spent on homework per week by school attended.

	CH	CS
0 - 4	18	3
5 - 9	17	13
10 - 14	9	15
15 - 19	3	6
20 - 24	2	4
> 25	0	5
No response	2	0
Total	51	46

6.3.2 Pupils' future aspirations

The information related to the future aspirations of pupils from both the schools was used to compile the following list of similarities and differences between the respondents from the two schools.

6.3.2.1 Similarities

1. The majority of respondents indicated that they were studying for an ME (Table 6.11).

Table 6.11 : Number of pupils indicating studying for an Matriculation Exemption (ME) by school attended.

	CH	CS
Yes	46	43
No	1	2
No response	4	1
Total	51	46

2. Fulltime study at a university was the most popular first choice for post - matriculation activity by pupils studied in both schools. Furthermore, it should be noted that nine Capital Secondary and three City High pupils had this as their only choice (Tables 6.12a and 6.12b).

Table 6.12a : Number of pupils indicating their first and second Post matric choices by school attended.

	CH		CS	
	1	2	1	2
Fulltime (FT) university study	18	2	27	0
Part-time (PT) university study	0	3	1	6
study FT at a college or tech.	11	6	5	8
study PT at a college or tech.	3	3	1	2
obtain FT employment	2	15	1	11
obtain PT employment	0	5	0	6
start own business	0	0	0	2
Total	34	34	35	35

Table 6.12b : Number of pupils indicating only a first choice for Post matric activity by school attended.

	CH	CS
only university FT	3	9
only university PT	1	0
only college or tech. FT	8	1
only college or tech. PT	1	0
only FT employment	4	1
Total	17	11

3. Amongst the second choices for post - matriculation activity, fulltime employment was dominant with many choosing this option together with study at a tertiary institution (Table 6.12a).

4. Given the choices, the respondents preferred post - matriculation activity, it was not surprising that the careers(6) they wished to pursue in the future invariably required further education after matriculation (Tables 6.13a and 6.13b).

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6. These were the respondents own careers description of careers they would like to do in the future. These were not grouped into occupational categories in order to retain the precision of respondents aspirations.

Table 6.13a : Pupils' choice of a future career at City High.

Sales manager	9	Psychologist	1
Doctor	7	Psychiatrist	1
Accountant	7	Dentist	1
Teacher	5	Paramedic	1
Law enforcer	3	Nurse	1
Electrician	3	Carpenter	1
Social worker	3	Teller	1
Engineer	2	Secretary	1
Mechanic	2	No response	1
Physiotherapist	1	Total	51

Table 6.13b : Pupils' choice of a future career at Capital Secondary.

Doctor	14	Teacher	1
Engineer	8	Biologist	1
Accountant	7	Radiologist	1
Computer programmer	2	Mechanic	1
Physiotherapist	1	Pharmacist	1
Genetics researcher	1	Nurse	1
Journalist	1	Designer	1
Lawyer	1	Geologist	1
Businessman	1	Unsure	2
Total			46

5. A noticeable trend amongst the respondents from both schools, who did provide information on their parents' occupation, was the desire by them to follow career pathways similar to their parents. This was especially

evident in cases where parents were teachers, policemen or nurses.

6. The majority of respondents from both schools were confident that it would be possible for them to enter the field of their chosen careers in the future (Table 6.14).

Table 6.14 : Pupils' responses on the possibility of them achieving career aims by school attended.

	CH	CS
Yes	33	39
No	16	6
No response	2	1
Total	51	46

6.3.2.2 Differences

1. Fulltime study at a college or technikon received a more favourable response from City High respondents, than those from Capital Secondary, as a first choice for post - matriculation activity (Tables 6.12a and 6.12b).

2. The differences in the variety of careers chosen by pupils and the high future expectations of Capital Secondary respondents was also noticeable. At City High the most popular choice was that of sales manager with careers in the medical profession also being preferred. Respondents at City High also intended to become accountants, law enforcers, social workers and electricians. Capital Secondary respondents opted mainly for careers in the science field with the medical field and engineering being favoured the most. Greater variation was evident with

Capital Secondary respondents aspiring to become computer programmers, a biologist, genetics researcher, geologist and fashion designer (Tables 6.13a and 13b).

3. The analysis of pupils' positive responses as to whether it would be possible for them to pursue their chosen careers in the future, revealed interesting variations in the answers. There were respondents at City High who noted that they were studying relevant subjects. This they believed would enable then to enter the field of their chosen careers. For example, a pupil who wanted to enter the marketing field wrote that he could achieve this aim :

> Because my subjects are directly based on commerce - they include Business Economics, etc.(7)

Others stated that it was possible to succeed in the future because they had a liking for or were interested in the chosen career. For example a future accountant stated that :

> It will be possible for me to enter this occupation because I like it very much and it is interesting.

Related to the above, a desire to improve existing conditions was given as a reason by respondents as a reason for possible entry into the chosen occupation. In this regard, a girl who wished to be a policewoman wrote :

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7. When quoting respondents every attempt was made to record the exact words that were used. However in some cases alterations were made for purposes of clarity. In such instances it was ensured that the intended meanings of pupils was not lost. For example in this quotation the pupil used the words "base" and "commercial". These were replaced to make reading easier.

> I want the new South Africa to have peace and prosperity. I hate the violence in our country.

For City High pupils, financial factors were also considered to be important for their future prosperity. This point was highlighted when the following statement was examined :

> I always wanted to be a doctor but it will depend on money - whether I will have money or not.

Interestingly, and related directly to the investigation, one pupil noted that it was possible for her to enter her chosen occupation because :

> If you do Mathematics it is so easy to get a job anywhere.

Additional statements made by City High pupils on the above themes may be found in Part 1.1 of Appendix E.

The responses of Capital Secondary pupils indicated that they were very aware of the specific subject requirements for the career that they wished to pursue in the future. This was evident in the fact that 21 respondents stated that not only were they studying the relevant subjects but that their marks were of the standard required for further study. These pupils stated that this made it possible for them to study at a tertiary institution which would enable them to obtain the necessary academic qualifications to fulfil their career aspirations. For example, one pupil wrote :

> For engineering / dentistry one must obtain 60 % in Physics and Maths. I obtain marks which are above these requirements. Therefore I should be able to enter this occupation.

Others stated that the financial arrangements made by their families would enable them to study at a tertiary institution. There were also pupils who responded that they were aware that the career opportunities in their chosen fields were good. This point is highlighted when the following statement made by a pupil who wanted to become an accountant is examined :

> Businesses are being opened every day. Also now that the apartheid era is over other countries would be willing to invest in South Africa, thus creating job opportunities for me.

One issue, that was not evident in the responses of City High pupils but which was mentioned by three Capital Secondary pupils was the influence of adults (teachers and parents) on the pupils' career choices. For example, a girl who wanted to become a journalist wrote :

> I believe that I am better with my languages than science subjects. Hence, my choice. Also I have been successful in many essay writing competitions and my English teacher has encouraged me to pursue a career in journalism.

Additional statements made by Capital Secondary pupils on the above themes are in Part 1.2 of Appendix E.

6. Of the negative responses from City High pupils regarding the possibility of attaining future career goals, one pupil who wanted to be an accountant stated that this would not be possible because of Mathematics. This pupil wrote :

> It cannot be possible because of Mathematics - I'm not good at it.

Some City High respondents noted that family consideration prevented them from achieving their career aims. One of

these pupils stated that :

> Because I have no parents to help me on by giving me money to study at university, and for completing school.

In fact the majority of City High pupils who gave negative responses cited the lack of finance as the main obstacle to fulfilling their career aspirations. This was evident in the following statement made by a pupil who wanted to be a psychologist :

> It is because we are not a rich family. Our problem is money to study at university and money for family needs.

Further statements made by City High pupils on these issues are to be found in Part 1.3 of Appendix E.

Not only were there fewer negative responses regarding future career achievements from Capital Secondary pupils, their responses also different from those of the City High pupils. Most of these Capital Secondary pupils stated that their poor academic achievement would prevent them from attaining their future career goals. One of these pupils who wanted to become a civil engineer in the future referred directly to Mathematics when he wrote :

> My Maths and Physics symbols are too low.

In contrast to City High pupils, only one Capital Secondary pupil made direct reference to financial constraints as a hindering factor. This pupil who wanted to start his own business after matriculating wrote :

> A lot of money will be needed to start a business and I don't have that much money.

Additional statements made by Capital Secondary pupils on the above two themes are in Part 1.4 of Appendix E.

6.3.3 Mathematics as an examination subject

This section of the analysis was devoted to issues such as the number of respondents studying Mathematics on the Higher Grade and Standard Grade and the amount of time devoted to Mathematics homework. The data related to these issues are presented in Tables 6.15 to 6.16 below. More importantly, however, this analysis also examined pupils' responses to the question asking why they chose Mathematics as one of the six subjects for the SCE. The similarities and differences that emerged on these four issues are listed below.

6.3.3.1 Similarities

1. The majority of respondents, that is 67% from City High and 61% from Capital Secondary, indicated that they did fewer than five hours of Mathematics homework a week. This information is provided in the following table :

Table 6.15 : Hours spent on Maths homework per week by school attended.

	CH	CS
0 - 4	34	28
5 - 9	13	12
10 - 14	1	5
15 - 19	0	1
> 20	1	0
No response	2	0
Total	51	46

2. The analysis of pupils' responses as to why they chose Mathematics as one of the six subjects for their SCE revealed that the principal motivating factor for both groups of pupils related to their belief in its importance in their future careers. In this regard the predominant theme was that Mathematics was the key for success in their chosen career fields. The following statement made by a Capital Secondary pupil emphasised this point :

> Mathematics is going to be more beneficial to me in future years. The occupation that I want to enter is Accountancy and it requires Mathematics. Mathematics is required or is an advantage for a good job.

A similar viewpoint was expressed by a City High pupil when he wrote :

> I chose Mathematics because what I want to do after matric needs Mathematics.

Other statements made by pupils on this issue are listed in Part 2.1 of Appendix E.

3. Related to the above theme was the importance of Mathematics for entry to university or college. For example, a City High pupil stated :

> If you go to university Mathematics is needed.

Additional statements on this theme are listed in Part 2.2 of Appendix E. It is important to note that the data on which the above two points are based suggested that pupils' belief in the importance of Mathematics can be related to two aspects, namely, the issue of access into their future career (that is as a subject that must appear

on their certificate) as well as a requirement within the career itself (that is Mathematics as a discipline is important and needed for their future career).

4. Another similarity between the two groups of pupils was their belief in the importance of Mathematics since it provided the individual with the necessary skills to survive in a modern society. With regard to this, the improvement of thinking skills and daily life skills was mentioned. This was evident in the following statement made by a Capital Secondary pupil :

> Maths is exciting and very tricky. It teaches one how to handle problems which may be implemented in life skills.

Further statements on this issue are to be found in Part 2.3 of Appendix E.

5. There were also pupils from both schools who stated that Mathematics played an important role in improving thinking skills. For example a City High Pupil made the following statement :

> Mathematics is a subject that helps a student to develope his / her mind.

Further statements on this theme are listed in Part 2.4 of Appendix E.

6.3.3.2 Differences

1. At the time of investigation, 30 City High and 35 Capital Secondary pupils indicated that they were studying Mathematics on the Higher Grade. Noticeable, was the fact that 17 % more City High pupils were studying the subject

on the Standard Grade. This information is provided in the following table :

Table 6.16 : Respondents' Maths grades in 1994 by school attended.

	CH	CS
Higher	30	35
Standard	21	11
Total	51	46

2. The information regarding the respondents' Mathematics test symbols was not used in the analysis because they were not verified with the teachers' records.

3. The majority of Capital Secondary respondents stated that the importance of Mathematics for obtaining "a good job" was the motivating factor when they chose Mathematics as an examination subject. This theme was appropriately expressed in the following statement made by a Capital Secondary pupil :

> Today every single job involves Maths. If you want to do something good, Maths is compulsory for the future

More statements made by Capital Secondary pupils are listed in Part 2.5 of Appendix E.

Related to the above theme, five Capital Secondary pupils responded that Mathematics was essential if one was going to succeed in life. As one of these pupils wrote :

> To become "someone" in this world, Mathematics is imperative.

It was interesting to note that though City High respondents also felt that Mathematics was important to gain employment, they did not specifically refer to the importance of Mathematics for "good jobs". Rather, respondents from this school responded that by studying Mathematics their chances of gaining employment were enhanced. This is expressed in the following statement :

> Mathematics is important - everywhere they need Mathematics qualifications. It helps you find a job quickly.

Additional statements made by City High respondents on this issue are listed in Part 2.6 of Appendix E.

4. The difference of emphasis of key issues between the two groups of pupils was also noticeable in the fact that most Capital Secondary pupils mentioned that they chose Mathematics since they found the subject to be enjoyable and challenging. Only ten City High respondents expressed similar thoughts. The responses of Capital Secondary pupils suggested that these pupils enjoyed studying the subject and the challenges it offered, hence their choice of it. This is apparent in the following statement :

> I find Mathematics to be interesting and enjoyable. I enjoy solving the various algebraic, geometric and trigonometric problems. It serves as a challenge for me and I am not satisfied until I have solved a problem.

These pupils also listed factors such as good teachers, an understanding of the subject, high achievements and favourable performances at Primary school and Junior secondary levels as reasons for their liking the subject.

Additional statements made by both groups of pupils on the interesting and challenging nature of Mathematics are to be found in Part 2.7 of Appendix E.

5. An important difference that emerged between the two groups of pupils was the fact that some City High pupils had no choice but to study Mathematics for the SCE since the course options available to them in Standard 8 were very limited and in most cases contained Mathematics. This was discussed in Chapter 5 and is evident when Part four of Appendix D is studied. Some pupils had no choice, but were forced to study the subject since it was part of the courses containing other subjects they wished to study. Some of the pupils who gave their lack of choice as a reason for their studying Mathematics expressed strong feelings about this state of affairs as can be deduced from the following statement :

> I didn't choose it but I was forced to study Mathematics because of the other subjects I'm doing : Business Economics, Accounting, Economics, Zulu and English. These subjects require Mathematics.

In contrast to the above, only three Capital Secondary pupils stated that they studied Mathematics because it was part of their chosen course.

Additional statements on this theme are listed in Part 2.8 of Appendix E.

In addition to the above similarities and differences it is worth noting that the education policies adopted by the past South African governments have not gone unnoticed amongst

respondents. The effect of these past initiatives on the present and future was appropriately captured in the following statement made by a City High pupil as to why he chose Mathematics :

> I chose Mathematics because when I look back at the apartheid era, Africans were not part of Science subjects, they were thrown to the Humanities. In African schools we have a lack of Science and Mathematics teachers because these pupils were doing Humanities, they know nothing about Mathematics. So if I fail to become a doctor I shall become a Mathematics teacher.

6.3.4 Pupils' perceptions of Mathematics

This part of the analysis attempted to gain an insight into how the two groups of pupils perceived Mathematics. Using the information gathered it was decided that the following five categories of analysis would yield the necessary information on pupils' perceptions of Mathematics :

1. Pupils' preference for Mathematics;
2. Pupils' responses and their explanation for the rating of the importance of Mathematics;
3. The advice that pupils would give to a Standard 7 pupil on Mathematics or course selection;
4. Their views on whether more pupils should study Mathematics and how this could be achieved;
5. The status of the various examination subjects.

Using the information derived from the analysis of the above categories, the following list of similarities and differences in perceptions of the two groups of Mathematics pupils were compiled.

6.3.4.1 Similarities

1. When the information regarding the Mathematics pupils' preference for the subject was analysed, the information derived was in keeping with the reasons supplied by them for their choice of Mathematics as an examination subject. As revealed in the following table, the majority of pupils gave positive replies concerning their preference for Mathematics.

Table 6.18 : Numbers of respondents indicating their liking of Maths by school attended.

	CH	CS
Yes, very much	14	15
Yes, most of the time	20	26
No, not much	14	5
No, not at all	3	0
Total	51	46

Most respondents from City High motivated their positive responses for Mathematics by providing reasons such as their enjoyment of the subject, its practical nature and the understanding of content. For example, one of these respondents wrote :

> I do like Mathematics because it is an easy subject to study for the exam. People don't like Maths because they think Mathematics is too difficult. I find it easy to understand the subject.

Related to the reasons why City High pupils chose Mathematics as an examination subject, some pupils stated that they liked the subject because it would assist them in achieving their goals in life. This point is emphasised

in the following statement :

> I like Maths very much because it is the key to a better future and jobs.

Additional statements made by City High respondents on the above two themes are listed in Part 3.1.1 of Appendix E.

The majority of Capital Secondary respondents referred to their understanding of the subject, the enjoyment provided and the interesting nature of Mathematics as reasons for pupils liking the subject. However, noticeable and different from the responses of City High pupils was the fact that many of the Capital Secondary respondents referred directly to specific sections in Mathematics when discussing their preference for the subject. The following statement made by a respondent captures the essence of pupils' thoughts on this theme :

> Sometimes it is very enjoyable like Trig and Geometry. Also Algebra but I do not really enjoy working with numbers, multiplying and dividing. I enjoy working with Geometry and Trig examples. It is interesting to find a solution hidden behind all those lines and diagrams and shows just how easy the example is and yet it looks so complicated.

Other Capital Secondary respondents identified the challenges that Mathematics offered as a factor for their liking of Mathematics. This is highlighted in the following statement :

> It's challenging. Makes me think, increases and exercises my mental state or capacity. I feel I do pretty well in it and I like to work with complicated stuff.

Related to the challenging nature of Mathematics,

respondents stated that they liked the subject since it did not require the swotting of notes but rather success depended on one's logical thought process. In addition, others referred to the feelings that were evoked when a solution was derived from a question for a Mathematics problem. These themes were evident in the following two statements :

> (1) It is not a subject where you can swot and reproduce notes. It involves applying the work learnt to the various problems and how you manipulate your knowledge to solve problems.
>
> (2) It's a pleasure to solve a tough problem that you are struggling with - and finally succeeding.

Capital Secondary respondents also credited the activities of the Mathematics classroom with their liking of the subject. Factors such as the Mathematics teacher, enjoyable lessons or good teaching methods were mentioned. The following statement highlights this point :

> I like Mathematics because of my teacher. In my opinion I find our Maths teacher to be very good in explaining and making me understand Maths.

Further statements made by Capital Secondary respondents on these themes are listed in Part 3.1.1 of Appendix E.

2. The majority of respondents from both schools considered Mathematics to be either important or very important. This information is contained in the following table :

Table 6.19 : Pupils' responses indicating the importance of Maths by school attended.

	CH	CS
Very important	28	38
Important	21	8
Not important	0	0
Not at all	2	0
Total	51	46

When analysing the explanations that pupils gave for their responses it was found that the themes that emerged were the same as those already discussed in previous sections of this analysis. These dominant themes are listed below. Statements made by pupils on these issues may be found in Part 3.2 of Appendix E.

1. Mathematics is required for future careers. Pupils also stated that it was a prerequisite for "good jobs";
2. The subject is required for entrance into universities and colleges;
3. It is essential to know Mathematics in order to function effectively in a modern technological society;
4. Mathematics improves one's thinking skills.

3. With respect to the perceived importance of Mathematics, only two City High pupils stated directly that they would not advise a Standard 7 pupil to study Mathematics because it was difficult. The answers of all the remaining pupils suggested that they would advise pupils to study the subject. The reasons given by the majority of the

remaining pupils for their positive advice reflected their own reasons for choosing Mathematics, and their preference for the subject and its perceived importance. Often the reasons given by Capital Secondary respondents were similar to those of the City High respondents. For example, one Capital Secondary pupil wrote :

> Maths is an absolute necessity. It helps one cope with other subjects. It increases one's chances of getting a good job or even getting into tertiary education.

In addition to this, respondents from both schools offered suggestions on how to succeed in the subject. Future Mathematicians were advised to work hard, concentrate on lessons, refrain from copying, and to take the subject seriously. Respondents from both schools even had similar advice on how to succeed in Mathematics. For example one Capital Secondary pupil wrote :

> I would tell them that they should most definitely do Maths because it is an enjoyable subject to do. I would also tell them that they must be able to work hard in order to get a good symbol. Maths is hard to a certain extent but if one works harder then one can achieve what one wants to.

Additional statements relating to the advice for Standard 7 pupils are to be found in Part 3.3 of Appendix E.

6.3.4.2 Differences

1. When compared to the responses of Capital Secondary pupils there was a significantly greater number of City High pupils who provided negative responses regarding their preference for Mathematics than Capital Secondary pupils. One of the main reasons for this was related to the

difficulty experienced by City High pupils in the subject or their lack of understanding of the subject. This is evident when the following statement is examined :

> The reason for my not liking it is that I don't understand Mathematics at all and I find it very difficult.

Another explanation provided by City High respondents for the negative responses was that they did not like Mathematics because they had to study it since it was Part of their chosen course. This point was highlighted in the following statement :

> My reason for not liking Mathematics is I am a commercial subject pupil and it will be better for me if I learn commercial Mathematics. I'm very confused with this Maths because it doesn't help me in my subjects especially Accounting because here we count money in different ways.

In addition to these reasons, there were respondents who stated that they disliked Mathematics because of their teachers or the teaching methods that were used. One of these respondents wrote that :

> My history and Mathematics teachers are not so good. So I don't like Maths so much. Sometimes I am determined that I will understand Mathematics. Then the teachers often disappoint us and discourage us by not attending our classes and teaching us.

In contrast to the above, the reasons provided by Capital Secondary respondents for their negative attitude to Mathematics, related to the difficulty of the subject and its unexciting nature. Additional statements related to respondents' negative attitudes to Mathematics are to be found in Part 3.1.2 of Appendix E.

2. Although no Capital Secondary pupil stated that a Standard 7 pupil should not choose Mathematics, a noticeable difference in their responses to that of the City High pupils was the cautionary nature of the advice given. Future Mathematics pupils were warned that when selecting the subject they should take into consideration factors such as : their attitudes and feelings for the subject, their future aspirations regarding careers and tertiary education, the marks achieved and the intense studying required in order to succeed. Having the correct attitude towards Mathematics is emphasised in the following statement :

> To succeed in Maths, you've got to enjoy the subject. A negative attitude only cultivates a hate for the subject. Thus, you would lose interest and your marks would wane.

The essence of the advice given by Capital Secondary respondents is appropriately expressed in the following statement which is amusing and noteworthy :

> "If you want to be a dude ... Do Maths !!!"
> I will state the pros and cons of Maths and tell him that Maths is easy and fun if you work at it (some advice that I myself should consider).
> LOGIC
> Maths is a challenge and Life is a challenge.
> So, what is Life without Maths ?

3. Despite the favourable responses of City High respondents on the importance of Mathematics, a number of these pupils answered negatively or gave no response when questioned as to whether more pupils should study the subject. This information is presented in the following table :

Table 6.20 : Numbers of respondents indicating whether more pupils should study Maths by school attended.

	CH	CS
Yes	26	45
No	19	1
No response	6	0
Total	51	46

In addition, a significant number of respondents gave no explanations for their responses. From the explanations that were supplied it was found that the majority of the respondents had misinterpreted the question since they merely restated the responses that they had provided when questioned previously. However, there were some City High pupils whose answers suggested that pupils be made aware of the importance of Mathematics. This would encourage more of them to study the subject (Part 3.4.1 of Appendix E).

In contrast to the above, the pupils from Capital Secondary had a variety of interesting suggestions to offer on teaching methods and teachers, revealing the importance of Mathematics and making pupils aware that the subject is enjoyable. The majority of these responses dealt with improving teaching methods and teacher attitudes towards Mathematics. Pupils expressed strong feelings on the issue that good Mathematics teachers and teaching methods are required to ensure that more pupils study the subject. For example, one pupil made the

following statement :

> Proper teachers. Not teachers who go to the chalkboard and work out problems to themselves. They should try and take more time to explain and speak to the class in a cool and calm tone. Not in a tone that would scare you.

On teaching methods, another pupil wrote the following :

> The teacher should make Maths exciting by having different, new and exciting ways of teaching. Children should not be made frightened of Maths by drilling them with hard examples at the start. Teachers should start off with Level 1 questions and then go on to Level 4, even though pupils are in Standard 9. It is good to know the basics at first. They should not be reminded that they are in Standard 9 and Higher Grade, but should be encouraged and take a step at a time.

There were others who referred to Primary school Mathematics when making suggestions. This was evident in the following statement :

> Most pupils don't choose Maths as one of their subjects in their courses since they find it difficult before Standard 8. Therefore I would suggest that more emphasis be placed on Primary school Maths where the foundation is laid. Primary school teachers should be more persistent when teaching the subject.

Pupils also suggested that more time be spent on Mathematics :

> Weaker pupils should be given extra lessons by teachers and pupils who do well in Maths should help the weaker pupils out.

Related to the above discussion on Mathematics classroom activities, pupils recommended that in order to get more pupils to study Mathematics, it must be viewed as something enjoyable. The introduction of Mathematics talks, games, excursions, competitions and crosswords were

recommended. In addition to this, it was suggested that the practical nature of the subject should be revealed and more awards be given for the subject, especially for those studying it on the Standard Grade. Some of these issues are contained in the following statement :

> Make Mathematics more fun. Involve more practical uses to Maths. Mathematical games and quizzes should be used in the classroom. More outdoor assignments should be given. Show pupils why a section is studied and how it can be applied in life.

Finally, there were suggestions that younger pupils should be made aware of the importance of the subject. This they believed would encourage more pupils to study the subject. This theme is embodied in the following remarks :

> Pupils should be encouraged and shown what a vital role Mathematics plays in life. They should be made aware of how helpful it can be to them.

Once again there was a pupil whose amusing yet logical remarks captured the essence of the preceding discussion. This pupil wrote :

> Encouragement at Primary school and Standards 6 and 7 level. Excellent teachers. Let's face it, one needs a good teacher to study a good subject. Use Maths as a means of entertainment - introduce Mathematics novelties - games during Maths lessons, Maths crosswords, etc.
>
> Fun + work = Maths enjoyed by pupils ie. more pupils taking Maths
> Work + work + boredom + no clarity while doing Maths = 0 pupils.
> Maths is a challenging subject ! It should be taken and treated this way.

4. Pupils' preference of the various examination subjects and the reasons that were provided for their choice also

revealed differences between the two groups of pupils. This information is provided in the table below :

Table 6.21 : Numbers of pupils indicating their favourite subject by school attended.

	CH	CS		CH	CS
Phy. Sc.	5	11	Zulu	1	0
Bus. Eco.	4	0	Eng.	8	2
Bio.	2	8	Eco.	4	0
Maths	16	6	Comp. Sc.	0	3
Acc.	7	5	Afrik.	0	2
Geog.	0	8	No response	4	1

At City High, Mathematics was regarded as the favourite subject with English, Accounting and Physical Science following in ranking. The reasons that were given for English as a choice mainly centered around the fact that at home pupils spoke an African language. English was considered to be important for purposes of communication since it would increase their chances of gaining employment. Pupils also noted that at school the medium of instruction was English. They therefore stated that proficiency in English assisted their understanding of other subjects. Accounting and Physical Science were chosen mainly because pupils understood them and felt that these subjects would help them in their future careers.

In contrast to the above, Capital Secondary pupils ranked their favourite subjects as follows : Physical Science, Biology, Geography and Mathematics. Physical Science was

chosen because pupils found it to be exciting, challenging, practical and related to life. Biology was one of the favourite subjects mainly because pupils understood the subject and it taught them about the environment. Pupils said they found Geography easy to understand since it was to a large extent based on general knowledge.

6.4 Non - Mathematics pupils

The analysis of data provided by the non - Mathematics pupils revealed that often there were similarities and differences between the two groups and the Mathematics pupils. Therefore, it was decided that explanations in the following discussion would be brief with only new information being elaborated upon.

6.4.1 Biographical details

There were 85 non - Mathematics pupils who participated in this investigation. There were 46 pupils from City High and 39 from Capital Secondary. The biographical details of these pupils relating to their age, gender distribution, home language, number of family members currently living with them, educational levels and occupation of parents, Mathematics education of family members and homework details were analysed. The analysis of this information revealed the following similarities and differences between the two groups of non - Mathematics pupils :

6.4.1.1 Similarities

1. The number of female non - Mathematics respondents was

greater than that of male respondents (Table 6.22).

Table 6.22 : Gender distribution by school attended.

	CH	CS
Male	17	14
Female	29	25
Total	46	39

2. In both schools the majority on non - Mathematics pupils lived with between four and six other family members (Table 6.23).

Table 6.23 : Number of family members in household by school attended.

	CH	CS
< 4	15	12
4-6	20	27
> 6	11	0
Total	46	39

3. More than 65% of the non - Mathematics pupils from both schools had no family member who had studied Mathematics after matriculating (Tables 6.24a and 6.24b).

Table 6.24a : Responses on family members having studied Maths at Post matric level by school attended.

	CH	CS
Yes	5	3
No	31	35
No response	10	1
Total	46	39

Table 6.24b : Family m members with Post matric Maths by school attended.

	CH	CS
Father	3	0
Mother	0	0
Brother	2	2
Sister	0	1
No response	0	1
Total	5	3

4. There were 22 non - Mathematics respondents from City High and 20 from Capital Secondary who spent less than five hours a week on homework (Table 6.25).

Table 6.25 : Hours spent on homework per week by school attended.

	CH	CS
0 - 4	22	20
5 - 9	14	9
10 - 14	4	7
15 - 19	0	2
20 - 24	1	1
> 25	2	0
No response	3	0
Total	46	39

6.4.1.2 Differences

1. There was a significant age difference between the pupils of City High and Capital Secondary. The majority of Capital Secondary pupils were younger than 18 years whilst most City High pupils were older than 20 years of age (Table 6.26).

Table 6.26 : Respondents age by school attended.

	CH	CS
< 17 years	8	35
17-20 years	15	4
> 20 years	22	0
No response	1	0
Total	46	39

2. The majority of City High pupils noted that Zulu was spoken at home whilst all Capital Secondary pupils indicated that English was their home language (Table 6.27).

Table 6.27 : Home language by family school attended.

	CH	CS
Zulu	44	0
Suthu	1	0
Xhosa	1	0
English	0	39
Total	46	39

3. The majority of Capital Secondary respondents indicated that their parents had a high school education with most

fathers working in factories or shops and the majority of mothers being housewives (Tables 6.28 to 6.30). Although City High respondents provided similar information regarding the education levels of their parents and their fathers' occupation, a definite conclusion could not be reached since a significant number of City High respondents provided no information.

Table 6.28 : Parents' level of education by school attended.

	CH		CS	
	Father	Mother	Father	Mother
no school education	0	1	0	1
primary	0	4	4	4
high school	24	25	24	28
college diploma	2	4	1	1
university degree	1	2	1	0
>1 university degree	1	0	0	0
Not sure-don't know	9	6	4	4
No response	9	4	5	1
Total	46	46	39	39

Table 6.29 : Father's occupational category by school attended.

Category	CH	CS
Professional, technical and related worker	4	1
Clerical and related worker	1	2
Service worker	0	1
Production, sales and transport worker	12	26
Unclassified	9	2
No response	13	3
Total(8)	39	35

Table 6.30 : Mother's occupational category by school attended.

Category	CH	CS
Professional, technical and related worker	4	1
Clerical and related worker	2	1
Service worker	9	0
Production, sales and transport worker	2	9
Housewife	5	26
Unclassified	15	0
No response	8	1
Total(9)	45	38

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8. Seven pupils from CH and four from CS indicated that their fathers were deceased.
9. One pupil each from CH and CS indicated that their mothers were deceased.

4. More Capital Secondary pupils indicated that they received homework assistance "frequently" from family members. A significantly larger number of City High pupils responded that they "never" received such assistance.

Table 6.31 : Frequency of homework assistance by family members by school attended.

	CH	CS
frequently(eg.once a week)	15	21
sometimes(eg.once every month)	13	15
never	17	3
No response	1	0
Total	46	39

6.4.2 Pupils' future aspirations

The similarities and differences that are listed below are related to the non - Mathematics pupils future aspirations.

6.4.2.1 Similarities

1. A significant number of pupils from both schools only gave one choice : the post - matriculation study (Tables 6.31a and 6.31b). Of those who did indicate a second choice, obtaining fulltime employment was preferred by the majority of pupils from both schools.

Table 6.31a : Number of pupils indicating their first and second Post matric choices by school attended.

	CH		CS	
	1	2	1	2
study at a university FT	13	0	3	0
study PT through a university	1	3	1	1
study FT at a college or tech.	2	5	12	4
study PT at a college or tech.	4	2	1	1
obtain FT employment	0	11	4	12
obtain PT employment	1	2	3	7
start own business	2	0	1	0
Total	23	23	25	25

Table 6.31b : Number of pupils indicating only a first choice for Post matric activity by school attended.

	CH	CS
only university FT	7	1
only university PT	1	1
only coll./tech. FT	11	6
only coll./tech. PT	1	0
only FT employment	2	6
no response	1	0
Total	23	14

2. It was interesting to note that nursing was the preferred profession amongst respondents of both schools (Tables 6.32a and 6.32b). Furthermore, the majority of careers that were chosen by respondents from both schools required further education at a college or technikon.

Table 6.32a : Pupils' choice of a future career at City High.

Nurse	13	Pilot	1
Teacher	8	Phychologist	1
Law enforcer	6	Lecturer	1
Lawyer	5	Caterer	1
Social worker	4	Engineer	1
Fireman	2	No response	3
Total			46

Table 6.32b : Pupils' choice of a future career at Capital Secondary.

Nurse	8	Paramedic	1
Law enforcer	7	Sailor	1
Electrician	3	Factory worker	1
Physiotherapist	2	Printer	1
Lawyer	2	Carpenter	1
Businessman	2	Pastor	1
Air hostess	2	Designer	1
Secretary	2	lab. assistant	1
Teacher	2	Dramatist	1
Total			39

3. The majority of pupils from both schools gave positive responses when considering the possibility of entering their chosen careers in the future (Table 33).

Table 6.33 : Pupils' responses on the possibility of them achieving career aims by school attended.

	CH	CS
Yes	43	37
No	1	2
No response	2	0
Total	46	39

4. Pupils from both schools stated that it would be possible for them to enter their chosen professions in the future mainly because they were studying the relevant subjects. For example a City High pupil stated :

> I am doing History and Geography and this is enough for me to enter this occupation (social worker).

Similar thoughts were expressed by a Capital secondary pupil when she wrote :

> I have chosen nursing because I have Biology and Home Economics on the Higher Grade and that is the requirement to do nursing.

Additional statements made by pupils from both schools on this theme are listed in parts 1.1 and 1.2 of Appendix F.

6.4.2.2 Differences

1. The majority of the non - Mathematics pupils from City High responded that they were studying for an ME whilst for most of the Capital Secondary pupils this was not the case (Table 6.34).

Table 6.34 : Number of pupils indicating studying for an Matriculation Exemption (ME) by school attended.

	CH	CS
Yes	31	17
No	9	20
No response	6	2
Total	46	39

2. Fulltime study at a university was the most popular first choice for post - matriculation activity amongst City High respondents. Capital Secondary respondents on the other hand preferred fulltime study at a college or technikon (Tables 6.31a and 6.31b).

3. The careers chosen by pupils from Capital Secondary was more varied than that of City High pupils. However, it is important to note that more City High pupils chose careers that required university education than Capital Secondary pupils (Tables 6.32a and 6.32b).

4. The differences that emerged regarding the possibility of pupils entering their chosen careers in the future, related to pupils' awareness of particular job requirements. City High pupils stated that it was possible for them to fulfil their career goals because they liked the career, found it interesting or they wanted to improve existing social conditions. This is evident in the following two statements :

> (1) It is a job that I will enjoy when doing it. I prefer to help people who are in danger (fireman).
>
> (2) It will be possible because I like to help children who are suffering because they have no homes or parents (social worker) .

Capital Secondary pupils however, referred to their abilities and dispositions which they felt would enable them to succeed in the chosen field. For example one pupil stated that :

> I have qualities needed to become a policeman eg. I am not scared of violence or blood and I am able to protect myself.

In addition to the above, some pupils responded that they would succeed in the future because their families were already established in the field. This is evident in the following statement of a future businessman :

> My family is widely established in the business. We have many liquor stores.

Additional statements made by City High and Capital Secondary pupils on the above issues are listed in parts 1.1 and 1.2 of Appendix F.

5. Of the negative responses regarding the possibility of entry into the chosen career in the future, the a single City High pupil made reference to financial constraints (Part 1.3 of Appendix F). However, both the pupils from Capital Secondary referred to the lack of Mathematics as an examination subject being the reason they felt it was not possible for them to achieve their career goals in the future. One of these pupils wrote :

> Because Maths is included in doing a nursing job. I've looked at forms which I got from the hospital and there are also some things that does not suit my needs because I am not doing Maths I'm not qualified for a nursing job.

The second statement made by a Capital Secondary pupil in relation to Mathematics is listed in Part 1.4 of Appendix F.

6.4.3 Mathematics as an examination subject

This part of the analysis examined pupils' reasons for their not choosing Mathematics as one of their six examination subjects. The similarities and differences that emerged from the comparison of information are listed below.

6.4.3.1 Similarities

1. For the majority of non - Mathematics pupils from both schools the main reason that they did not choose the subject was its difficult nature and pupils' lack of comprehension. For example, a City High pupil made the following statement :

   > I didn't chose Mathematics because it is difficult. I don't understand the subject.

   Similar sentiments were shared by a Capital Secondary pupil who wrote :

   > Because I feel I am weak in Maths. I really cannot understand Maths and it is quite difficult.

2. Another common and significant reason that respondents provided for their not studying Mathematics was their poor performance in the subject prior to Standard 8. Low marks and failure in tests and examinations resulted in

respondents excluding Mathematics as a future examination subject. This is evident in the following statement by a Capital Secondary pupil :

> I am unable to cope with Maths. I've been doing Maths in Primary school and I've noticed that my performance was very poor. I just could not achieve a pass in Mathematics.

This was also the reason why the following City High pupil did not choose Mathematics :

> When I was in Standard 7 I was not good in Mathematics. I decided that I would not be good at Mathematics in Standard 8. So I decided to leave Mathematics.

3. Respondents from both schools also referred to Mathematics teachers, their chosen careers and the effect of Mathematics on examination results as factors that motivated them in not choosing Mathematics as an examination subject. These themes are listed below and are substantiated by the responses of pupils from both schools.

3.1 Inappropriate teaching methods or bad Mathematics teachers prevented pupils from choosing Mathematics.

Response from a City High Pupil :

> I don't like Mathematics because I remember one day I didn't know an answer. The teacher took me outside and hit me with a stick and asked me to collect stones that I could count with. I was confused. After I collected the wrong amount of stones the teacher hit me again until I gave her the correct stones. From that day I started to hate Mathematics.

Response from a Capital Secondary pupil :

> I found Maths to be extremely interesting but could barely understand some sections. I felt that my Maths teachers were different. I say this because when I was in Standard 6 I had about five teachers (Maths) for the year and each one had a different method of teaching therefore I became confused and disinterested.

3.2 Pupils stated that they did not choose Mathematics because it was not needed for their chosen career.

Response from a City High pupil :

> There is no need for me to learn Mathematics because the work I want does not need Mathematics. It needs other subjects.

Response from a Capital Secondary Pupil :

> Because through my years in school I have been finding out information about being a air hostess which has been my greatest ambition. So I chose a course to fit and help me for my ambition. Maths was not compulsory.

3.3 Some respondents felt that if they had chosen Mathematics it would have affected their performance in other subjects since it was so demanding.

Response from a City High pupil :

> Because Mathematics needs you to study all the time and you will not be able to study the other subjects.

Additional statements made by the pupils of both schools on all of the above themes which were similar are listed in parts 2.1 to 2.5 of Appendix F.

6.4.3.2 <u>Differences</u>

1. A significant difference in the factors motivating pupils not to choose Mathematics was the reference to the courses available to pupils at the beginning of Standard 8. Pupils

from City High noted that they did not choose Mathematics mainly because of the other subjects in the courses that contained Mathematics. As discussed previously, these pupils had a limited number of courses available to them. This point is highlighted in the following statement made by a City High pupil who wanted to study Mathematics but was prevented from doing so because Physical Science belonged to the same course :

> I don't do Mathematics because of Physics. You know Mathematics is going with Physics. If you do Maths you must do Physics. My problem is Physics is very difficult for me and I wouldn't pass it. That is why I decided to drop Mathematics. I have no problems with Maths. Physics is the problem.

However, the responses of pupils from Capital Secondary revealed that these pupils had choices and that they were more interested in courses that did not contain Mathematics. This is evident in the following statement :

> Mathematics is very difficult for me and I prefer doing a domestic course.

Similar statements made by pupils from both schools on these issues are listed in parts 2.6 and 2.7 of Appendix F.

2. Another noticeable difference in the responses of the non - Mathematics pupils from both schools concerning their subject choice was the fact that some City High pupils stated that they did not choose Mathematics because they had difficulties when counting and could not think fast enough. This is evident in the following statement :

> Mathematics is not my favourite subject even when I was in lower Primary school. The reason for this is that I am not a fast thinker.

No Capital Secondary pupil made similar comments.

Additional statements made by City high pupils on this theme are listed in Part 2.8 of Appendix F.

6.4.4 Pupils' perceptions of Mathematics

The perceptions of the non - Mathematics pupils were analysed using similar procedures to those employed for the analysis of the perceptions of the Mathematics pupils. That is, the perceptions of the non - Mathematics pupils were examined by analysing their preference for Mathematics, their responses and their explanation for the rating of the importance of Mathematics and the advice that these pupils would give to a Standard 7 pupil on Mathematics or course selection and their views on whether more pupils should study Mathematics and how this could be achieved. The similarities and differences that emerged from this analysis of the perceptions of non - Mathematics pupils are listed below.

6.4.4.1 Similarities

1. The analysis of the data regarding the non - Mathematics pupils' liking for the subject revealed that the majority of the pupils from both schools did not like Mathematics (Table 6.35).

Table 6.35 : Numbers of respondents indicating their liking of Maths by school attended.

	CH	CS
Yes, very much	14	1
Yes, most of the time	3	3
No, not much	9	17
No, not at all	17	16
No response	3	2
Total	46	39

The explanations that pupils provided for their responses coincided with their reasons for not choosing Mathematics as an examination subject. The majority of pupils from both schools listed the difficult nature of the subject as being the main factor for their not liking Mathematics. For example a City High pupil wrote :

> When I am doing Maths I find that I don't understand the work. For me Mathematics is difficult to learn and to understand it.

Additional statements made by pupils from both schools on the difficulties of Mathematics are listed in Part 3.1.1 of Appendix F.

2. The responses of pupils concerning the importance of Mathematics was similar for both schools (Table 6.36).

Table 6.36 : Pupils' responses indicating the importance of Maths by school attended.

	CH	CS
Very important	23	19
Important	7	11
Not important	8	6
Not at all	5	3
No response	3	0
Total	46	39

The majority of the non - Mathematics pupils stated that they believed the subject to be important or very important. The dominant themes that emerged from the analysis of the explanations were the importance of Mathematics for jobs, entry into tertiary institutions and its use in a modern society. The statements made by pupils on these issues are listed in parts 3.2.1 to 3.2.3 of Appendix F.

3. When advising Standard 7 pupils regarding Mathematics and course selection, pupils from both schools had similar advice regarding hard work, correct studying methods, attention during lessons and completion of homework.

6.4.4.2 Differences

1. In addition to the difficulties that were experienced with Mathematics, Capital Secondary pupils also referred to the unexciting nature of the subject as a factor that motivated their dislike. For example one pupil stated

that :

> I find it to be quite boring and I sometimes lose complete interest in the subject.

Further statements that were made by Capital Secondary pupils on this theme are listed in Part 3.1.2 of Appendix F.

2. It was noticeable that more City High pupils gave positive replies for their liking of Mathematics than Capital Secondary pupils. However, the analysis of their responses showed that they mainly referred to the importance of Mathematics in obtaining work and the use of the subject in daily life. Capital Secondary pupils on the other hand referred to the challenges and the satisfaction gained when working with Mathematics. Some of the statements made by pupils on these issues are listed in Part 3.1.3 of Appendix F.

3. It was noticeable that when pupils referred to the importance of Mathematics for future employment, the majority of Capital Secondary pupils made specific reference to "good jobs" like their Mathematics counterparts (Part 3.2.1 of Appendix F).

4. Although the negative responses of pupils from both schools regarding the importance of Mathematics dealt with future employment, most Capital Secondary pupils provided explanations which took into consideration factors such as type of employment and contacts in the workplace. For example one pupil wrote :

> The subject is not a matter of life and death. In today's world whether you do Maths or any other subject it doesn't make a difference. Nowadays to get a job it is whom you know and not what you know. You can do Maths on the highest grade possible but tomorrow you'll never get a job, unless you have a contact.

5. The majority of pupils' responses implied that they would advise a Standard 7 pupil to study Mathematics in the future. However, there were significant differences in the advice given. City High pupils mainly referred to the importance of Mathematics in obtaining employment in the future. They stated that they would make Standard 7 pupils aware of this, thus encouraging them to study the subject. This is evident in the following statement :

> I will tell them to do this subject because the chances of getting work with Mathematics are plenty. Better than those who do General subjects.

Further comments by City High pupils on this issue are listed in Part 3.3.1 of Appendix F. There were 20 City High pupils who provided no responses to this question.

In contrast to the above, Capital Secondary pupils stated that they would enquire about the pupils' performance and enjoyment of Mathematics. Only if the responses were positive would they encourage a Standard 7 pupil to study the subject in the future. For example one pupil wrote :

> I would ask him or her if they enjoyed Maths, and if they understand it. If they say Yes, then they should give Maths a try. But if their answer is No then I would say don't do Maths. Firstly because its no use you doing a subject that you are not happy with and you know you are going to fail. Do a subject that you know you are going to pass, and that will help you pass matric.

Additional statements made by Capital Secondary pupils regarding their advice to Standard 7 pupils are listed in Part 3.3.2 of Appendix F.

6. The responses of non - Mathematics pupils from both schools regarding their opinions as to whether more pupils should study Mathematics were very similar to those of their colleagues who studied the subject. Although the majority of City High pupils stated that more pupils should study Mathematics, there was a significant number who gave negative replies or no responses (Table 6.37).

Table 6.37 : Numbers of respondents indicating whether more pupils should study Maths by school attended.

	CH	CS
Yes	21	29
No	18	8
No response	7	2
Total	46	39

Furthermore, there were 16 pupils who provided no explanations for their responses. Of those City High pupils who did provide explanations, previous explanations regarding the importance of Mathematics and the advice that would enhance pupils' performance in the subject were restated. However there were two pupils who made reference to the encouragement of parents and Mathematics workshops as methods that would encourage more pupils to study the subject. These statements are listed in Part 3.3.1 of Appendix F.

The majority of the non - Mathematics pupils from Capital Secondary as compared to those from City High stated that more pupils should study Mathematics. Although some of the explanations given by these pupils revealed that they too had merely restated previous responses, there were some explanations that raised pertinent points regarding the improvement of Mathematics teaching methods, extra tuition and the syllabus. For example a pupil had the following recommendation to make concerning teaching methods :

> If you brought professional teachers and televisions and high teck material to illustrate Maths better. Explaining a problem to a child on the chalkboard can be boring and unimaginative. But if one makes it exciting Maths can be enjoyed. Make Maths more fun - get better "teachers"

Additional statements made by the non - Mathematics pupils of Capital Secondary on these issues are listed in Part 3.4.2 of Appendix F.

The above analysis of the responses of the Mathematics and non - Mathematics pupils highlighted some important similarities and differences between the pupils who participated in this investigation. A discussion of some of the significant issues that emerged during this examination is presented in the following chapter.

CHAPTER SEVEN

RESEARCH FINDINGS AND INTERPRETATIONS

In this the concluding chapter of the investigation, the major findings that emerged from the analysis of data are discussed. These findings are then interpreted in relation to some pertinent Sociological paradigms. Thereafter, some of the issues that future research should take into consideration are addressed. This chapter ends with a discussion of the educational research implications of this study.

7.1 Discussion of major findings

From the analysis of the similarities and differences that were listed in the previous chapter, two significant points emerged. These were :

1. The learning experiences of the respondents from City High were significantly different from those of Capital Secondary pupils.
2. The great majority of pupils shared common perceptions regarding the importance of Mathematics.

The discussion that follows elaborates on these two points. In this discussion information regarding the Mathematics as well as non - Mathematics pupils has been integrated.

7.1.1 Biographical details

1. There was a significant difference in the ages of the two groups of respondents. City High respondents were considerably older than Capital Secondary respondents.

This is evident in the fact that whilst 62 % of the respondents were 16 years old, only 0,07 % of City High respondents were of the same age. Although political unrest was identified by pupils and teachers of City High as the main cause of educational disruption, other factors such as teenage pregnancies, limited finance and the need for some pupils to work in order to supplement the family's income were also listed as reasons for pupils spending more time in school than their Capital Secondary counterparts.

Instability in South African society and the inequitable distribution of resources because of the implementation of past apartheid policies have been major factors which have resulted in Blacks not having access to similar educational experiences as the other racial groups. The success achieved by GNU in addressing the plight of the disadvantaged in South African society will determine the extent to which all South Africans share in similar educational experiences. The significance of such success is also evident when one examines the next point.

2. Unlike the pupils from Capital Secondary, many of those from City High were unaware of the educational levels and occupations of their parents, especially in respect of their fathers. Discussions with pupils revealed that death, abandonment of family responsibilities and a lack of communication because employment away from home were the reasons for pupils not providing the required

information.

3. English was the medium of instruction at both schools. For all City High pupils however, this was a second language since an ethnic language was spoken at home. Capital Secondary pupils used English as their home language. It was also noticeable during the visits to City High that Zulu was the medium of communication between pupils and teachers outside the classroom(1).

If one accepts that Mathematics is universally considered to be difficult subject, the fact that some pupils have to learn the subject in a language that is foreign to them merely compounds the problem. Attention should therefore be given to the teaching of the subject in the form of new methodologies which would assist second language learners. Such methodologies must also be supplemented by textbooks and other teaching aids that address the plight of second language learners.

7.1.2 Pupils' future aspirations

1. The majority of respondents indicated that their chosen post - matriculation activity would be further education at a tertiary institution. However, pupils' responses revealed that those from Capital Secondary were more aware

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1. No observation of classroom activities took place. However it is interesting to note that during a Mathematics lesson this researcher observed at another township high school, the teacher wrote all necessary details in English on the chalkboard. The entire lesson however, (including pupils' responses) was conducted in Zulu.

of the requirements to fulfil such aims than City High respondents. The lack of career counselling at City High and the fact that many of these pupils had indicated only a single choice as their post - matriculation activity indicated that few pupils had formulated any definite plans - with alternatives - for their future.

2. The above issue is emphasised when one examines the career choices and pupils' views as to whether it would be possible for them to fulfil their future aspirations. The career choices that were presented by Capital Secondary pupils revealed that they had higher aspirations and that their choices were more varied than those of City High pupils. There was evidence to suggest that Capital Secondary pupils took into consideration their academic achievements as well as their personality traits when deciding on a career. It was apparent that these pupils were influenced in their choices by their families, teachers, guidance counselors and the media. City High pupils however, believed that their liking of a career or the fact that they were studying the appropriate subjects was sufficient for them to fulfil their career aims. Discussions with teachers and pupils at City High revealed that these pupils had been exposed to little information and formal guidance regarding careers and the requirements thereof.

The above two points can be addressed by the redistribution of the services of qualified teachers to

provide counselling for pupils in disadvantaged areas. This will impact positively on pupils' educational experiences. In addition, organised industry should be encouraged to establish links with schools in order to supplement career counselling. This could be done by sponsoring excursions to the workplace, providing temporary employment during vacations and arranging for experts to talk to pupils about specific careers.

7.1.3 Mathematics as an examination subject

1. For the majority of pupils the principal motivating factor for choosing Mathematics as an examination subject was the perceived importance of the subject for entry into tertiary institutions and future careers. However, whilst City High pupils believed that Mathematics was the key to obtaining employment in general, Capital Secondary pupils believed that the subject was necessary for "good jobs" and high status careers.

   As discussed in the introductory chapter one of the consequences of past apartheid policies was the restriction of Blacks to the levels of semi - skilled and unskilled workers. It is therefore not surprising that Black pupils have not been exposed to a multitude of careers, as is the often case with their counterparts in the other racial groups. This problem has been compounded by inadequate career counselling.

2. It is important to note that for the non - Mathematics pupils, factors such as the difficult nature of the

subject, poor performances in lower standards, inappropriate teaching methods, "inadequate" Mathematics teachers and pupils' played an influential role in their choice of examination subjects. Significantly, these pupils implied that if past circumstances had been better, they would have chosen Mathematics as an examination subject.

3. There were pupils from City High who indicated that they did not choose Mathematics since they had difficulties with counting in the lower standards and they believed that they could not think fast enough in order to study Mathematics successfully.

   The above two points are related to inappropriate teaching methods in Mathematics and misconceptions of the subject which are the result of such practices. The redistribution of the services of suitably qualified Mathematics teachers, retraining of existing teachers, introduction of innovative teaching methods and resources will contribute to enhancing the Mathematical experiences of pupils.

4. One of the more significant findings to emerge was the fact that City High pupils had very little choice in their examination subjects. This was mainly due to the limited number of courses available to them. Often pupils had no choice but to study Mathematics because it was combined with other subjects that they wanted to study. Conversley, some pupils enjoyed Mathematics and would have chosen it, but did not because they believed that the

remaining subjects in the course would prove to be too difficult and thus contribute to their failure.

Capital Secondary pupils were apparently not faced with such dilemmas. There were two reasons for this. Firstly, the variety of courses that were available was significantly greater. Secondly, even if a Capital Secondary pupil wanted to study a course that was not available, that pupil could easily attend one of the many neighbouring high schools where the course would invariably be available.

The introduction of additional suitably qualified teachers to the education system so that all pupils have access to subjects they want to study will result in pupils having more rewarding and enriching educational experiences.

7.1.4 Pupils' perceptions of Mathematics

1. Pupils' responses, when questioned on their preference for Mathematics, corresponded with the explanations given regarding their choice of Mathematics as an examination subject. Mathematics pupils cited factors such as their understanding and enjoyment of the subject as well as its practical and challenging attributes for their liking of the subject. On the other hand, non - Mathematics pupils listed factors such as their lack of understanding, the difficult nature of the subject and adverse classroom experiences for their not liking the subject.

2. Significantly, and despite the above differences between Mathematics and non - Mathematics pupils regarding their preference for the subject, the majority of pupils considered the subject to be either important or very important. In addition, it was also noticeable that the explanations given by these pupils for the perceived status of Mathematics mainly focused on themes related to the significance of Mathematics for future careers, the importance of the subject for entrance into universities and colleges, the need to know Mathematics in order to function effectively in a modern technological society, and the role played by Mathematics in improving one's thinking skills.
3. Related to the above, the majority of pupils' replies regarding their advice to Standard 7 pupils concerning Mathematics implied that they would advise these pupils to study Mathematics.
4. Most pupils believed that more encouragement should be given to pupils to study Mathematics in the future than the number that did then. Although there was very little constructive advice from City High pupils on how this could be achieved, Capital Secondary pupils had some innovative suggestions. Interestingly, these suggestions concerned teachers, teaching methods, revealing the importance of Mathematics and making pupils aware that the subject is enjoyable.

7.2 Interpretation of findings

Initially it was argued that a micro - perspective of pupils'

association with Mathematics was important as this would contribute to our understanding of the crisis in Mathematics education. In the discussion to follow some of the more pertinent Sociological paradigms are used to interpret the above research findings.

Despite the racial skewing in the percentage of matriculants studying Mathematics for examination purposes (refer to Table 1.2) it is apparent from the above findings related to pupils' perceptions of Mathematics that the majority of pupils from both schools had a positive affinity for the subject. This is evident in the fact that most pupils considered the subject to be important or very important, their advice to Standard 7 pupils to study the subject, and their belief that more pupils should choose Mathematics. Why then do relatively fewer Black pupils study Mathematics for examination purposes ?

An explanation may be derived from an examination of the findings related to the biographical details, future aspirations and the responses for not choosing Mathematics given by City High pupils. Even if one accepts that Mathematics is a difficult subject, it is obvious that for City High pupils factors such as instruction in a language that was not the home language, limited number of subject sets available, the lack of suitably qualified teaching personnel, inappropriate teaching methods, the disruptions to schooling and the poor family environment have had a major influence on the pupils' Mathematical experiences. It is also

evident that although some of these factors are relevant for Capital Secondary pupils, for the majority their experiences at school were more favourable than those of City High pupils.

Parts of the introductory chapter as well as Chapter 3 explained the differentiated system of education and the formulation of the South African Mathematics curriculum, which were the result of the apartheid policies of the past. It was evident from those discussions that education and especially Mathematics education was used as a means of oppression against the Black majority in South Africa. The evidence from this investigation tends to support that argument since all of the factors that were listed in the previous paragraph can be traced back to previous governmental polices which promoted racial differentiation. The inequitable distribution of finances for example, which resulted in Black education having the lowest expenditure per pupil has contributed to an educational environment in which there is a significant shortage of adequately qualified teachers, and other educational resources. In order to cope with these shortfalls schools invariably increased their pupil - teacher ratios and made fewer subject sets available to pupils in the SSP. Similarly, all the remaining factors, that is, medium of instruction, disruptions to education and the poor family background could invariably be traced directly or indirectly to the apartheid policies of the past. The influence of these factors, as was evident in the responses of City High pupils, resulted in inadequate

learning experiences which affected pupils' perceptions of Mathematics and their choice of the subject for examination purposes.

The attempted use of education to maintain the control of the dominant group in society may be explained with reference to the theories of reproduction. In Chapter 2 reference was made to critical theory as outlined by Bowles and Gintis (1976), Althusser (1977) and Bourdieu (1977). It was argued that these theorists emphasised the political nature of education by revealing the role that schools play in reproducing the inequalities inherent in society. Economy, state power and culture which have been the focus of these theorists, go a long way in explaining the existence of factors which have stifled Black education. However, it should be noted that theories of reproduction, which have been described as economic reductionism and determinism, are often critisised for the lack of consideration of factors pertaining to human agency.

In an attempt to overcome the limitations of the theories of reproduction, theorists such as Giroux (1983), Apple (1982), Willis (1977) and Molteno (1987) have examined resistance in education and the extent to which the ongoing struggles between groups have reproduced the status quo. The work of these theorists was also discussed in Chapter 2. They view schools, not only as sites of reproduction of the existing inequalities, but also as sites of contestation and struggle.

Therefore, according to Willis (1977) state schools and the oppositional culture within them are especially significant in revealing a circle of unintended consequences which act finally to reproduce not only a regional culture but the class structure and the structure of society itself.

Although during the course of this investigation no overt resistance in the form of rebellion against education and the process of schooling was noticeable, pupils' responses revealed that they had acquired strategies to cope with the difficulties of Mathematics. For example, despite their perceived importance of the subject which was informed by teachers, peers, parents and the media, the non - Mathematics pupils decided not to choose Mathematics in order to avoid failure. These pupils had chosen the "easier" route to obtain a matriculation certificate. In order to preserve their own self concept, these pupils have interpreted the circumstances that they found themselves in and based on this they made informed decisions. For them this is a sensible decision - Why study Mathematics and have a miserable time ? This discussion is significant in that it highlights the importance of an understanding of micro issues such as pupils' perceptions of a subject when investigating the educational process.

In addition to the above, the discussions on the findings that were presented at the beginning of this chapter reveal that reproduction theories cannot on their own explain the factors that have influenced pupils' perceptions of

Mathematics and their choice of the subject. The responses of City High pupils which revealed their understanding that Mathematics was not essential for their careers, the difficulties experienced by them when working with numbers, and their belief that one needed to think fast in order to study Mathematics, cannot be attributed to past education policies alone, but to common misconceptions related to the subject.

In Chapter 3 the discussion on culture and Mathematics revealed that structural factors are not the only factors that may influence pupils' perceptions and their choice of Mathematics. The discussion highlighted the importance of the Mathematics of traditional cultures by examining the concepts of counting, space and variety. The Mathematics of different groups in society was also discussed. The importance of such issues to this investigation is that they may be used to understand some of the above responses of City High pupils. For example, it cannot be discounted without any evidence to the contrary, that the difficulty experienced by City High pupils when counting (especially in a foreign language) is not associated with the methods used within their cultural group.

The above interpretations suggest that no single sociological paradigm can sufficiently account for the findings that have emerged in this investigation into pupils' perceptions of Mathematics. Although structural factors have played a significant contextual role in shaping pupils' perceptions of

Mathematics, the above discussion informs us that resistance to education and cultural influences cannot be discounted.

7.3 Implications for education

The creation of a single Ministry of Education in 1995 and the envisaged equitable distribution of educational resources holds the promise of redressing the atrocities of past education polices. This, together with social improvements, can only improve existing conditions. However, it must be accepted that normality in education cannot necessarily be achieved overnight or with large - scale investment in physical and human resources. It is therefore apparent that the crisis in Mathematics will remain with us for some time to come. Current policies in Mathematics education should examine alternate avenues which would begin to alleviate the inherent problems in Mathematics education.

The following consolidated list of recommendations draws on the earlier discussion of the major findings :

1. The revision of the Mathematics syllabus by taking into consideration the inputs of teachers and pupils. For example the inclusion of functional Mathematics, that is, Mathematics in relation to everyday life, in the current syllabus to enhance the practical nature of the subject.

2. Linked to the above point, the various ability groups as regards Mathematics need to be identified and the syllabus needs to altered to cater for them. For example, a modular system of education could be introduced with packages of

Mathematics being offered to pupils.

3. The system of evaluation that is used also needs to be reviewed. Pupils should not be judged solely on their performance in one examination at the end of schooling careers. Methods that advocate a system of continuous assessment which takes into consideration the performance of the pupil in everyday classroom activities needs to be implemented.

4. Textbooks and medium of instruction should be revised to cater for second language learners.

5. Innovative teaching practices which enhance the intrinsic value of the subject should be introduced. Included in such methodologies should be the use of existing teaching aids. There is therefore a need for informative teacher workshops on these issues.

6. Experts in industry should be used to address pupils on the importance of Mathematics for future careers. Links should be established with industry so that pupils are able to visit various institutions so that they may gain first hand experience of the uses of the subject.

In addition, it was apparent during the course of this research that there was a significant lack of research pertaining to the micro - issues of South African Mathematics education. It is believed that research in Mathematics foundation on which future Mathematics education policy

decisions could be based. The following areas for future research in Mathematics education became apparent during the course of this investigation :

1. Additional research needs to be conducted into the activities in the Mathematics classroom. Educators need to be aware of the success and failures in the Mathematics curriculum;
2. Related to the above, future research should also focus on content, teaching methodologies and learning programmes that might enhance the image of Mathematics. Pupils must be able to enjoy Mathematics, master it, and work at speed and with confidence.

In concluding this study, attention needs to be drawn to the fact that although the learning experiences of the two groups of pupils were different, both the Mathematics as well as the non - Mathematics pupils acknowledged the importance of the subject. This implies that the critical factor in pupils choosing Mathematics is their experiences with the subject.

Although macro issues such as the distribution of resources have undoubtedly impinged on the experiences of pupils in different learning environments, the findings of this study tend to suggest that factors within schools and especially within classrooms are what really count. Therefore, the recommendations for future classroom practice and areas of research that emanated from this study provide valuable insights on how the crisis in South African Mathematics

education can be addressed.

APPENDIX A

Courses selected by pupils in the SSP at Northdale Secondary

		Standard 10			
1	S 2	Maths	Physical Sc	Biology	Geography
2	S 7	Maths	Physical Sc	Biology	Accounting
3	S 10	Maths	Physical Sc	Biology	Music
4	C 1	Maths	Accounting	Economics	Bus.Eco
5	C 2	Maths	Accounting	Economics	Typing
6	G 35	Maths	Accounting	Biology	History
7	G 45	Maths	Geography	Biology	Music
8	G 46	Maths	Geography	Biology	Art
9	G 48	Maths	Geography	Biology	Accounting
10	G 50	Maths	Geography	Biology	Typing
11	G 51	Maths	Geography	Biology	Woodwork
12	G 52	Maths	Geography	Biology	Metalwork
13	G 98	Typing	Accounting	Biology	Geography
14	G 105	Biology	Accounting	Geography	Metalwork
15	G 131	Maths	Geography	Biology	Woodwork
16	G 254	Maths	Accounting	Geography	Music
17	N 10	History	Accounting	Typing	Bus.Eco

		Standard 9			
1	S 1	Maths	Physical Sc	Biology	History
2	S 2	Maths	Physical Sc	Biology	Geography
3	S 17	Maths	Physical Sc	Biology	Compt.Sc
4	C 2	Maths	Accounting	Economics	Typing
5	G 35	Maths	Accounting	Biology	History
6	G 48	Maths	Accounting	Biology	Geography
7	G 50	Maths	Geography	Biology	Woodwork
8	G 52	Maths	Geography	Biology	Metalwork
9	G 66	History	Geography	Biology	Typing
10	G 98	Typing	Geography	Biology	Accounting
11	G 294	Maths	Accounting	Economics	Comp.Sc

		Standard 8			
1	S 7	Maths	Physical Sc	Biology	Accounting
2	S 17	Maths	Physical Sc	Biology	Comp.Sc
3	C 1	Maths	Accounting	Economics	Bus.Eco
4	G 43	Maths	History	Biology	Typing
5	G 48	Maths	Geography	Biology	Accounting
6	G 51	Maths	Geography	Biology	Woodwork
7	G 52	Maths	Geography	Biology	Metalwork
8	G 294	Maths	Accounting	Economics	Comp.Sc

APPENDIX B

The questionnaire used in the study

PUPIL QUESTIONNAIRE

Dear Student

The following questionnaire forms part of a research project. Please note that there are no "right" or "wrong" answers to many of the questions : I am interested in your personal opinions.

PLEASE NOTE :

1. DO NOT write your name.

2. Please complete this questionnaire as fully as possible. If there are questions you cannot answer, leave these blank.

3. If you are unsure of anything, please ask.

4. Please make sure that you have SIX pages of questions.

5. Once again, I assure you that your answers will be read only by me.

6. Please hand in the completed form.

Thank you for your co-operation.

Yours sincerely

Sandras Appanna

1. Age : ____ years 2. Gender : Male [ ] Female [ ]

3. Home language : _____

4. How many members of your family are living with you at present? _____

5. What is the highest level of education of your parents ? (place a tick in the appropriate space)

	Father	Mother
no school education		
primary school		
high school		
college/technikon diploma		
university degree		
more than one university degree		
I'm not sure - don't know		

6. What is your father's occupation ? _____

7. What is your mother's occupation ? _____

8. a) Have any of your family members studied Mathematics after Matric ? _____

   b) If yes, supply details : _____

_____

_____

_____

9. On average, how many hours a week do you spend doing homework ? _____

10. How often do your family members assist you with your homework ? (place a tick in the tick the appropriate space)

frequently (eg. once a week)	
sometimes (eg. once every month)	
never	

11. Are you studying for a Matric Exemption ? _____

12. When you leave school what do you intend to do ? (mark your first choice...1 and your second choice...2)

study at a university full-time	
study part-time through a university	
study at a college or technikon	
study part-time through a college or technikon	
obtain full-time employment	
obtain part-time employment	
other (state)	

13. a) What occupation would you like to enter in the future ? _____

b) Do you think it will be possible for you to enter this occupation? (place a tick in the appropriate space)

Yes		No	

c) Explain your choice in 13.b) _____

_____

_____

_____

14. Is Mathematics one of the subjects that you are currently studying ? Yes [ ] No [ ]

15. Answer a) OR b) :

a) If Mathematics IS one of your subjects, why did you choose it ? _____

_____

_____

_____

_____

_____

_____

_____

b) If Mathematics is NOT one of your subjects, why did you not choose it ? _____

_____

_____

_____

_____

_____

_____

16. If you are studying Mathematics :

a) On what grade do you study the subject (eg. Higher or Standard grade) ? _____

b) What was the symbol you obtained in the last test for Mathematics ? ____

c) How many hours a week do you spend doing Mathematics homework ? _____

17. a) Do you like Mathematics ?
(place a tick in the appropriate space)

Yes, very much	
Yes, most of the time	
No, not much	
No, not at all	

b) What are some of the reasons for you answer in 17 a) ?

_____

_____

_____

_____

_____

_____

_____

18. a) Do you think Mathematics is an important subject ?
(place a tick in the appropriate space)

very important	
important	
not important	
not at all	

b) Give reasons for your above choice.

19. Of the six subjects you are studying for examination purposes, which is your favourite ?

20. If your answer in Question 19 is NOT Mathematics, what made you choose this subject ?

21. If you were allowed to, what advice, about Mathematics would you give a Standard 7 pupil who is about to make a subject / course selection ?

22. a) Do you think more pupils should study Mathematics than is currently the case ?

Yes +---+ No +---+
| | | |
+---+ +---+

b) If "Yes", what would help more pupils to do the subject ?

+--------+
|THE END|
+--------+

APPENDIX C

Copies of the letters giving departmental permission to conduct research at the chosen schools

Republic of South Africa
Republiek van Suid-Afrika

EDUCATION AND CULTURE SERVICE
ONDERWYS EN KULTUURDIENS

(EX ADMINISTRATION: HOUSE OF DELEGATES)
(EX ADMINISTRASIE: RAAD VAN AFGEVAARDIGDES)

☎ (031) 3606911 Fax: (031) 374261

Truro House
Trurohuis
17 Victoria Embankment
Victoria Embankment 17
Private Bag X54323
Privaatsak
DURBAN
4000

Ref. No. A10/29/2/45
Verw. No.

Enquiries D.P. Maharaj
Navrae

1994 -09- 09

Mr S. Appanna
E.P.S. Secondary
211 Bombay Road
PIETERMARITZBURG
3201

Sir

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT HEATHER SECONDARY SCHOOL

Your letters dated 1994-08-23 and 1994-09-01 have reference

1. Permission is hereby granted to you to conduct your research at Heather Secondary School provided that :

1.1 prior arrangements are made with the principal concerned;

1.2 participation in the research by pupils is on a voluntary basis; and

1.3 all information gleaned is treated confidentially and used for academic purposes only.

2. Kindly produce a copy of this letter when visiting the school.

3. The Department wishes you every success in your research and looks forward to receiving a copy of the findings.

for EXECUTIVE DIRECTOR

940908/res/tm

DEPARTEMENT VAN
ONDERWYS EN OPLEIDING

DEPARTMENT OF
EDUCATION AND TRAINING

Privaatsak X212
Private Bag
0001 PRETORIA
(012) 312-5080 Fax
Navrae/Enquiries: G D THERON

Verw. Ref. 15/1

Magister Building/-gebou
123 Schoeman Street/-straat 123
PRETORIA
"IMFUNDO"

1994 -09- 31

Mr S Appanna
35 Newlyn Road
Allandale
PIETERMARITZBURG
3201

Dear Sir

APPLICATION FOR CONDUCTING A RESEARCH PROJECT IN THE DEPARTMENT OF EDUCATION AND TRAINING

1. Your request to conduct research in the Department of Education and Training has been evaluated and approved.

2. Your application and relevant documentation have been referred to the Regional Chief Director: Natal Region, Private Bag X9026, PIETERMARITZBURG, 3200. Telephone (0331) 949454.

3. You are advised to contact the above Regional Chief Director to finalise the arrangements for your research.

Kind regards

ACTING DIRECTOR-GENERAL: EDUCATION AND TRAINING
W25M1350/rg

APPENDIX D

Information on subect sets

1. Subject sets available to SSP pupils at Capital Secondary during 1994. English and Afrikaans are compulsory subjects.

No.	Code	Subjects			
1	S1	Phy.Sc.	Maths	Bio.	Hist.
2	S2	Phy.Sc.	Maths	Bio.	Geog.
3	S7	Phy.Sc.	Maths	Bio.	Accounting
4	S9	Phy.Sc.	Maths	Bio.	Home Economics
5	S11	Phy.Sc.	Maths	Bio.	Art
6	S15	Phy.Sc.	Maths	Bio.	Tech.Dr.
7	S16	Phy.Sc.	Maths	Bio.	Speech and Drama
8	S17	Phy.Sc.	Maths	Bio.	Computer Studies
9	G14	Phy.Sc.	Maths	Geog.	Computer Studies
10	G19	Phy.Sc.	Maths	Geog.	Tech.Dr.
11	G31	Phy.Sc.	Maths	Tech.Dr.	Metalwork
12	G276	Phy.Sc.	Maths	Geog.	Computer Studies
13	G277	Phy.Sc.	Maths	Acc.	Computer Studies
14	G289	Phy.Sc.	Maths	Hist.	Computer Studies
15	G35	Maths	Bio.	Hist.	Acc.
16	G48	Maths	Bio.	Geog.	Acc.
17	G52	Maths	Bio.	Geog.	Metalwork
18	G57	Maths	Bio.	Typing	Acc.
19	G75	Bio.	Hist.	Art	Woodwork
20	G76	Bio.	Hist.	Art	Metalwork
21	G77	Bio.	Hist.	Acc.	Typing
22	G80	Bio.	Hist.	Acc.	Woodwork
23	G82	Bio.	Hist.	Bus.Eco.	Typing
24	G84	Bio.	Hist.	Bus.Eco.	Woodwork
25	G85	Bio.	Hist.	Bus.Eco.	Metalwork
26	G86	Bio.	Hist.	Typing	Woodwork
27	G88	Bio.	Hist.	Typing	Housecraft
28	G198	Bio	Hist.	Typing	Home Eco.
29	G89	Bio.	Geog.	Art	Housecraft
30	G98	Bio.	Geog.	Acc.	Typing
31	G99	Bio.	Geog.	Acc.	Bus.Eco.
32	G100	Bio.	Geog.	Bus.Eco.	Typing
33	G101	Bio.	Geog.	Bus.Eco.	Woodwork
34	G102	Bio.	Geog.	Bus.Eco.	Metalwork
35	G103	Bio.	Geog.	Bus.Eco.	Housecraft
36	G104	Bio.	Geog.	Acc.	Woodwork
37	G105	Bio.	Geog.	Acc.	Housecraft
38	G107	Bio.	Geog.	Typing	Housecraft
39	G201	Bio	Geog.	Typing	Home Eco.
40	G187	Phy.Sc.	Maths	Acc.	Tech.Dr.
41	G130	Maths	Bio.	Bus.Eco.	Tech.Dr.
42	G202	Maths	Bio.	Hist.	Speech and Drama

No.	Code	Subjects			
43	G203	Maths	Bio.	Geog.	Speech and Drama
44	G204	Maths	Bio.	Acc.	Speech and Drama
45	G205	Maths	Bio.	Home Eco.	Speech and drama
46	G209	Bio	Hist.	Home Eco.	Speech and Drama
47	G210	Bio	Geog.	Home Eco.	Speech and Drama
48	G220	Maths	Bio.	Tech.Dr.	Metalwork
49	G221	Maths	Geog.	Tech.Dr.	Metalwork
50	C1	Maths	Eco.	Acc.	Bus.Eco.
51	C2	Maths	Eco.	Acc.	Typing
52	C5	Maths	Eco.	Bus.Eco.	Typing
53	G231	Bio.	Geog.	Typing	Speech and Drama
54	G278	Maths	Bio.	Acc.	Computer Studies
55	G294	Maths	Acc.	Eco.	Computer Studies

2. Subject sets selected by SSP at Capital during 1994.

	Standard 8			Standard 9			Standard 10		
Sets	Boy	Girl	Tot.	Boy	Girl	Tot.	Boy	Girl	Tot.
S1	6	5	11						
S2	19	7	26	12	7	19	6	1	7
S7	6	16	22	17	24	41	7	23	30
S15							6	1	7
S16	4	3	7						
S17	14	6	20	6	8	14	3	9	12
C1	7	15	22	11	8	19	15	8	23
G19							11	0	11
G35	0	15	15	0	20	20	2	23	25
G48	8	12	20	6	18	24	4	8	12
G52	29	0	29	21	0	21			
G98				0	7	7	0	15	15
G99				5	0	5	16	11	27
G100				7	15	22	9	8	17
G101	20	0	20						
G198	0	15	15						
G201	0	20	20	0	11	11			
G202	4	11	15						
G210	0	6	6	0	9	9			
G231				12	2	14			
G277				5	1	6	3	1	4
G278							2	0	2
G294							1	0	1

3. Optional streams available to JSP pupils at City High.

Streams	Subjects
Stream 1	Acc. / Hist. and Geog.(1)
Stream 2	Acc. / Bus. Eco. / Typing
Stream 3	Bus. Eco. / Typing / Home Eco.
Stream 4	Bus. Eco. / Hist. and Geog.

4 Optional streams available to SSP pupils at City High.

Streams	Subjects
Stream 1	Maths \ Phy. Sc. \ Bio. \ Acc.
Stream 2	Maths \ Acc \ Eco. \ Bus. Eco.
Stream 3	Maths \ Afrik. \ Bio. \ Home Eco.
Stream 4	Afrik. \ Bio. \ Hist. \ Geog.

5 Number of pupils studying the optional subjects at City High during 1994.

Subjects	Std 8	Std 9	Subjects	Std 8	Std 9
Afrik.	58	131	Hist.	67	96
Maths	62	64	Geog.	67	97
Phy. Sc.	16	27	Eco.	26	32
Bio.	103	152	Bus. Eco.	46	59
Acc.	42	45	Home Eco.	20	32

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1. This was treated as a single subject with History and Geography making up the syllabus. Equal lesson time, marks and assignments were devoted to the differing subject matter. One City High teacher compared this to General Science in which aspects of Physical Science and Biology are combined.

APPENDIX E

Additional statements made by Mathematics pupils

1. Pupils future aspirations

1.1 City High pupils' reasons for achieving their future career goals

Studying relevant subjects

I have experience in commercial subjects. (chartered accountant)

Because management is relevant to the subjects I have chosen. (manager)

I take these subjects to help me become what I want to be. (mechanic)

Because I'm doing commercial subjects which is a practical subject and I always work hard especially in Accounting so as to pass it. (charted accountant)

Liking for or interest in the career

It is the only job that I will enjoy doing. I also feel I will be good at it. (teacher)

Desire to improve conditions

I like to be a English teacher because I need to help people who are not educated.

Financial reasons

If you want to be a policeman you train for only six months and you pay less for training.

Because my father and mother already have money for my education. (doctor)

I'm going to apply for a bursary. (physiotherapist)

1.2 Capital Secondary pupils' reasons for achieving their future career goals

Good marks in relevant subjects

The requirements to study Chartered accounting at university are being met by academic results.

I am presently studying a course which entails subjects based on the sciences eg. Physics, Biology and my symbols in these subjects have been good enough, I think that to enable me to pursue a career in the science field. (any career in the science field)

I do very well in Accountancy at present and I enjoy the subject. My aggregate for the last exam was a "B". If I keep this up, I should be able to enter this field. (accountant).

Financial reasons

If I want to make something work I would go out and do it. Furthermore my father has ensured me that he would send me to university. (doctor)

I know that my parents have or will have the sufficient finance and I can work hard and consistently. (doctor)

My results meet the requirements of university and I can afford it.

Existing job opportunities

With the changing situation in S.A. the country is becoming developed and more importance is being placed on nature and the effects development has on it - especially on land. (geologist)

Maths and Physics results are relatively high. Availability of jobs in this field. Shortage of chemical engineers in S.A. This field has not been exhausted. (chemical engineer)

The influence of adults

Since my dad is a policeman I have access to all his law books - I have a keen interest in law - especially capital law. My family are encouraging me as well. (lawyer)

There is a demand for physiotherapists - I read this in a booklet that was given to me earlier this year by a teacher.

1.3 City High pupils reasons for not achieving career goals

Family considerations

Because I haven't got a father who can help me. I only have a mother.

At home we haven't got enough money. And I'm not living with my father.

Financial constraints

Because there is a shortage of money.

Because my family does not have enough money, I have a financial problem. I will try by all means to enter the doctor's school at Medunsa.

Because I think my parents may not have enough money.

1.4 Capital Secondary pupils' reasons for not achieving career goals

Poor academic results

May not be accepted. Only the top 50 matriculants get into medical school.

Financial constraints

Probably because of financial difficulties or I will not be good enough.

2 Reasons for choosing Mathematics as an examination subject

2.1 Needed for future career

Responses from Capital Secondary pupils

I chose Mathematics because if I am unable to pursue my career as a doctor, I can study other subjects to attain another career.

I knew from the outset that I wanted to get into the medical field thus Maths was essential.

If you are going to do engineering after school,

you need Maths - so I chose it.

Responses from City High pupils

I've chosen Mathematics because if you want to be an accountant you must study Mathematics.

I chose it because I want to be a doctor. If you are a doctor there are many uses for Mathematics.

Since I want to be an administration manager I must have Mathematics in my Std 10 certificate.

2.2 Needed for university or college enterance

Responses from Capital Secondary pupils

I need Maths to gain entry to a university.

Your Maths mark is one of the marks that are looked at when you are entering college or technikon.

Response from a City High pupil

Because Mathematics is a subject that is very important if you want to go to technikon - you can only enter if you are doing Mathematics.

2.3 Mathematics is important in modern society

Responses from Capital Secondary pupils

It is a subject that is essential and important in our modern world. Without Mathematics you cannot become somebody.

In my opinion it is vital for one, regardless of whether one intends on staying at home and not studying or working, one needs Maths as it is very important in ones everyday activities. If you want to succeed in life -that is get a tertiary education and a job -you need Mathematics.

Response from a City High pupil

I chose it because it helps me to understand lots of things in life.

2.4 Mathematics improves one's thinking skills

Responses from Capital Secondary pupils

Mathematics increases one's ability to think logically. It also teaches us to apply what is learnt.

Mathematics makes you really think and it teaches you to analyse problems.

Mathematics is a daily convenience in life. Better understanding and comprehension when it comes to problems, eg. plan of a house, building, etc.

Responses from City High pupils

It improves my thinking - I able to think fast by studying Mathematics.

I chose it because it improves my mind.

2.5 Mathematics is necessary for "good jobs"

Responses of Capital Secondary pupils

Mathematics is an important subject for a good job. So basically I chose Maths to help me get a job.

It is one of the major requirements for most good jobs today. Without Mathematics job opportunities in the real world are limited.

I feel that Mathematics is one of the most important subjects today. Everything in the world uses Mathematics in some way. Therefore, in order to get a good job Mathematics is a must.

2.6 Increases employment opportunities

Responses of City High pupils

If you do Mathematics there are more job opportunities when you finish matric.

It is because Mathematics helps one to do any work. If you haven't studied Mathematics you are like a country without a president. So you must make sure you have this subject.

Because it makes it easy to get a job and if you go to university Mathematics is needed.

2.7 Mathematics is enjoyable

Responses of Capital Secondary pupils

Maths is exciting. It is a subject that makes you think. Also I love Maths and I have loved Maths before choosing my course.

I enjoy working with numbers and trying to work out problems, it is difficult and I don't like to back down from something that is difficult. Maths is quite interesting.

I love Maths, I not only enjoy the subject as a whole but I like challenges too. Playing with figures and shapes => (geometry) - is what I find exciting.

Responses from City High pupils

Because for me Maths is easy and I know how to study it.

Mathematics makes you think, it is a challenging subject.

It is a subject that keeps me thinking all the time.

2.8 Mathematics was part of the chosen course

Responses from Capital Secondary pupils

I had to do it because it was part of the course I wanted to do.

It happened to be in the course I chose, along with the other subjects that I like eg. Physics.

Responses from City High pupils

I did not choose Maths but was forced by the other subjects that I am studying which go with Maths.

I didn't chose it, but was forced to study it because it also goes with my favourite commercial subject, Accounting.

I chose it because the course that I wanted to study had Mathematics. I didn't chose it because I like it or know it.

3 Pupils' perceptions of Mathematics

3.1 Pupils' preference for Mathematics

3.1.1 Positive responses

Statements from City High pupils

Enjoyable subject

Mathematics is a good subject. It is easy to understand.

I like Mathematics because it is practical as well as theoretical subject.

I understand Mathematics. I even treat Mathematics as a game. I enjoy doing Maths.

Important for the future

Because it can help me to achieve my goals.

I wish to be a doctor in the future. You must have Maths as a subject for this.

Mathematics teaches me how to manage problems and things which are going to help me in the future.

Statements from Capital Secondary pupils

Certain sections are interesting and enjoyable

Some parts of Maths are interesting, there are other ares I think, that are stupid. The interesting parts get you thinking and as a result you like Mathematics more and more.
I find it very interesting that figures can be arranged in such a way that they can provide us with more meaning. I enjoy working with numbers - arranging and rearranging them. Maths is also a challenge and is a good test that reveals capability and comprehension ability.

It is interesting like when we have to solve the brain teasers.

Mathematics is challenging

It poses a great challenge. It is easy and one can easily obtain good results. It test ones thinking capability and prepares one for the outside world.

Mathematics is interesting and sometimes fun. But I like it most of all because of its challenges.

It makes you think. Its a matter of applying the theory that you have learnt. There isn't a set answer for a problem There are a variety of solutions.

No swatting required

Mathematics offers challenges in problem solving. It is also a diverse subject which involves logical thinking -> no swatting.

Working with numbers is better than learning a swatting subject.

Makes one feel good

I like to solve extremely hard problems because the feeling is great.

It makes me feel good when I solve a difficult problem.

Good Mathematics teachers

I have an excellent teacher. He explains things fully and makes it easy as possible to learn.

The present teacher has splendid techniques of teaching Maths.

Now that I have a different teacher who explains and teaches well, I understand everything.

3.1.2 Negative responses from

Statements from City High pupils

Mathematics is difficult

Because Mathematics is a very difficult subject. Sometimes the teacher shows us how to do it but when I go home I have problems with it.

First of all it is difficult to understand. If you study it you must consider each and every step of the particular problem you are solving.

Mathematics is just a waste of time and energy. There are many useless things in Mathematics, eg. x, y, x2, square roots, parallel lines, etc.

It is part of the chosen course

The reason is that I do Mathematics because of the course that I want to do needs it. Not because I like it.

It is because my other subjects need Mathematics.

Statements from Capital Secondary pupils

Mathematics is difficult

It is difficult to solve problems especially when the work is not understood.

At times one gets totally lost and it is difficult to get back from there.

Sometimes the subject gets too complicated and tricky and I cannot find solutions. I then tent to get frustrated and hate it.

Mathematics is not exciting

Mathematics is not very exciting. I would rather be doing something else.

3.2 The importance of Mathematics

3.2.1 Mathematics is required for future careers

Responses of City High pupils

Each and every course in this world needs a good symbol in Maths. You cannot be employed if you do not have Mathematics in your certificate. Especially those who study commercial subjects as well as science.

If you need a good job you have got to have Mathematics.

Yes, Mathematics is a very important subject because may jobs require people who have studied Maths and know it well.

Responses from Capital Secondary pupils

Most careers require a knowledge of Mathematics. More opportunities are presented to people who have studied Mathematics.

In order to get a good job one must have an understanding of Mathematics. I think the business world depends greatly on Mathematics.

Most jobs require you to have done Maths. If you do not do Maths it is difficult to get a job.

3.2.2 Required for entrance into tertiary institutions

Responses of City High pupils

Yes it is important, because at the colleges or technikon if you want to be a teacher or accountant you need to know Mathematics.

If you want to go to a college you must have a Mathematics symbol to qualify.

Its because people cannot go to university without Mathematics especially if you are a student of commercial subjects.

Responses from Capital Secondary pupils

Basis of tertiary education. Widens ones perspective in technology and logic. Most "professional" jobs (nuclear physics, chemical engineering) require Higher Grade Maths at university. One is left with a very cramped list of Subjects (degrees) at university when Maths had not been studied at secondary level.

One needs Maths to get into a tertiary level of studying.

Mathematics is essential to get into varsity or to get a job.

3.2.3 Needed in modern society

Responses of City High pupils

In order to do things in this world you've got to know Maths.

I think Mathematics is important to everybody so that people know how to count.

It because our world is controlled by Mathematics.

Responses from Capital Secondary pupils

Mathematics is used in every aspect of your life. Your daily interactions with people has something to do with Maths. Its vital to know Mathematics for you to understand how systems around you work.

Maths is something that is all around us. We need to know Maths to carry on with our daily lives.

Mathematics is needed in everything and everywhere. I feel that you cannot do most things without it.

3.2.4 Mathematics improves thinking skills

Responses of City High pupils

Mathematics helps one to have a fast mind especially when counting things.

Because if you do Mathematics your mind becomes very fast at all things that you do.

Mathematics makes people to think.

Responses from Capital Secondary pupils

It exercises your mind. It makes you think and to use what skills you never knew existed. I find it surprising that I can solve certain things if I use the basics. If you look at something and say you can't, you won't. But if you apply yourself, your skills and rules it will help you to show-off what you have.

It helps in developing students thinking and reasoning abilities. It also gives pupils a chance to improve their skills which will enable them to solve problems in other subjects which require application of work eg. Physical Science.

Mathematics developes reasoning and logical thinking.

3.3 Advice to future Mathematics pupils

Responses from City High Pupils

The advice that I will give a Standard 7 pupil is that if you are Mathematics student you need to listen to your teacher teach so that you can understand the work. If you do not understand you must ask your teacher to explain again. Mathematics also requires a pupil to practise a lot.

I will tell them that Mathematics is an important subject in our lives. It is not a difficult subject. This subject is not only for the brilliant pupils. If you do Mathematics you are supposed to do a lot of problems at home. You are supposed to understand the chapter before the teacher teaches the class. This will make it easy for you to understand.

Mathematics is easy because you do not study it but you practise it in order to know it better. If you have been given homework try and do it at home. Don't copy in the classroom.

Responses from Capital Secondary pupils

I would advise them to chose the subject as it is important, even if they are unable to keep it on Higher Grade. Maths is important because the best and interesting jobs need a person to have studied Mathematics in school and after school.

If Maths presents a problem ie. you find it difficult to comprehend a Mathematical problem then other subjects should be considered. If you have an occasional problem with the subject that can be overcome Maths should be considered when choosing a course.

It is nice but if you don't enjoy it and feel that you don't need it then it isn't for you as a subject.

3.4 Suggestions on what would make more pupils study Mathematics

3.4.1 Responses from City High pupils

Reveal the importance of Mathematics

Pupils must be made aware that Mathematics is an important subject in commerce. Mathematics is useful in business, science studies and technology.

Pupils must be made aware of the fact that many schools in Black communities do not have Mathematics teachers. If more pupils study Mathematics then there will be no school without a Mathematics teacher and Black communities will get better jobs.

Mathematics is very helpful to those pupils who would like to have bright future.

3.4.2 Responses from Capital Secondary pupils

Better teachers

Firstly, a good teacher makes a good pupil. Therefore if a person teaches well, then a pupil would learn better, and also understand better. Maths teachers should have a different way of teaching, by this I mean they should not take the subject so seriously. Of course it is important but it must be enjoyable too.

I think if the teachers would stop saying it gets much more difficult as one moves each year to the next standard. It would also help if the teachers encouraged the pupils to study the subject. Also if the teacher would make the classes more exciting and laugh a little with the students. I the teacher would pay more attention to the students who are not very good at Maths instead of giving their attention to those who know Maths. Most students dislike Maths because they do not understand it. Understanding Maths is what makes a student know more, like and enjoy the subject. If the teacher is not encouraging and enthusiastic towards the student, the student is turned away from Maths as a subject to chose.

Availability of teachers who are well versed with how to teach Maths.

Improved teaching methods

Teachers should devise new ways of introducing ideas so that the concept will be remembered by the pupil.

The teacher should question his / her students as to whether his teaching methods are efficient. If not, he / she must rectify their methods.

Introduction of teaching methods whereby the subject is made easier.

Emphasis on Primary school

Pupils must receive a good grounding of Maths in Primary school.

Good Maths teachers from Primary school.

Extra time should be spent on Mathematics

More lesson time should be allocated to Maths.

More time should be spent on difficult sections and work should be revised. More revision and making Maths fun will encourage more students.

There should be more time for the subject in order to fully understand all the concepts.

Make Mathematics enjoyable

More Maths outings. Brighten the children's horizons, show them what fun Maths is and how simple it could become if they are willing to work.

Motivate pupils about the subject. Remove the fear of the subject. Display the skills that would make it easier to study and understand Maths.

Reveal the importance of Mathematics

Encouragement of important the subject is. Constant reminders about the fact that without Maths they might not be able to capture their dreams.

If a positive attitude towards the subject is to be created, then people should be made aware of the importance of Maths in ones career.

Younger students who are just about to make course selections are probably afraid to take Maths because of the horrible pictures that have been painted about the subject. Students should be encouraged to see the good side of Maths - the side that is going to help them. It would be more beneficial to them.

3.5 The status of examination subjects

3.5.1 Responses from City High pupils

English

The thing that made me choose this subject is that English is an important language because it makes us understand what other people say. For example, I am a Zulu speaking girl. If I visit a place where they don't understand Zulu I'll use English to communicate with them. In our school all subjects are taught in English except Zulu.

I think English is important to everyone because in these days everyone people use English a lot and if you don't know it you may find that you are at a loss. It is not only used where we live but also in many countries.

Because I think English is a basic subject since almost all other subjects are explained in English except for Afrikaans and Zulu.

Accounting

Because my understanding of Accounting is good. It is the key to the job that I want to do in the future.

I choose this subject because this subject because I like it very much and I want to be an Accountant.

Physical Science

I understand Physical Science better than other subjects.

Physical science is one the subjects that I need to fulfil my goals in life.

I like Physical Science because I want to become an electrician and this subject has provided me with some knowledge about this job.

3.5.2 Responses from Capital Secondary pupils

Physical Science

I always liked it and it intrigued me with all the inventions and experiments. I chose it because it involves practical work and I like this because it lets me to get in contact with the subject.

I like it because it's exciting, challenging and complicated. It's a little like Maths but a lot more work and I enjoy the experiments and the learning of the scientific discoveries. I like to keep up with technological advancements.

Physical Science takes a great deal more concentration and knowledge to perform. It brings about an enhanced state of thinking. It makes one familiar with the realities of life.

Biology

Biology is a subject that interests one, as it makes one understand the various things about the environment and even the human and animal body. When you look at things around you, you are not ignorant of what it is and how it was formed. I like learning about those aspects or life.

I haven't had to change my grade. I've always attained either an A or B and it is simpler to understand. Besides Biology, is fascinating and interesting. It's amazing about how much one can learn about ones body, the animals and nature.

I am interested in nature and how the plants and animals function. Through practical experience it is easy to understand.

Geography

It is interesting, it is mostly easy to know the work because it is mostly general knowledge and one can understand Geography very easily - it is not difficult.

Although there are a lot of notes, Geography is mainly general knowledge, and I am quite good at general knowledge. It's enjoyable to learn.

APPENDIX F

Additional statements made by non - Mathematics pupils

1. Pupils' future aspirations

1.1 City High pupils reasons for achieving their future career goals

Studying relevant subjects

Since Standard 6 I am doing well in History and even English and Afrikaans is not a problem. (lawyer)

Because I like it and my subjects allow me to do this job. (traffic cop)

It is possible because it is my wish and I am studying the relevant subjects that are needed when you want to be a pilot. My weight and height is right.

Liking for or interest in the career

Because I want to teach young people. (teacher)

Because I want to know how to repair engines and how to repair my car. I want to work at the Toyota factory. (mechanical engineer)

Desire to improve conditions

Because there are lots of children who live on the streets and look for food in dust bins. So if I become a social worker I will be able to care for them.

In my country there are many people who are sick but there is no one who can help them because there are few nurses. (nurse)

1.2 Capital Secondary pupils reasons for achieving their future career goals

Studying relevant subjects

I am doing a course at school which would assist in either of my choices after school. (flight attendant / teacher)

I want to be a secretary. At the moment I am doing the right subjects at school.

At the moment I'm good at Typing and have two of my subjects on the Higher Grade - Biology and Business Economics which would help me in nursing.

For nursing one needs to do Biology on the Higher Grade and two more subjects - which I am doing.

Because I am doing the subjects that I need on the Higher Grade. I am doing the subjects that need to be done. (laboratory assistant)

Possess correct disposition and ability

Because I know for a fact that I have the potential and ability. All I need to do is to get my exemption and be dedicated towards my tourism course at the college. (air hostess)

I work well with sick and injured people. I don't fright to see blood or a dead person or clean people who are injured or sick. (nurse)

I am calm and caring. This would help me when I have to deal with older people. (nurse)

Family established in chosen profession

My father is a machinist and maybe he can help me in obtaining a job. (factory worker)

I have uncles and aunts in the navy. (sailor)

1.3 City High pupils' reasons for not achieving career goals

Financial constraints

I think the problem might be finance because my father does not earn enough money.

1.4 Capital Secondary pupils' reasons for not achieving career goals

Not studying Mathematics

I have not done Maths as a subject in my course. (nurse / paramedic)

2 Reasons for not choosing Mathematics as an examination subject

2.1 Difficult and not easy to understand

Responses from City High pupils

I didn't choose it because it is very difficult - it needs people who are hard working.

Because I can't understand at all. When the teacher gave me homework I couldn't remember what the teacher told me at school.

I don't like Mathematics because I don't understand some of its content like Geometry. Mathematics is difficult and it needs good people and hard workers.

Responses from Capital Secondary pupils

From Standard 6 onwards I always disliked Maths. I could never understand it. It always confused me. I found Maths to be difficult and I often failed it.

I don't understand Maths. I find it to be very difficult.

It is a subject that I would never understand. There are too many problem solving questions which I never understood from Primary school.

2.2 Bad performance in lower Standards

Responses from City High pupils

It is because in Standard 6 I had no time to study and I performed badly. That changed my attitude towards Maths.

From Standard 3 to Standard 6 I did not do well in Mathematics. That is why I did not choose it

I saw no reason for choosing Mathematics whilst I know I am not doing well in it.

Maths was a difficult subject for me in Standard 6. I therefore decided to do History and Geography.

Responses from Capital Secondary pupils

I have always found it to be difficult and confusing and I failed Maths in Standards 6 and 7.

I had low marks in Maths in Standard 7 and I didn't really apply myself fully towards trying to understand Maths.

In Standard 7 I used to have bad passes in Mathematics and I felt that I would not better myself.

2.3 Teachers and teaching methods

Responses from City High pupils

My class teacher was not teaching us well.

I did not choose Mathematics because when I was in Standard 8 I had a problem with my Mathematics teacher. Therefore when I decided to return to school I left out Maths.

Responses from Capital Secondary pupils

Because I never liked Maths. The teachers just put me off from doing the subject.

2.4 Mathematics not necessary for chosen career

Responses from City High pupils

To be a lawyer you need other subjects - not Mathematics.

I do not think that Mathematics is necessary for the work that I want to do. When you repair a car we use tools.

Responses from Capital Secondary pupils

When I was in Standard 6 and 7 I felt Maths very difficult. I found that I was totally weak in this subject and I hated this subject. When the time came for me to pick a course I decided to pick a non - Maths course because there was no use for Maths in my future -> pastor.

Certain jobs and posts do not require Maths.

2.5 Mathematics effects the results of other subjects

Responses from Capital Secondary pupils

Maths is hard and complicating. If I had to learn for the examination and I was doing Maths I would have to be with my Maths books and have less time for my other studies.

If I had chosen Maths I would not have been able to cope with my other subjects.

In the past I found Maths to be a difficult subject. If I really learnt Maths I found it is a bit difficult to cope with the other subjects including English and Afrikaans.

All along, even in Primary school I was not good in Mathematics and I felt that when I write for my matric exception I would not get it because Maths would be the subject that would let me down.

2.6 Prefer other courses

Responses from Capital Secondary pupils

Firstly because I dislike Maths. And I feel Maths is difficult. The course I am doing presently is the course I wanted to do.

2.7 Structure of courses

Responses of City High pupils

My reason is that Maths is placed with other subjects. I like Biology, History, etc. and Maths is placed with Economics and Accounting.

I don't do Mathematics because I am doing Geography and History.

2.8 Fast thinking

Responses of City High pupils

Maths needs people who think very fast and I can't do that and it is difficult.

I had a problem in Maths - counting and in fast counting.

Because I am not fast in counting. I am sometimes confused when counting. So that is why I did not choose Maths.

3 Pupils' perceptions of Mathematics

3.1 Pupils' preference for Mathematics

3.1.1 Mathematics is difficult

Statements from City High pupils

I don't like to do Mathematics because it is too hard. It is more difficult than any other subject.

I don't understand it. For me it is very difficult.

Statements from Capital Secondary pupils

I find it to be very difficult. I cannot cope with it.

I feel it is very hard. Some of the questions I do not understand. I tried very hard to do Maths and answer questions but I felt is was not easy.

It is highly confusing.

Complicating. Hard to learn. Too much notes. Too many sections.

There are lots of formulae to learn. Different examples have different ways to work it out. In geometry there are different theorems to remember.

Firstly it is too complicated. Too many methods and steps to follow. Most of the time you forget what you learnt or what you did in the classroom.

3.1.2 Mathematics is not exciting

I find it to be quite boring and I sometimes lose complete interest in the subject.

It is a difficult subject that is sometimes boring especially when one has absolutely no idea about what is going on.

3.1.3 Statements from City High pupils

Needed for jobs

Because Mathematics is important. Every job needs Mathematics.

If you do Maths you will be able to find better jobs in banks and offices.

I like Mathematics because it could help me become a policeman.

It is because with Maths you have a good chance in doing Chemistry, being a doctor and other profitable jobs.

Helps in daily life

Because sometimes we need to count things - if you go to the shop to buy groceries and to count the change.

Helps you to think fast and to count money.

Statements from Capital Secondary pupils

Mathematics is challenging

It is fun it keeps your brain working by solving problems and working out angles and things.

Makes one feel good

I enjoy working with numbers. It keeps my mind and brain working. I feel intelligent when I do Maths.

3.2 The importance of Mathematics

3.2.1 Mathematics increases job opportunities

Responses of City High pupils

It is important because there are many jobs that require Mathematics. There may be some job that you like but cannot enter if you don't have Mathematics.

There are no jobs that do not require Mathematics.

If you want a good job you must do Mathematics.

Maths gives you a good chance in so many things in this life. When you do Maths you are going to have a good chance in your career.

It is important because if you want a job like nursing you can't if you haven't got Maths.

In most of the skilled jobs they require Mathematics.

Responses from Capital Secondary pupils

If you want a good job and if you want to receive a good salary at the end of the month then Maths is important. Today nearly every job you look at involves some little knowledge of Maths.

When one is in the field of Maths one can receive the highest posts. Maths can get one any job - since computers and technology is coming in. The most qualified and top men in the country do Maths.

Nowadays every high classified job needs Maths and computers.

Without Mathematics it is almost impossible to get a good job. The main thing that employers look for is whether you have done Maths or not and what were your grades.

Well without Maths you are nothing today. Nearly every job you go for needs Maths. Maths is very important in order for you to get a good job.

3.2.2 Required for entrance into tertiary institutions

Responses of City High pupils

Maths is important for many things. When you have a Maths certificate the doors of all universities are open to you.

If you want to go to university you need Mathematics. The application forms require Mathematics. If you don't have it you will not be registered.

Responses from Capital Secondary pupils

A person with Maths stands a better chance of getting into technikons or colleges.

With Mathematics it is easy to get into university, college, etc.

3.2.3 Needed in modern society

Responses of City High pupils

Because everything in this world needs Maths.

Most of the things in this world needs people who have got Mathematics.

In many things in the world you need to count. If you don't know how to count you know nothing.

Responses from Capital Secondary pupils

Mathematics is about figures - something we use in our daily lives.

Maths is very important because all over the world, every step or move that you make, you are faced with Maths.

3.2.4 Mathematics is not need for future career

Responses of City High pupils

It is not important to me because I want to be a nurse.

In my plans I don't need Mathematics. (future teacher)

Because it is not important when you repair a car. All you need are tools. (future mechanic)

Responses from Capital Secondary pupils

Because you don't have to do Maths to do everything. Maths in a way is important but not always. Unless you are going to work for a firm that deals with Maths.

It is not important if you want to do nursing like I have chosen.

There are quite a lot of occupations without Maths. All you need is a matric exemption for the type of job you need. So I guess Maths is not exactly important.

Many people have got jobs without Maths. For example, those who passed matric with Maths still do not have a job, while the others who have not done Maths have high class jobs.

Because the only thing you really use Maths for on an everyday basis is with money. Which is easy. You might not need Maths to become a lawyer or psychologist.

3.3 Advice to future Mathematics pupils

3.3.1 Responses from City High Pupils

Helps in gain employment

I would advice him / her to continue with Mathematics so that it would be easy to find a job.

I will advice a pupil to study Mathematics because lot of skills need Maths.

In order to get a better job you must do Mathematics and other subjects but Maths is very important.

3.3.2 Responses from Capital Secondary pupils

Only if one understands / can cope with the subject

I will tell the pupil that he should take Maths if he can cope with it.

It's entirely left up to him / her if he / she understands Mathematics, well go for it. But if you don't understand you are just wasting your time, you'll fail the subject.

If he or she likes Maths and has done well or passed Maths I feel that they should do the subject.

If a student is very good at Maths and understands Maths problems then he should do Maths. But if a student wants to do Maths and all of his school years he failed Maths tests, I would advice him that he should think about what the next three years of Maths would be like.

Only if one enjoys the subject

If they like the subject then I would tell them to go ahead and choose a course with Mathematics.

My advice to the pupil would be - I you like the subject then go for it.

3.4 Suggestions on what would make more pupils study Mathematics

3.4.1 Responses from City High pupils

Encouragement by parents

Encouragement, love of the subject so that the people must like the subject. Mathematics is a good subject. I also think that if the parents encourage their children about Mathematics I am sure we will have more people who excel in the subject.

Mathematics workshops

I will introduce workshops and people who would assist us in teaching Mathematics during holidays and weekends.

3.4.2 Responses from Capital Secondary pupils

Improved teaching methods

If the teacher could make the subject more exciting for the pupils. They must not be too serious about Maths. They must easier ways to make the pupils understand the focal point of the whole problem.

Maths should be made more fun.

Extra tuition in Mathematics

Tuition can help many pupils pass. Because pupils get to understand the subject privately.

Make Mathematics easier

If there wasn't so many sections in Maths. If the work was not a lot. If the work could be made easy.

Reveal the importance of Mathematics

People coming around schools advising children about the selection of courses. They should tell them the benefits of Maths.

Make them see how important it is. Tell them about how many jobs in world ask for Maths. Maths could take you very far.

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