

FACTORS INFLUENCING THE CHOICE OF MATHEMATICS AS A SUBJECT
AT SENIOR SECONDARY LEVEL

by

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"not to us, O Lord, not to us but to your name be the glory, because of your love and faithfulness".

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(iii)

"I declare that

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is my own work and that all the sources
that I have used or quoted have been
indicated and acknowledged by means of
complete references".

...*D. T. Ngobeli*.....

SIGNATURE

.....*June 1994*.....

DATE

D.T. NGOBELI (MRS)

(iv)

This work is dedicated to my husband Thanyani, a great mathematics teacher of his time, and to all mathematics teachers in secondary schools. To them I say:

"Do not withhold good from those
who deserve it, when it is in your
power to act".

(Proverbs 3 : 27)

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SUBJECT AT SENIOR SECONDARY LEVEL

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SUMMARY

The study was undertaken to identify the factors that influence standard seven pupils when they choose whether to continue with mathematics at senior secondary level or not. The relative importance of the factors was also determined.

The literature study identified the following factors: attitude towards mathematics, utility of mathematics, family members' influence, mathematics teacher's influence, peer group influence, achievement and gender.

The empirical study dealt with the following:

* A 77 item questionnaire was completed by 201

- * standard seven pupils.
- * The statistical analysis revealed significant differences between pupils who chose mathematics and those who did not, with regard to all variables except gender.
- * A regression analysis identified the most influential factors as achievement, family members' influence, attitude and the mathematics teacher.
- * The overall implications were:
 - Pupils be made to experience success so that their attitudes may change.
 - Parents must be involved in their children's education.

Key terms

Secondary school child; mathematics achievement; cognitive factors; non-cognitive factors; peer group; attitudes; mathematics teacher; family members; mathematics.

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CHAPTER 1

INTRODUCTION AND ORIENTATION

1.1. BACKGROUND

Mathematics is a compulsory subject in all schools from Grade 1 up to standard seven. At the end of the standard seven year, the pupils must decide whether they would like to continue studying mathematics as one of their school subjects in the senior secondary level or not.

A wide spectrum of factors may influence the pupils when they have to make this choice. Some factors may be cognitive in nature, for example, intelligence, aptitude and ability or achievement; some may be non-cognitive, for example, interest, attitude, self-concept and motivation; and some may be external, for example, the role of parents and other significant people in the pupil's life. This study will attempt to focus on these variety of factors which may influence the pupil when he has to decide whether to continue or discontinue with mathematics at senior secondary school level.

It is important to do research on the factors that influence the pupil when he has to make the choice of whether to continue with mathematics or not, because mathematics has increasingly become one of the most important subjects of our times. Rambaran (1989:7) points out that at present great and rapid technological changes are taking place, and, as a result, the demand for students with an adequate knowledge of mathematics has become a matter of paramount importance.

If the factors that influence the pupils' choices are identified, efforts could be made to guide the pupils at an early stage prior to the making of this decision. Because of the increasing demand for pupils who have studied mathematics, it is important that pupils be given guidance in the junior secondary phase with regard to the importance of mathematics, so that as many pupils as possible should choose mathematics at the senior secondary level.

1.2. AWARENESS OF THE PROBLEM

The writer became aware of this problem when she was teaching at a college of education in Venda during the

period 1985 to 1989. The students there were studying for the Junior Primary Teachers' Diploma and the Senior Primary Teachers' Diploma. All these students had to study mathematics as one of their academic subjects. Although the mathematics offered there was a very basic course, there were students who found it a stumbling block. In most instances, students who had not studied mathematics at senior secondary school were the ones who experienced problems. Those who had done a study of mathematics sailed through the course with little or no problems.

As the political climate of South Africa is changing rapidly, even the job situation is changing. Now, more than ever, skilled workers are needed, both black and white. Most careers that are needed for the development of our country require students with a sound knowledge of mathematics. In fact, mathematics is used as an entrance requirement for training in most careers or occupations. Mathematics is regarded as a prerequisite, an ancillary course or a co-requisite for most courses that a student would like to pursue after matric.

The writer realized that for those students who wish to pursue their studies after matric, mathematics is the key subject which opens many doors to studying a variety of courses successfully.

1.3. THE IMPORTANCE OF MATHEMATICS

Mathematics is a key subject as it is applied in a large number of subjects in one form or another. It is also becoming more and more relevant in the predominantly technological and scientific world of today. The choice of mathematics as a subject at senior secondary level will affect the child's future and the manpower requirements of our country. A pupil needs appropriate guidance when he or she makes this important choice.

When pupils have to go to institutions of higher education, like universities, colleges of education, technikons and others, the fact that they have studied mathematics or not will affect them. A student who has not studied mathematics at senior secondary school will not have as much of a chance of satisfying

admission requirements or have a wide choice of career as the one who has done so.

"Mathematics is a tool for use in various careers" (Arguille:1987:16).

Arguille goes on to say that probably no discipline affords more career versatility than training in mathematics, with the general career outlook for people with mathematical training getting better each year.

This would imply that pupils who have not studied mathematics end up not being adequately prepared for the modern technological world that we live in. As a result there is always a shortage of skilled manpower required for the maintenance and growth of the economy of the country.

Mudeliar (1987:1) points out that the study of mathematics is important in the education of those who wish to make their mark in today's technological world. With the sophisticated science and engineering of the twentieth century, mathematics has assumed a greater relevance than ever before. Those scholars whose interest and aptitude for mathematics result in useful application will enjoy a wider range of

opportunities.

Besides being important for adaptation in this modern and technological world of today, mathematics is also important for the child's self-actualisation. The Department of Education and Training syllabus for mathematics for standard eight states that mathematics contributes to the education of the pupils, with special emphasis on development of logical thoughts and habits of systematic, accurate and neat methods of working. This implies that mathematics, by developing these habits in the child, helps the child to study other subjects successfully.

Rambaran (1989:29-33) says that studying mathematics enables the child to solve mathematical problems in daily life. Mathematics helps the child to acquire skills such as thinking critically and applying techniques in verbal problems in other school subjects and in daily life. It also provides a suitable type of discipline to the mind of the learner, so that it develops the child's powers of reasoning and thinking. The child will be able to view real life situations critically and objectively.

Rambaran (1989:29-33) goes on to say that mathematics as a subject inculcates the spirit for economy, purposefulness, productivity, creativity and constructive living. It trains the faculties of discovery and invention. Because it is practised persistently, it develops the habits of concentration and self-reliance, and it helps the child to discover order, pattern and relations, not only in the man-made world, but in the natural world as well. In mathematics one has to use appropriate words and terms, therefore studying mathematics develops the learner's powers of expression and leads to habits of accuracy, clarity, brevity, precision, consciousness and certainty in expression.

In the light of the afore-mentioned facts, it can be concluded that mathematics is a very important and interesting subject, therefore it is essential that as many pupils as possible should be encouraged to choose it as one of their subjects in the senior secondary level.

1.4. STATEMENT OF THE PROBLEM

The present study seeks to investigate the factors that influence pupils in secondary school when they have to choose whether to study mathematics at senior secondary level or not.

The problem which this study seeks to investigate can be summarized as follows: What are the different factors that can be identified as having an influence upon the child when he has to make a choice whether to study mathematics at the senior secondary level or not?

1.5. AIMS OF THE STUDY

The study consists of two parts, that is, a literature study and an empirical study. The aims of the literature study will be to study the nature, meaning and uses of mathematics. A study will also be made of various factors that may influence pupils when they choose whether or not to continue with mathematics at senior secondary school. The secondary school child or the adolescent, the child who has to make a decision, will also be studied.

The main aim of the empirical study will be to investigate the relative importance or varying influence of the different factors that influence the standard seven pupils in Venda in the choice of mathematics as a school subject at senior secondary level.

1.6. METHOD OF RESEARCH

1.6.1. Literature study

In the literature study the writer will gather data from a number of sources. A study will be made of the nature, meaning and importance of mathematics as a subject and how helpful it can be for the child's future.

A study will also be made of the factors that may influence the pupils when they choose whether to continue with mathematics or not. The adolescent, who is the child under investigation, will also be studied.

1.6.2. Empirical study

1.6.2.1. The research group

Standard seven pupils from two senior secondary schools in Venda will be involved in this study. Standard seven pupils have been chosen because at the end of the standard seven year mathematics is no longer a compulsory subject, pupils have to decide whether they would like to continue with it in standard eight or whether they would like to choose other subjects in its place.

The writer will choose schools where mathematics is not a compulsory subject. All the standard seven pupils in the schools chosen will answer the questionnaire.

1.6.2.2. Pilot study

A pilot study will be undertaken with a class of standard seven pupils from a neighbouring secondary school which will not be included in the sample, in order to test the feasibility of the study.

Tuckman (1978:25) says that a pilot test, which uses a group of respondents who are part of the intended test population, but will not be part of the actual sample, attempts to determine whether questionnaire items possess the desired qualities of measurement and discriminability.

A pilot study also helps to sort out technical mistakes or problems. It helps to ensure that the pupils understand the questionnaire items and the language concepts used. It also helps the researcher to be able to estimate the time that will be needed to answer the questionnaire.

1.6.2.3. The questionnaire

Data in this study will be gathered by means of a self developed questionnaire. Mahlangu (1987:84-85) points out that the advantages of the questionnaire are that it permits a wide coverage at a minimum expense of time and money; it makes greater validity of the results by promoting the selection of a larger and more representative sample; it can be assessed without much loss of time; it allows uniformity and ensures that answers are more comparable as the respondents

will get the same set of questions, phrased in exactly the same way; and it may elicit more objective answers because it is impersonal. Cohen and Manion (1989:106) add on this by stating that the questionnaire is clear, unambiguous and uniformly workable.

The basic structure of the questionnaire will be that of closed questions, which call for brief answers or indications, for example, drawing a cross on one of a series of clues.

The questionnaire will be completed during the guidance period in the schools involved. The respondents will not be allowed to communicate when completing the questionnaire. Instructions relating to the completion of the questionnaire will be clearly defined. Pupils will be asked to consider each question carefully and then respond truthfully. Anonymity will be assured to improve reliability of results.

1.6.2.4. Statistical techniques and processing of data

An item analysis, t-tests, chi-square test and a

regression analysis will be undertaken in order to process the data from the questionnaire and consequently arrive at certain conclusions.

1.7. DEFINITION OF KEY CONCEPTS

1.7.1. Mathematics

Literature reveals that it is very difficult to define mathematics. Various people have different definitions of mathematics, depending on their field of interest. The teacher, the economist, the businessman and the scientist, all see mathematics from their own point of view.

According to the Webster's Third New International Dictionary (1976:1393)

"mathematics is a science that deals with the relationship and symbolism of numbers and magnitudes, and that includes quantitative operations and the solution of quantitative problems".

On the other hand Davis and Hersh (1981:6-7) say that a naive definition is that

"mathematics is the science of quantity and space".

Expanding on this definition they add that mathematics also deals with the symbolism relating to quantity and space. The sciences of quantity and of space in their simpler forms are known as Arithmetic and Geometry. Arithmetic is concerned with numbers- additions, subtractions, divisions and multiplications. Geometry is concerned in part with spatial measurements.

One can conclude that mathematics is a science that is concerned with numbers and their operations, and it is also concerned with space and its measurements.

1.7.2. Factors

Tuckman (1978:60) states that independent variables may be called factors, and their variations may be called levels. The Webster's Third New International

Dictionary (1976:813) defines a factor as

"an element, circumstance or influence that contributes to the production of a result".

One can therefore conclude that factors are variables that contribute to observed differences in behaviour. For the purpose of the present study, those variables that influence the pupils when they decide whether to continue with mathematics or not, will be known as factors.

There is a wide spectrum of factors that may influence the pupils, and they can be divided into two main groups, that is, internal and external factors.

1.7.2.1. Internal factors

These are the factors that are inherent or from within the individual. They can be divided into cognitive and non-cognitive factors.

(a) Cognitive factors

Some of the factors that may influence the pupils are cognitive in nature. Gagne (1985:5) maintains that on the cognitive level, one tries to explain behaviour in terms of mental constructs.

Mwamwenda (1989:337) refers to cognition as a person's mental capacity, involving reasoning and dealing with various problems calling for objective thinking. To add on this Hendrikz (1986:98) says that

"an individual's ability to make sense of, and to use the information coming to him through his senses from the world, implies cognition".

Cognitive factors are therefore those factors that involve the person's mind or intellect. Usually they can be reduced to empirical factual knowledge and measured. Examples of cognitive factors are intelligence, aptitude and achievement.

(b) Non-cognitive factors

Non -cognitive factors are those factors that cannot be reduced completely to empirical cognitive statements because they have an emotional element in their content. In non -cognitive factors, emotions, affection and conation are involved. Examples of non-cognitive factors are interest, attitudes, self-concept, motivation and others.

1.7.2.2. External factors

These are the factors that are from without an individual or from the environment. They are not inherent, they are derived from an external source. These factors have existence which is largely independent of the mind, but they nevertheless exert much influence on the person. Examples of such factors are the influence of parents, family members, teachers and other significant people in the pupil's life.

1.7.3. The secondary school child

The child under investigation in this study is a

secondary school child and he or she is in standard seven. He or she is about fourteen years of age.

According to Vrey (1990:165)

"the total development of the secondary school years is usefully described by the term adolescence, which literally means growing or developing towards something".

This means that the secondary school pupil is an adolescent.

Newman and Newman (1986:2) say that the term adolescence is derived from the Latin word "adolescere", which means to grow up. Adolescence is the period of life that is often mentioned as the time of transition between childhood and maturity.

Adolescence is the time when the individual is striving to wean himself from the family and become a self-sufficient and independent person. This period starts with puberty and continues until the late teens. It is a lengthy period and there is no consensus among the different

authors and psychologists as to the age limits. Siann and Ugwuegbu (1980:127) say that this period is usually from about 12 or 13 years of age to about 17 or 18 years; while Mwamwenda (1989:40) says that the period ranges from the age of about 12 to about 21 years.

The secondary school child, and specifically the standard seven child, falls within these age limits. The standard seven child is about 14 years of age and he makes the choice whether to continue or discontinue with mathematics at senior secondary level at the time when he is experiencing the growth spurt of adolescence.

1.8. THE PROGRAM TO BE FOLLOWED

In the present chapter, the introduction and orientation to the problem to be investigated is discussed.

In chapters 2,3 and 4, attention will be given to the survey of the relevant literature. Chapter 2 will focus on the exposition of the concept mathematics. Studies on the meaning, nature and uses of mathematics

will be undertaken.

Chapter 3 will focus on the variety of factors that may influence the pupil when he or she makes the decision whether to study mathematics at senior secondary level or not.

Chapter 4 will make a study of the secondary school child. He or she is the child under investigation and his or her life world will be examined.

The planning and execution of the empirical investigation will be done in chapter 5.

In chapter 6 the findings of the empirical investigation will be made and conclusions arrived at.

Chapter 7 will focus on an overview of the study as a whole, and the recommendations and implications which the researcher wishes to make with regard to the study.

CHAPTER 2

MATHEMATICS: ITS MEANING, NATURE AND USES

2.1. INTRODUCTION

The main issue of this chapter is to discuss the meaning, nature and uses of mathematics. This discussion is undertaken in order to point out the significance and importance of mathematics for the secondary school child, so that when he or she has to decide whether to continue or discontinue with mathematics at the senior secondary level, he should be aware of its value and key role in this technological world of today.

Mathematics is an old and widely used subject. It is used in almost every sphere of life. As a result, not a single author or researcher can claim to have studied, investigated or written about every aspect embodied in the discipline.

In support of the notion that mathematics is an old subject, Stewart and Tall (1977:3) say that

mathematics is a human activity performed in the light of centuries of human experience, using the human brain, with all the strengths and deficiencies that this implies.

Mathematics has thus been in use for centuries. The most primitive and ancient tribes have used mathematics of some kind, no matter how basic it may have been.

Mathematics is furthermore not a static subject, it is dynamic. Many problems and aspects that were not regarded as mathematical in the past, are now embodied in mathematics, and many more will be included in the future. For example, in cookery, when the cook wants to prepare a meal for more people than the ones that the recipe has catered for, the ingredients must be increased proportionally, using mathematical principles, so that the recipe and taste of the food should not change. If the ingredients are increased randomly, the recipe would not be a success. The child therefore needs to know some mathematics in order to cope well in life.

Through the years mathematics has developed into a

vast body of knowledge and has become a very widely used discipline. It permeates life generally, and enables us to organize and understand everyday occurrences and how mathematical principles may be applied in a variety of situations. It is therefore important that the child must realize this when he has to make a choice of continuing with mathematics at senior secondary level or not. As it permeates life in general, it means that at one stage or another the child will need a knowledge of mathematics, either in his future career or in his everyday human activities.

Although mathematics is such a vast discipline, pupils must be encouraged to develop a positive attitude towards it. Acquah (1987:15) says in this regard:

"Far from being the awesome subject it has always been assumed to be, mathematics is an interesting subject which can be enjoyed and passed by the average high school student".

This encouraging statement by Acquah should be taken into consideration when the pupils make their choice.

2.2. THE MEANING OF MATHEMATICS

It is very difficult to answer the question: what is mathematics? Many attempts have been made by different people, laymen, professionals and mathematicians to define mathematics, but few of the definitions are satisfactory. Each of these people defines it from his own perspective and point of view, therefore leaving out other aspects. It is also difficult to define mathematics because if new discoveries are made, the definitions will also change.

A knowledge of the meaning of mathematics is very important for the child who has to decide whether to continue or discontinue with it. The way in which the pupil understands its meaning will influence how he will view mathematics. Its meaning, to him, may influence him to choose or not to choose it as one of his subjects at senior secondary level.

Although it is difficult to define mathematics, various writers have attempted to do so. Hornby

(1989:768) defines mathematics as

"the science of numbers, quantity and space, of which, for example, trigonometry and geometry are branches".

Mathematics thus deals with numbers (arithmetic) and shape (geometry). The manner in which the child will come into contact with numbers and figures will give rise to the idea he will have about mathematics and will later influence him in his choice at senior secondary school.

Hollands (1980:92) defines mathematics as

"a complicated but highly organized system that has many branches. At an elementary level there is arithmetic, algebra and geometry, but each of these has been extended at higher levels and many branches added. Trigonometry, topology, mechanics, dynamics, statistics, probability, analysis and logic are but a few."

On the other hand the Dictionary of Physics and Mathematics defines mathematics as the

"deductive study of shape, quantity and dependence: the two main areas are applied mathematics and pure mathematics, the former arising from the study of physical phenomena, the latter the intrinsic study of mathematical structures" (Lapedes :1978:605-606).

These definitions lay emphasis on the fact that mathematics is mainly concerned with numbers and shapes.

However, Sawyer (1971:12) brings in this definition:

"Mathematics is the classification of all possible problems, and the means appropriate to their solution".

This definition is somewhat too wide. Sawyer also says that mathematics is the classification and study of all possible patterns. Pattern here is understood in a very wide sense, to cover almost any kind of regularity that can be recognized by the mind. Pattern is the relatively stable thing in the world. Recognition is possible, not because experience ever repeats itself, but because in all the flux of life, certain patterns remain identifiable.

Sawyer's definition shifts emphasis from numbers to shapes. If the child has a negative attitude towards the study of shapes due to an earlier experience, this definition and meaning of mathematics by Sawyer will most probably influence him not to choose mathematics at the senior classes.

Mathematics is many-sided. It has many important properties and aspects. A wide range of varied disciplines have developed from it. No one definition of mathematics can be able to exhaust all its angles and include all its properties.

However from the various definitions, the writer deduces that mathematics basically deals with numbers and space. It includes all the simple calculations which we undertake daily in our lives, for example, the cost of an article in a shop and the change we should get after having bought something. It also includes all the other complicated calculations which need formulae and intricate calculations. The four mathematical computations, that is, addition, subtraction, multiplication and division, which we use in our daily lives in one form or another, are also included.

Although at times mathematics appears to be very abstract, it gives results that are of practical value. Through mathematics we are able to know and differentiate shapes and objects in our life. The manner in which the child understands the meaning of mathematics can therefore influence him to continue or discontinue it at senior secondary level.

2.3. THE NATURE OF MATHEMATICS

According to Lamon (1972;36) any discussion of the nature of mathematics must emphasize its ever-changing character. This is probably the aspect of mathematics least known among non-mathematicians, despite its basic influence on the formation of other aspects of mathematics.

We may be able to understand more about mathematics by looking at its nature. The nature of mathematics can be elucidated by considering a few of its important properties.

2.3.1. Mathematics as a calculatory science

Mathematics is a calculatory science. Murray and

Ford (1981:671) points out that mathematics as a logical body of knowledge can be used as a guide for arriving at precise results. If the precise results are expressible in terms of numbers or are arrived at with the use of numbers, then the calculatory nature of mathematics becomes evident. The calculational ingredients of mathematics are varied. They may be numerical, notations, geometrical aids, mathematical models, algebra and logarithms, tables, graphs, analogue computations, digital calculators, punched cards and programmed machines.

At one stage or another, in our everyday life, a person will need to make some calculations, no matter how trivial. Even in the work place some mathematics may be needed, although calculators may be used. If the pupil understands this nature of mathematics he will see its value for him and this will have an influence on his choice.

2.3.2. The dual nature of mathematics

Mathematics is generally divided into two classifications, that is, pure and applied mathematics.

2.3.2.1. Pure mathematics

According to Kertz (1979:29) pure mathematics is primarily concerned with the development of mathematical system. The term pure is adopted by mathematicians to indicate that this type of mathematics is purely theoretical. De Lange (1987:116) adds on this by stating that abstractions, generalizations and above all, specialization are three types of activities undertaken by pure mathematicians.

In pure mathematics, the subject is studied for its own worth. It is unique and offers aspects of study which are not to be found in any other subject. The secondary school child may find this interesting and therefore may decide to go on with mathematics for this reason.

2.3.2.2. Applied mathematics

De Lange (1987:118) says that applied mathematics means beginning with a situation in some other field in real life, making a mathematical model, or

interpretation, doing some mathematics on the model and applying the results to the original situation. On the other hand, Kramer (1970:44) says that applied mathematics consists of those mathematical sciences which deal with situations in the real world, for example, statistics, physics, astronomy, biology, economics, psychology and others; or deductive systems derived from various portions of those subjects.

It can therefore be deduced that applied mathematics is the mathematics which is utilized by other disciplines. This means that the child who wants to further his studies after matric cannot ignore mathematics as it permeates almost every field of knowledge. This fact should be taken into consideration when the child chooses whether or not to study mathematics in higher classes as this may hold the key to his future.

There is, however, no distinct separation between pure and applied mathematics. They are not water-tight compartments with no interaction between them; but, instead they are so intimately related that it is difficult to separate them.

2.3.3. The abstract nature of mathematics

Kroeze (1989:6) maintains that mathematical labour is of a purely abstract nature, although it arises from the concrete, creative reality and is sometimes also made applicable to it by means of other sciences. Aleksandrov, Kolmogorov and Lavrentev (1964:1) say that the abstract nature of mathematics is easy to see. They go on to say

"we operate with abstract numbers without worrying about how to relate them in each case to concrete objects. In school we study the abstract multiplication table, that is, a table of multiplying one abstract number by another, not a number of boys by a number of apples, or a number of apples by the price of an apple".

Although mathematics is often used in real-life situations, when it is studied, especially in the school situation, it is very abstract. Subtraction is studied, for example, in an abstract manner, but it shall be used when goods are bought from the stores,

so that we can be given the correct change back after having made our purchases. The pupils should be aware of this, so that the abstract nature of mathematics should not frighten them away from it. They must be aware that it is capable of being used in the concrete world.

2.3.4. Mathematics as a science

Mathematics has been called the queen of the sciences. According to Bell (1978:23)

"it is more exact than the physical sciences although not in an absolute sense. It contains few inconsistencies and logical paradoxes. In spite of the fact that logical difficulties still exist in the foundations of mathematics especially in the mathematics of infinite sets, it has been an accurate and indispensable tool in social, economic and technological development".

Mathematics is indeed a science, although it differs from the natural sciences in that it is not dependent on experiments, but on logical structures. It does

have its own terminology, its own field of study and it is exact.

2.3.5. Mathematics as a language and tool

Mathematics is used as a language and as a tool in many areas of life. Van Rooyen (1966) says that mathematics is a language because it satisfies one of the basic requirements of a language by being a medium which enables man to record and to systematize his ideas, to form new ideas and to communicate them to others. As a language mathematics is universal, exact, concise and uses easy words like group, field, limit, infinity and others, for very complicated ideas.

As a tool mathematics is used in the natural sciences, engineering and also the social sciences.

The child will need to know this universal language in order to cope well in this technological world that we are living in. The child will also need to know this tool if he is to study for courses like engineering, science, economics, computer science and others.

2.3.6. The inductive and deductive nature of mathematics

Mathematics has two faces. It has a deductive and an inductive nature.

2.3.6.1. The inductive nature of mathematics

Kertz (1979:31) is of the opinion that inductive type of reasoning is the process of reasoning that arrives at a general conclusion based on multiple observations or multiple occurrences. In support of this, Smith (1973:4) says that the type of reasoning where we first observe patterns and then predict answers to more complicated problems is inductive reasoning. It involves reasoning from particular facts or individual cases to a general conjecture. It means that a generalization is made on the basis of some observed occurrences.

The inductive nature of mathematics will help the pupils to make generalizations from observed occurrences. This is one of the educational goals that the pupils should have in order to succeed in their

academic life.

2.3.6.2. The deductive nature of mathematics

According to Kroeze (1989:5) the mathematician must be able to deduce theorems from previous theorems or axioms. In this way he reasons from the general theory to the particular case, for example, the application of a theorem to a specific rider.

The deductive nature of mathematics teaches the pupil to be able to infer or to draw a conclusion, which is a necessity in education. Pupils should be aware of this so that when they make their choices they should take this into consideration.

2.3.7. Mathematics is verifiable

Mathematics is verifiable, we can prove if anything is right or wrong. Howson and Wilson (1986:12) state that in mathematics there is verifiable certainty, and that children are able to know what is wrong and right at their own level of competence in mathematics, and can verify it themselves.

Mathematics therefore helps children not to accept everything at face value, but to be able to verify and be certain. It leads children towards being inquisitive. Children have to be inquisitive in order to have a desire for learning, therefore the fact that mathematics is verifiable and satisfies the child's curiosity, may be a factor that influences the child to choose to continue or discontinue with mathematics at senior secondary level.

2.3.8. Synthesis

From the aforesaid discussion of the nature of mathematics, it is clear that mathematics is a very extensive subject. It has a wide range of different properties, some of which have been discussed here. A single definition of mathematics can never be able to include all its features, and therefore we can be able to understand what mathematics is by looking at its nature. When pupils choose whether to take mathematics or not, they must be aware of its nature, so that they should see its value and make a rational choice.

2.4. THE SCHOOLS OF THOUGHT IN MATHEMATICS

There is no unanimity among mathematicians as to the origin, foundation, meaning and validity of mathematics. Various mathematicians give different assumptions as far as the beginning, nature and scope of mathematical theories and methods are concerned.

In this regard Kleene and Feferman (1981:633) say that in the first quarter of the twentieth century three main schools of thought arose to account for and resolve the crisis in the foundations of mathematics. The three schools of thought are called Logicism, Formalism and Intuitionism. They were principally led, respectively, by Russel, Hilbert and the Dutch mathematician and philosopher Brouwer. Each of these schools of thought is a version of a more or less traditional view of the nature of mathematics.

2.4.1. Logicism

The assumption of the logistic school of thought is the fact that mathematics is a discipline that depends on logic. All its assumptions are proven in a step by

step way until a conclusion is reached. Smith (1973:302) says this

"we speak of mathematical systems with theorems that follow logically from basic assumptions. Logic is a method of reasoning that accepts no conclusions except those that are inescapable. Everything must be defined in a way that leaves no doubt or vagueness in meaning".

The logistic school of thought is based on the fact that in mathematics everything can be verified in a step by step way.

2.4.2. Formalism

According to Boyer (1968:661), Hilbert came to be regarded as the leader of the formalistic school of thought, which some of his successors carried to the conclusion that mathematics is nothing but a meaningless game played with meaningless marks according to certain formal rules agreed upon beforehand.

To add on this Van Rooyen (1966) says that the formalist's thesis is that pure mathematics is the science of the formal structure of symbols. The formalists dispute the reducibility of mathematical concepts. They attach much importance to the formal nature of mathematical symbols, which they consider to be independent of any meaning anybody may attempt to attach to them.

The basic assumption of the formalist is the fact that we engage in mathematical activity for its own sake. The formalists create mathematical theories and symbols and believe in their purity without having other meanings attached to them. To the formalists then, mathematics is pure, formal and consistent.

2.4.3. Intuitionism

The intuitionist's thesis is that pure mathematics is a construction on the basis of the intuitively given set of natural numbers. According to Van Rooyen (1966) the intuitionists regard mathematics as a sphere of thought which is entirely intuitive, self-sufficient and self-generating and which is completely

independent of language or classical logic.

Lamon (1972:43) says that intuitionism is sometimes characterized as a mathematics of doing, where a person does not prove that something exists by showing that the assumption of its non-existence leads to contradiction, as in high school geometry, but rather the person shows how to construct the thing that he or she wants to prove exists.

The intuitionists believe in constructing what they believe exists, that is, they believe that an entity can be constructed if it exists. They do not, like the formalists, believe that if there is no contradiction, then the entity exists, but that the entity must actually be constructed.

2.4.4. Synthesis

The nature of mathematics, or the perception of the nature of mathematics that the pupils have, may influence them to choose to continue or discontinue with mathematics at senior secondary level.

42-47
Uses of Maths

2.5. THE USES OF MATHEMATICS

Mathematics is a useful subject, it can be applied in almost all spheres of life in one form or another. Harold (in D'Ambrosio 1980:486) stated that mathematics has been or can be applied constructively to some natural phenomenon. To add on this Lamon (1972:36) says the following

"it appears that no matter how abstract and seemingly removed from physical reality mathematics may become, it works; it can be applied either directly or indirectly to the external world. Television, radio, air travel, and so many other things would not have been possible without mathematics".

Different people have different meanings of the utility of mathematics. A teacher, an architect, a book publisher, an astronomer, a civil engineer and many others, have different meanings of the utility of mathematics. The standard seven pupils' perception of the utility of mathematics will influence his choice

of mathematics as a senior secondary school subject.

It is impossible to cover all the uses of mathematics, but an attempt will be made here to point out some of the uses of this subject.

2.5.1. Mathematics and the professions

Entry into many different careers requires a certain standard of mathematical knowledge. Jarvis (in Mudeliar 1987:2) states that mathematics is often called a critical filter. As a critical filter it plays an important part in the selection of young people for employment and for places at universities and technikons.

Howson and Wilson (1986:11) assert that a major reason for the persistence of the special place held by mathematics in the school curriculum is the way in which it has been used for the last two centuries as a screening device or filter for entry into numerous professions.

In order that a school leaver can get suitable employment or a young person who has passed matric can get a place at institutions of higher education and in most vocations, a mathematical background is necessary. If a child wants to be an engineer, doctor, computer analyst, physiotherapist or architect, to quote but a few, it is necessary for the child to have studied mathematics at senior secondary school. This means that the child's future career will influence him to choose to continue or discontinue with mathematics in higher standards at school.

2.5.2. Mathematics and other school subjects

Mathematics is applied in other school subjects in one form or another. Many school subjects call upon mathematics to assist their work. Pupils must be made aware of the fact that mathematics is not just another subject taught at school, instead it is seen everywhere in the world around us and in other school subjects that are studied at school.

Because mathematical methods and techniques are used in the study of other school subjects in one form or

another, a pupil who does not study mathematics will have difficulties in other school subjects, for example, in Geography, when pupils have to do mapwork, mathematical techniques are used.

In order to cope well in other school subjects, the child will need mathematics. It permeates a number of subjects that are studied at secondary school; the pupil cannot avoid it completely, as it will come up in other forms, in various subjects that he will be studying.

2.5.2.1. Science

According to the Assistant Masters Association (1973:208) mathematics can be regarded as a key to the sciences. In Physics, almost every physical experiment requires mathematical calculations to obtain the results, and mathematical techniques find frequent application. The same also applies to Chemistry.

Mathematical methods have also been introduced to deal with statistical and other data in Biology. All the physical sciences lean heavily on mathematics and it

is being used increasingly in these sciences.

2.5.2.2. Geography

Mathematical techniques and methods are being used increasingly in Geography, for example, in map work, when pupils have to calculate distance using the scale that appears on the map. Mathematical techniques have to be utilized to make the necessary calculations. When the pupils choose to study mathematics or not to, this factor must be taken into consideration.

2.5.2.3. Cookery and Needlework

The Assistant Masters Association (1973:209) states that costing and budgeting are mathematical applications in these subjects. Adapting menus, for example, ingredients given for six people and the meal required for two people, is an example of proportion. Drafting in needlework and dressmaking has slight connections with Geometry.

Mathematics is useful to many other subjects besides the ones that have been mentioned here. It can be

applied in, for example, Woodwork, Agricultural science, Arts, Economics, Accountancy and others. There is an increasing use of mathematics in the social sciences.

The fact that mathematics is used in other school subjects is a factor that may influence the pupils' choices. If they are aware of its importance in this regard, they may decide to continue with it in senior classes.

2.5.3. The contribution of mathematics to general educational goals

Mathematics contributes to the attainment of general educational goals, for example, ability to solve problems, to predict, to have powers of expression, to be creative, to have critical powers, and others.

According to Howson and Wilson (1986:12), for many centuries mathematics was seen as a subject in which reasoning powers could be trained. It also develops critical powers and enables people to handle the mass of data with which they are constantly bombarded with

in this information age.

Mathematics further contributes to general educational goals because it teaches pupils to be able to solve problems. Riedesel (1985:18) says that problem solving is the process of applying previously acquired knowledge to new and unfamiliar situations. In solving problems, students need to be able to apply the rules of logic necessary to arrive at valid conclusions.

Solving problems in a step by step, logical way, is an important educational goal, so for the child to cope well in his education, he needs mathematics, because, as Stewart and Tall (1977:3) state

"mathematics helps the child to be able to think logically".

Through the study of mathematics, pupils learn how to predict, which is another important goal. Riedesel (1985:19) says that pupils should learn how elementary notions of probability are used to determine the likelihood of future events. They should be familiar with how mathematics is used to help make predictions

such as, for example, election forecasts. This means that pupils who study mathematics will be better able to predict than the ones who do not.

According to Rambaran (1989:32), mathematics helps develop the learner's powers of expression. In mathematics one has to use appropriate words and terms. Habits of accuracy, clarity, precision and certainty in expression are formed and strengthened by the study of mathematics. The qualities that have just been mentioned are very important and necessary if the child is to succeed in his education as a whole.

Mathematics also contributes to general educational goals by teaching the child about measurement. Riedesel (1985:19) maintains that as a minimum skill, students should be able to measure distance, weight, time, capacity and temperature. Students should be able to measure in day to day life and in other school subjects, not only in mathematics. Pupils can get this skill if they study mathematics as one of their subjects.

As a subject, mathematics inculcates the spirit of

purposefulness, productivity, creativity and constructive living. Rambaran (1989:30-31) says that it trains the faculties of discovery and invention and it also develops the habits of concentration, self reliance, discovery and the love of hard work. These habits are inculcated through persistent practice that is necessary in mathematics.

For the child to succeed in education and be what he wants and can be, the study of mathematics is necessary and important, because it can lead to the attainment of general educational goals. This is a factor that must be taken into consideration when the child chooses to continue or discontinue with mathematics at senior secondary level.

2.5.4. Utility of mathematics to mathematics

Besides it being useful to other subjects, mathematics is also useful to itself. The subject may be pursued for its own worth. Other aspects of mathematics may shed light on its other aspects. According to Davis and Hersh (1981:80-81), a piece of mathematics may be used or applied to mathematics itself. For example, it

may be said that the theory of ideals is useful in the theory of numbers. This means that the materials, structures, techniques and the insights of the theory of ideals are used to cast light or to derive inferences with regard to the materials and structures of the theory of numbers.

If the child enjoys solving mathematical problems and working out mathematical theorems, then this aspect can be a factor that may influence him to choose mathematics as a senior secondary school subject. If, on the other hand, the child does not enjoy pursuing mathematics for its own worth, this may influence him not to choose the subject.

2.5.5. Utility of mathematics for the economist

Pearson (1982:vii) is of the opinion that economists use mathematics extensively to assist them in analysing economic problems. Some economists may lament the use of some of the high-powered mathematical techniques, which they claim obscure the real economics, but it is a fact that mathematical techniques provide an invaluable aid to the

understanding and analysis of many economic problems.

Pearson (1982:vii) goes on to give this example of the use of mathematical techniques in economics. He says that a firm may face a problem of deciding how much should be produced to maximize its profits. This is a key problem in economics. In order to analyze and solve this problem, the techniques of differential calculus are used. Thus, it is only by having a good grasp of mathematics that an economist can successfully master economics. This fact is reflected in the increasing introduction of mathematical and quantitative methods into economic and social science courses.

Pupils who are interested in pursuing careers in economics after matric should be motivated to choose mathematics in senior classes.

2.5.6. The utility of mathematics for the businessman

Mathematics provides the businessman with skills that he will need to solve business problems. Mathematics is relevant to everyday business decisions.

Smith and Van Doren (1985:1-2) say that every time a sale is made, the businessman adds and subtracts. As mark-ups are figured, percentage will be used a lot. The rules of decimals will also be used when the businessman works with dollars and cents. He will have to be good at changing fractions into percentage and vice versa, since he will be working with portions of the year in his records, he will also do some equations as he analyses his business.

It is clear that a businessman cannot be successful in his business unless he has a basic knowledge of mathematical principles and techniques. Therefore a pupil who sees himself as a future businessman may choose to continue with mathematics so as to use this knowledge in his future business.

2.5.7. Mathematics in recreation

Polya (1973:ix) says that mathematics may be fun and may also open up a vista of mental activity on the highest level. There are many games based on mathematical problems, for example, mathematical puzzles, tricks, mathematical explanations for number

tricks, and many others. Mathematics is also related to chess, card games and puzzles.

In his research, Corbitt (1984:18) asked students specifically what they found enjoyable about mathematics. Their most frequent response was, "playing maths games".

It means then that even though mathematics is an abstract subject, it can also be enjoyable. A pupil who enjoys playing mathematics games may transfer this interest to the subject itself and vice versa and may therefore choose to continue with it at senior secondary school level.

2.5.8. Mathematics in nature

According to Kelly and Ladd (1965:7) we see geometric shapes everywhere in the world around us. In nature there are forms that represent mathematical patterns. Some shapes in nature are geometric and/or symmetric. By being able to understand and to recognize mathematical or geometrical forms, we are better able to understand the world around us.

This interest in natural forms and shapes and their resemblance to mathematical patterns may motivate the child to choose to continue with mathematics as one of his subjects.

2.5.9. The common utility of mathematics

In a research study by Corbitt (1984:16-17), of the forty eight students who said that mathematics is important, thirty two cited the everyday usefulness of mathematics as justifying its importance. The ability to handle money in everyday transactions was the example given most frequently. This means that mathematics is a useful subject in our day to day lives.

Davis and Hersh (1981:83-84) support this idea by saying that mathematics' utility extends all the way to the man in the street. Some instances of this common utility are the following: when a family plans a household budget or when a price is arrived at in an architect's office, and other such instances. These computations may be trivial and may be performable by mathematically unsophisticated people; nonetheless

they are mathematics, and the computations that refer to counting, measuring and pricing constitute the bulk of all mathematical operations at the level of common utility.

It is clear that no matter how primitive a culture may be, at one stage or another it has to use mathematics. Even a small function like, for example, distributing apples among children, will need some division so that all the children can get an equal number of apples. Mathematics is important in our daily life experiences and at other times we are not even aware that we are making use of it.

2.5.10. Mathematics and the job situation

Saunders (in Gagne 1985:230) interviewed persons in hundred job categories representing the entire economic range in our society. He found that knowledge of basic arithmetic was necessary for sixty two percent of these jobs, and that knowledge of statistics was essential for sixty five percent of the jobs. This means that mathematics is used to a very large extent in the work situation.

In the job level mathematics is used from the lowest level of manual workers up to the highest level of administrators. It ranges from making very simple calculations up to complicated issues like constructing a mathematical model. In order that a person may succeed in the job situation, a basic knowledge of mathematics is highly preferable, because at one stage or another it will be used. As a future adult the child is going to hold a job, and therefore he will need mathematics.

2.5.11. Utility of mathematics for industry

According to Mudeliar (1987:2) many major industrial firms employ trained mathematicians as they realize the great value of mathematics in research and planning. Mathematics has great importance in engineering projects, for example, the design of a highway, a bridge or a giant dam would be impossible without mathematical formulas and calculations.

In industry, computers are being used increasingly, and employees other than those that are specifically trained to deal with them, are having to present their

work to, or receive the output from computers. A basic knowledge of mathematics is necessary and important for almost everybody who will find himself in the work place at one time or another.

2.6. SUMMARY

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Mathematics means different things to different people. It is used in a great variety of situations and disciplines, to a greater or lesser extent, as this discussion has endeavoured to demonstrate. It is impossible to cover all areas in which mathematics is utilized. It has penetrated the social sciences and other areas which seem to be far removed from it, like history, religion and war. Mathematics works and it has power.

To answer the question why mathematics has power and why it works, Davis and Hersh (1981:68-69) say that one very popular answer has been that "God is a mathematician". The authors go on to say that if we do not think that deity is a necessary hypothesis, we can say that the universe expresses itself naturally in the language of mathematics. The universe has imposed

mathematics upon humanity.

At the end of the junior phase of secondary school, pupils are asked to choose whether they would like to continue with their studies in mathematics or not. Whether the pupils are aware of its importance and uses or not, they do make this choice.

When pupils make this decision, there is a wide spectrum of factors that will exert influence upon them. Some of these factors have been discussed in this chapter. In the next chapter more factors that may influence the pupil in making the choice of whether to continue with mathematics or not, will be discussed.

CHAPTER 3

SOME FACTORS THAT MAY INFLUENCE THE CHILD WHEN HE OR SHE CHOOSES WHETHER TO CONTINUE WITH MATHEMATICS AT SENIOR SECONDARY LEVEL OR NOT

3.1. INTRODUCTION

Whenever a person has to make a decision, whether it is a minor or a major one, there is a wide spectrum of factors that will influence him or her. From grade one up to and including standard seven, mathematics is a compulsory subject at school. As from standard eight the pupils have a choice, they may continue with their studies in mathematics or they may choose not to continue with it.

When the junior secondary school child is faced with making such a decision, there is a variety of factors that may influence him. In the present chapter we shall look at these factors and how they influence the pupil when he chooses whether to study mathematics at senior secondary school or not.

Making a decision is not easy, it is a complex issue. Sometimes a decision is planned carefully, but often forced speedily by the demands of the situation. According to Jones and Gerard (1967:188) making a decision begins with cognitive activity during which the person sizes up his environment while determining the alternatives open to him. This is also characterized by conflict, he weighs the alternatives in terms of how each furthers or frustrates the values he holds, that is, he establishes an attitude towards each alternative.

The alternatives open for the pupils in this study are the different subjects that they may choose to study instead of mathematics. They should size up the environment and consider the alternatives. Then they can weigh these alternatives and consider the advantages or disadvantages of continuing with mathematics or not.

However, it may be difficult for the pupils to do this on their own. They do not live in a vacuum, they are susceptible to many influences, whether they are aware

of it or not. There are, therefore, a variety of factors that will influence them when they make this choice. Some of these factors will be discussed here.

3.2. INTERNAL FACTORS

Internal or intrinsic factors are those factors that are from within the child himself or herself. These factors influence the child to choose or not to choose mathematics as one of his subjects at senior secondary classes. These internal factors can dichotomously be divided into cognitive and non-cognitive factors.

Cognitive and non-cognitive factors cannot be separated, they can only be distinguished from one another, they are not mutually exclusive. In any cognitive factor, there is always also to a greater or lesser extent, a non-cognitive factor present, and vice versa.

3.2.1. Cognitive factors

These are the factors that are cognitive in nature.

According to Ginsburg (1983:331)

"a cognitive analysis attempts to analyse the cognitive processes responsible for the child's immediate behaviour".

This means that cognitive factors and processes may influence the behaviour of pupils, and therefore the choices that they will make.

Before attempting to discuss the cognitive factors that may influence the secondary school child, we shall first look at the meaning of cognition.

According to Hendrikz (1986:88) the term cognition is used by psychologists to refer to intellectual activities. These include all the ways in which we come to know and understand the world in which we live, to learn from it and to think about it. Intellectual or mental activities are terms that describe the processes of ability to think and learn, understand, remember, reason, solve problems and make decisions.

The term cognition refers to mental and intellectual processes. It refers to processes that take place in the mind of a person, and these processes will have an influence on the decision that the pupil will take, because, before the pupil decides, he or she has to think about it and weigh up the advantages and the disadvantages, and then arrive at a particular choice.

A discussion of some cognitive factors that may influence the secondary school child will be undertaken in the ensuing paragraphs. It is impossible to discuss all the cognitive factors, and for the purpose of this study, only three will be discussed, that is, intelligence, aptitude and achievement.

3.2.1.1. Intelligence

Since the beginning of this century, psychologists have been measuring intelligence with some success, and yet they are unable to agree completely as to its nature. A great number of psychologists have attempted to define intelligence.

Mwamwenda (1989:191 - 192) says that intelligence is

used with reference to a person's ability to adjust to his environment. He goes on to say that intelligence is what enables a person to think, act and behave in a manner that is normally acceptable to his society, thus facilitating his adjustment socially, intellectually and physically.

Fontana (1981:105) defines intelligence as

"the ability to see relationships,
and to use this ability to overcome
new problems".

If we see it this way then, we can realize that there are few aspects of a child's formal work in schools that do not appear to be influenced by it in some way.

According to Sylvia Scribner (in Sternberg and Wagner 1986:1) there are different kinds of thinking and it is useful to distinguish between theoretical thinking on the one hand, and practical thinking on the other. Scribner views practical thinking as the mind in action, using the term to refer to thinking that is embedded in the larger scale purposive activities of

daily life. Practical thinking serves to achieve the goals of the everyday activities in which one engages.

Most of the definitions and explanations lay emphasis on the fact that intelligence has to do with adaptation and adjustment to the environment. Adaptation covers adapting oneself to the existing environment, or selecting a new one if necessary. This implies that the pupil will use his intelligence to be able to adapt himself to continuing with mathematics, or selecting a new environment, that is, choosing another subject instead of mathematics.

In his studies, Mevarech (1985:156) found that in school the desirable repertoire involves high persistence, positive approach, low distractibility and ability to adapt to new situations. The qualities mentioned by Mevarech will help the child to make a decision for himself; and these qualities imply intelligence.

In order that pupils may adjust themselves to, and/or select a new environment, they will use their ability to adapt themselves, that is, they will need

intelligence. Intelligence is therefore a factor that may influence the pupil when he decides whether to continue with mathematics or not.

3.2.1.2. Aptitude

The term aptitude generally refers to a specific ability or capacity. Mwamwenda (1989:335) states that aptitude tests measure the extent to which individuals are likely to profit from future experience.

Taljaard (1983:2) defines aptitude as

"the potential a person has that enables him to reach a certain level of ability with a given amount of training and/or practice".

Aptitude therefore refers to the potential or proficiency that the person has in a particular area or subject, in this case mathematics. If the child's aptitude in mathematics is high, then there is a good chance that his performance in mathematics will be good, and therefore he is likely to choose to continue

with it when he is given a choice, and the reverse may also be true.

13 { In their studies Moore and Smith (1985:274) found that mathematics aptitude is generally defined by performance on standardized aptitude tests. Higher scoring students often chose to enrol in mathematics related courses more often than their lower scoring counterparts. This then means that aptitude is a factor that may influence the choice of mathematics.

Future scholastic achievement can be predicted from the aptitude test scores. However, these scores often serve as an aid for selection or placement, they are not used by the pupils themselves as they are not readily available to them. The pupils are mostly influenced by the evidence of such potential, that is, the achievement in the subject.

3.2.1.3. Achievement

Achievement refers to the performance of a pupil in a particular subject, in this study it refers to performance in mathematics. According to Powell

(1990:294) for more than two decades psychologists have observed that many persons, after having failed repeatedly at a designated task, abandon the activity and conclude that they can do nothing in future to effect a more positive outcome.

If pupils failed tests and examinations repeatedly in the lower classes, they learn not to like it and they will not enjoy it. If such pupils are given the option of continuing or not continuing with it in higher classes, the possibility is that they will choose not to continue with it.

In his study, Hackett (1985:47-48) says that lack of mathematics preparation and consequent lower levels of mathematics achievement result in the premature closure of options.

This statement by Hackett implies that low achievement may not be the result of inability or low aptitude in mathematics, but it may be because the pupil has not received suitable tuition in the subject. The pupils themselves may, however interpret low achievement as evidence of inability and may therefore choose not to

study mathematics at senior secondary level. This means that achievement in mathematics is a factor that may influence pupils when they decide whether to continue with mathematics at senior secondary level or not.

3.2.2. Non-cognitive factors

Non-cognitive factors are those factors that are within the person, but are not cognitive in nature, that is, cognitive processes are not directly involved. The Webster's Third New International Dictionary (1981:1535) defines non-cognitive factors as

"those factors not based on, or incapable of being reduced to empirical factual knowledge by reason of the emotive or imperative elements in their content".

Irrespective of whether the pupil's aptitude in mathematics is high or his performance is reasonably good, the pupil may still not like mathematics enough to choose to study it at senior secondary school. This may be due to non-cognitive factors like his attitude

towards mathematics, motivation, self-concept, his interest in the subject, and other factors.

For the purpose of this study, attitudes, motivation, self-concept and interest will be discussed as non-cognitive factors that may influence the child when he chooses whether to continue with mathematics or not.

3.2.2.1. Attitudes

According to Venter (1985:4) most writers attach to attitude a connotation of "feeling", "disposition" or "willingness" to respond. These characteristics of attitude vary in intensity and can either be positive or negative.

On the other hand Fontana (1981:219) states that psychologists define attitude as the relatively enduring orientations that individuals develop towards the various objects and issues they encounter during their lives, and which they express verbally as opinions. He goes on to say that attitudes contain elements of value and belief as well as varying

degrees of factual knowledge. Less obviously, they may be partly conscious and partly unconscious, with the two sometimes in conflict with each other.

Together with a few other writers, Light (in Venter 1985:4) views attitude as having essentially three components, namely, a belief, an emotion and an action component.

(a) The belief component

Pupils may have certain beliefs about mathematics, and such beliefs will affect them when a choice concerning mathematics has to be made. In their studies, Mtetwa and Garofalo (1989:611-615) found that students may have unhealthy beliefs about the nature of mathematics, school mathematical tasks and mathematical behaviour; and such beliefs are not always readily overcome.

Some examples of the beliefs that Mtetwa and Garofalo (1989:611-615) found among students are the following: mathematics problems have only one correct answer, doing mathematics is simply a matter of memorizing and

reproducing the facts, rules, procedures and formulas at the appropriate time; only geniuses are capable of creating mathematics, accompanied by such remarks as "I can't understand mathematics, after all I am not a genius".

According to Smith (1973:2) there is also a common belief that mathematics is a difficult, dull subject that is pursued only in a clear cut and logical fashion. This belief is perpetuated because of the way mathematics is presented in most text books.

Pupils who have such unhealthy beliefs about mathematics will probably choose not to continue with mathematics after standard seven.

(b) The emotional component

This component involves feelings and notions. Attitudes can be pleasant or unpleasant. Venter (1985:5) says that in mathematics, fear, anxiety and prejudice are some of the negative components of emotion. These emotional components can be acquired through first or second hand experiences with subject

matter.

As pupils were taught mathematics in the past years, that is, before standard eight, different feelings developed towards it. The feelings may be pleasant or unpleasant, and they may have come about because of the manner in which the subject was presented, or some unpleasant event that happened whilst the child was in contact with the subject matter and any other circumstances that may have arisen during mathematics lessons at school.

In their studies, Maqsd and Khalique (1991:379) found that mathematics phobia is generally observed in Bophutatswana school children; they tend to be apprehensive of classroom learning associated with number work. This mathematics phobia is strengthened by both parents and teachers by emphasizing their own learning difficulties in learning mathematical tasks. According to this study it appears that girls are more vulnerable to mathematics phobia than boys.

Where such unpleasant emotions exist, the pupils will not find the subject enjoyable and this will have a

great influence regarding the choice of mathematics as a senior secondary school subject. By the time the pupil reaches standard seven he already has some attitudes towards mathematics because, as Arguille (1987:20) maintains, attitudes towards mathematics as a school subject peak in early adolescence and decline through high school.

The emotional element, that is, fears, prejudices and phobias, no matter how unreasonable they may appear to be, will play a role in influencing the pupil when he makes this choice.

(c) The action component

Light (in Venter 1985:6) says that it is generally true that a change in beliefs about someone or something is usually accompanied by a change in behaviour towards that person or thing.

In this study it is mathematics towards which beliefs and feelings are directed, and the action or the actual concrete behaviour is the choice of this subject at the senior secondary level. If the pupils'

beliefs are unhealthy and the feelings are negative, then the possibility is that the pupils will choose not to continue with mathematics after standard seven; on the other hand if the beliefs are healthy and the feelings are pleasant, the pupils will most probably choose to continue with the subject.

Mukherjee (1978:518) asserts that taking attitudes as predispositions towards behaviour, it is reasonable to assume that the more positive a pupil's attitude towards learning a particular subject is, the more likely he is to succeed in that task. The more he succeeds in a particular subject, in this study mathematics, the more will he find it enjoyable and will want to continue doing it.

Attitudes are therefore the feelings, thoughts, ideas, prejudice, fears, beliefs and preconceived notions that a person has about a particular thing. Pupils may have different attitudes about mathematics, which means that an attitude is within the person concerned and is not inherent in the particular thing. By the time the child reaches standard seven, he has already developed certain attitudes towards mathematics, and

this is going to influence his choice.

According to Suydam (1984:12) attitudes towards mathematics are probably formed and modified by many forces, including teacher's enthusiasm and methods, parents and other adults, class-mates and other children, self-concept, learning style and experience with mathematics in and out of school. Although attitudes are within the person, external factors help to form them.

3.2.2.2. Motivation

According to Duminy and du Preez (1975:49) the term motivation as used by most writers, indicates an internal force that stimulates one to act in a certain manner in order to achieve a certain goal. Mwamwenda (1989:348) defines motivation as

"the causes of behaviour or whatever initiates and directs behaviour".

Motivation is therefore a driving force that makes a person do things in a certain manner. It is an

internal experience which cannot be studied directly. We infer its existence and nature from observation and experience of behaviour. Vernon (1969:1) says that we attribute a motivational basis particularly to types of behaviour that are recurrent and persistent and involve the employment of considerable energy; and which may also be accompanied by feelings of impulsion and desire.

This means that for the pupil to choose to continue with mathematics or not, will depend on how motivated the particular pupil is. Acquah (1987:15) says that because of the general prejudice against mathematics, pupils need a great deal of motivation before they can muster enough confidence to study the subject.

The teacher or any other significant person in the pupil's life can help to motivate the pupil by telling him the importance of mathematics and how likely it is to contribute to success in his life. This may stimulate him, and he is likely to be motivated if he thinks that it is worthwhile for him to study mathematics, and may therefore choose to continue with

it at senior secondary level. Motivation may therefore be a factor that may influence the child when he makes a decision whether to study mathematics at the senior secondary level or not.

3.2.2.3. Interest

Van den Aardweg (1993) describes interest as the deliberate, voluntary focus of attention, concern and activity on a particular person, object, event or sphere. If mathematics can draw the pupil's attention and interest, the possibility is that he will go towards it. If it is not interesting for him, the possibility is that he will move away from it.

It is easy for pupils to remember the concepts and skills acquired in studying a subject in which they have developed a special interest much better than those subjects which do not interest them. The more the pupil is interested in a particular subject, the more he will succeed in it. If he feels that he is good in mathematics, the likelihood is that he will want to continue with it in higher standards.

A considerable amount of interest is due to the fact that mathematics is a requirement for a number of tertiary courses. The syllabus itself can be a source

of interest for the pupils, as Acquah (1987:15) found. He found that in African countries like Ghana, Sierra Leone and Zambia where the so called traditional mathematics has been replaced by modern mathematics, the popularity of the subject has increased considerably. If it is interesting, then more and more pupils tend to want to study it.

There are many reasons why pupils find mathematics interesting or not interesting, but it does seem as if interest in mathematics will influence whether the pupil will want to continue with it or not.

3.2.2.4. Self-concept

Self-concept refers to the image that the person has about himself or herself. If this image is positive, the person will have a positive self-concept and he will most probably be self confident. If the image he has about himself is negative, he will have a negative self-concept and may tend to look down upon himself.

Lovell (1969:89) says that the individual's self-picture is a learned structure. It grows mainly

through training, identification with individuals and peer groups, the comments of other people and children, the acquisition of social roles, and the inferences drawn from his experiences

According to Marsh (1985:423-424) self - concept is multi-dimensional. It has several parts, each relating to specific activities. Mathematics self-concept comes into being as a result of the student's perceptions of his mathematical skills, reasoning ability and interest in mathematics. This means that mathematics self-concept will influence the choice of mathematics.

If the pupil feels that he is bad in mathematics, he may then have a negative mathematics self-concept, and when he is given a choice he may decide to discontinue with his studies in mathematics; the reverse may also be true.

We can have an idea of whether the child has a negative or a positive mathematics self-concept from the comments he makes about himself in connection with mathematics. Examples of such comments are: "I get good marks in mathematics"; "mathematics is one of my

best subjects"; "I always fail mathematics tests"; and others. Whenever the pupil has to make a choice, the idea that he has about himself will influence him.

The person's self-concept may not even be a true reflection of his ability, but his belief in connection with his ability, and it will nevertheless influence his choice. If he believes that he is bad in mathematics, he will not be interested in furthering his studies in it.

3.2.2.5. Synthesis

Attitudes, motivation, interest and self - concept are some of the non-cognitive factors that may influence the choice of mathematics as a senior secondary school subject. They are within the pupil and not inherent in the subject mathematics. These factors are interrelated, they are not mutually exclusive. Cognitive and non-cognitive factors are also interrelated. For example, interest in mathematics will influence achievement, which in turn may influence self-concept. These internal factors or their combination, will play a role in influencing the

child to choose to continue or discontinue with mathematics at senior secondary level.

3.3. EXTERNAL FACTORS

External factors are those factors that are not within the person himself or herself, but are found in the environment. Although they are in the environment, they are significant because they can exert pressure on the person, or can influence a person in one way or another. The standard seven child does not live in a vacuum, he lives with other people, therefore he is susceptible to their influences whenever he has to make a decision.

The influence from external factors may be direct, for example, when parents actually advise their children to continue with mathematics. It may also be indirect, for example, if the mathematics teacher handles the subject matter in a meaningful way for the pupils, or if he is self - confident and knows his subject well, this may influence pupils to want to continue with mathematics in higher standards.

Some of the factors in the pupil's environment that may influence him are: the teacher, the parents and other family members and the peer group.

3.3.1. The teacher

The teacher is a significant adult in a pupil's life. The way in which he presents subject matter in the classroom, his attitude towards the subject, whether or not he is self - confident, the manner in which he motivates his pupils, and others, will have an influence on the choice that will be made by the pupil.

The way in which the teacher perceives himself, his life-world, his pupils and his subject, determines the nature of the influence he will have or exert upon his pupils.

Whether the pupils will like mathematics or not, may be influenced by the teacher, as seen in a study that was conducted by Corbitt (1984:16-20). He asked fifty eight students at Commerce Middle School in Georgia, for explanations about why individuals might like

mathematics. Most explanations fell into two categories: (i) people like mathematics if they are good at it, and (ii) the mathematics teacher influences whether or not it is liked.

This shows that the mathematics teacher is a factor that may influence the pupil when he decides whether or not to continue with mathematics at senior secondary level.

(1981:63)

In the Human Sciences Research Council report compiled by the work committee on the teaching of the natural sciences, mathematics and technical subjects, it was found that a very serious situation seems to exist in the teaching of science and mathematics in black schools. It was found that the teachers are predominantly underqualified to teach these subjects. Among the 1626 mathematics teachers employed by the Department of Education and Training to teach mathematics in the standard 6 to 7 groups, 1138, that is, 70% of them were underqualified.

A teacher who is underqualified will usually lack self-confidence and his knowledge of the subject will

be minimal. This will have direct impact on the pupils he teaches. They may, as a result of the teacher, feel that mathematics is dull, difficult and complicated, and when it ceases to be compulsory, that is, from standard eight upwards, they may choose not to continue with it. It is therefore hardly surprising that many black pupils choose not to continue with mathematics at the senior secondary level.

The teacher may contribute greatly in making mathematics an unpopular subject. The fact that teachers are inadequately trained and therefore incapable; the fact that pupils have a poor understanding and proficiency in mathematics, as a result of having underqualified teachers; and the fact that some teachers and principals discourage pupils from taking the subject, are a combination that discourages pupils from furthering their studies in mathematics.

There are a number of things that a teacher can do to arouse the pupil's interest and to improve the pupil's attitudes and thus their self-concept towards mathematics. According to Acquah (1987;15) the teacher should strive to show his pupils how mathematics is

applied outside the classroom in everyday life, in industry, technology and elsewhere. This may help to show the pupils that mathematics is a useful subject and they may then choose to do it.

Suydam (1984:12) further states that the teacher must show that he likes mathematics, make it enjoyable, establish short-term goals that students have a reasonable chance of attaining, and show that mathematics is understandable by using meaningful methods of teaching.

The teacher is a powerful instrument that can influence the choice of mathematics among secondary school pupils. Pupils generally associate a subject with the teacher who teaches that subject. Whether the pupils will like and enjoy mathematics will, to a very great extent depend on the teacher. Likewise, whether they will choose to continue with it or not, may also depend on the teacher. If he motivates, encourages, challenges and generally make mathematics enjoyable, the possibility is that most of his pupils will choose to study mathematics at senior secondary level.

3.3.2. Parents

Although the secondary school child is striving for psychological independence, physically he still needs and depends on his family. At this stage however, the formal power of the parents and family has decreased.

Youniss and Smoller (1985:72-73) say that during the adolescent period, parents and their children move away from a structure of unilateral authority and begin to interact more co-operatively. Adolescents seek and parents grant greater independence than was true during childhood. However the adolescents view their parents as having the right to monitor, direct and control their behaviour and to present expectations for performance in matters such as school work or chores around the house. In addition, adolescents say that they seek advice from their parents especially about their plans for the future.

The young standard seven child, who is an adolescent, will therefore seek advice from his parents in matters concerning his future. If his parents are educated, he may ask for advice concerning the choice of mathematics. Parents' attitudes which are imparted to

the children, will have a great influence. If the parents have unhealthy beliefs about mathematics, they may impart such attitudes to their children, and this will influence the choice of mathematics negatively.

Parsons, Adler and Kaczala (in Pedersen, Elmore and Bleyer:1986:49) found a positive correlation between parents and students' attitudes towards mathematics. They also found that parents' attitudes differ with the sex of the child. They are more likely to push boys to study and do well in mathematics than girls.

Cutright (1989:4-5) states that there are a number of things that parents can do in order to encourage their children to like mathematics and therefore choose to continue with it in higher classes:

a) Parents must not undervalue mathematics and should not expect their children to do poorly in it. They must make sure that they treat mathematics like the important subject it is.

b) Both boys and girls should be encouraged to take advanced mathematics courses.

c) Parents should talk to their children about the importance and relevance of mathematics in their

personal lives and for future career opportunities.

Although secondary school children usually like to do as their friends do, in matters relating to their future and long-term projects they do seek the advice of their parents. The attitudes of parents towards mathematics will then influence the decision that the child will take. Some parents of the children in this study may not be educated and therefore not in a position of advising the child either way. Children of such parents will therefore be influenced by other factors rather than their parents.

3.3.3. The peer group

Broadly, the term peer group refers to all social relationships other than kinship ones, that exist between young people; more specifically it may denote either group or dyadic relationships. It can fairly be said, therefore, that the area defined by the peer group is large and that there is general consensus among psychologists that it has considerable developmental importance (Coleman:1979:95).

Seltzer (1982:53-54) on the other hand regards the adolescent peer group as a reference group. It can be either a membership or non-membership group; it can function as a negative or positive reference group; and it can provide a normative or a comparative function or both. It may or not be the primary reference group, it exists in relation to other groups or figures with varying degrees of strength. Its selection is a product of individual needs, the social situation, social demands and the normative orientation as a product of a history of secondary reinforcements.

Whether parents and teachers like it or not, when the child reaches secondary school, he becomes susceptible to peer influences. Even in matters pertaining to school, the peer group does have an influence on the pupil because this stage, adolescence, is a stage of conformity. The child would like to do as the members of his peer group do, in order to avoid rejection.

Because of the decline of the extended family, and as family ties weaken, the adolescent comes more and more under the influence of the peer group. Even when he

has to choose whether to continue with mathematics or not, he may find that there is no one else to seek advice from, except the peer group, which is neither qualified nor ready to give such advice.

Pupils who are most likely to be influenced and advised by the peer group are those whose parents are not interested in their school work, or those whose parents have died, or those whose parents work far away from home.

Secondary school children are at a stage when conforming with peers is very important. Hetherington and Parke (1979:507) say that there is a common belief that children become more conforming with age and that adolescents in particular adhere closely to the standards of their peer group.

There are reasons why people conform. Buss (1978:477) say that they conform because they want to obtain rewards, and the group can demand conformity by threatening to withhold these rewards. If a member of a group refuses to go along with the others they can stop liking him and punish him by rejecting him from

their company and branding him as different.

Adolescents do not want to be rejected by their peers, they want to be part of the group and to be accepted. If members of his group decide not to continue with mathematics at senior secondary level, he may decide to follow suit even if he is quite good in mathematics, in order to continue being a member of that group and not risk rejection.

If members of the group, on the other hand, value mathematics, they may spend a lot of time discussing it and its usefulness for job and career opportunities. The adolescent may then end up choosing to continue with it at senior secondary level. Either way, the peer group can influence the pupil in deciding whether to go on taking mathematics or not.

3.4. SUMMARY

The secondary school child may be influenced by a variety of factors when he has to decide whether to continue with mathematics at senior secondary level or not. He may be influenced by internal factors, that

factors that are inherent in him. These internal factors may be cognitive in nature, for example, intelligence, aptitude and achievement; or, they may be non-cognitive, like, attitudes, motivation, self-concept and interest. These internal factors are interrelated, and while they influence the child, they also influence one another.

The pupil may also be influenced by external factors, that is, factors that are in the environment. Although these factors are not from within the child, they are capable of influencing the decision that he will take. Examples of these external factors are, the teachers, the parents and the peer group.

In the next chapter the life-world of the secondary school child, the child who has to make the decision whether to continue or discontinue with mathematics at senior secondary level, will be discussed.

CHAPTER 4

THE LIFE-WORLD OF THE SECONDARY SCHOOL CHILD

4.1. INTRODUCTION

This chapter will focus on the life-world of the secondary school child in general, and the lifeworld of the secondary school child in Venda in particular.

The secondary school years span from standard six to standard ten. The standard six child is usually about thirteen years old, and the standard ten child about seventeen years old. The vast majority of secondary school children fall between these limits, though an extra year or two may be added on, especially at the upper end of the scale.

The children under investigation in this study are about fourteen years old. These children are the ones that must make a decision at the end of the standard seven year, whether they would like to further their studies in mathematics at senior secondary level or not.

4.2. ADOLESCENCE

Adolescence is an interesting, fascinating and challenging period of human growth and development. Vrey (1990:165) says that the total development of the secondary school years is usefully described by the term adolescence, which literally means "growing or developing towards something".

For almost all children, the secondary school years are adolescent years, and in this study we shall refer to the secondary school children as adolescents.

Harris and Liebert (1984:460) state that adolescence is the transitional period from the dependency of childhood to the independence and responsibility of being an adult. This is the time of both dependence and independence. The adolescent is likely to act in a childlike manner at one moment and with considerable maturity at the next. There may even be open conflict between these two roles.

This explanation by Harris and Liebert emphasizes the fact that the adolescent is neither a child nor an

adult. When faced with a choice, adolescents may act in a childlike manner and maybe make an irresponsible decision; or they may act with considerable maturity and therefore make a responsible choice after considering the other options that are open to them.

Ausubel, Montemayor and Svajian (1977:2) define adolescence as

"a distinct stage of development during which important and unique changes take place in the biosocial status of the adolescent".

McKeachie, Doyle and Moffet (1976:481) add on this idea by defining adolescence as

"a period of rapid physical changes, of conflicting motives and of ambiguous social expectations".

These definitions imply that there are significant changes biologically, physically, socially and psychologically in the adolescent.

Due to the immense change in the rate of growth that occurs during this period, adolescents are required to make many adjustments and therefore many choices, besides the choice of mathematics as a subject at senior secondary school.

While the standard seven child is trying to cope with the new changes in his body, he has to make choices in the classroom, he has to make decisions concerning subjects that he would like to study in the senior secondary phase, he has to choose whether he would like to continue with mathematics or not.

Adolescence is a distinct period of growth, characterized by great physical, social, psychological, emotional and intellectual changes in the young person. It is also characterized by the fact that the young person is no longer a child, but not yet an adult. Different authors differ as far as the chronological age limits of this stage are concerned.

4.2.1. Cultural and traditional views of adolescence

Development in adolescence depends to a great extent

on the society and on the particular political and economic tensions of the times. According to Craig (1989:369-370), in modern societies, adolescence stretches over the better part of a decade. This prolonged transitional period from childhood to adulthood is a modern phenomenon. In "primitive" societies the period of change is more condensed. In such societies, the young person undergoes a symbolic ceremony, name change or challenge, at puberty.

Newman and Newman (1986:112) support this by saying that in other cultures adolescence is not a stressful or turbulent period of life. Adolescents move gradually towards adulthood, building slowly on the roles and responsibilities already introduced during childhood. In other cultures, social expectations change dramatically after puberty, and the adolescents struggle to perform according to changing expectations.

Adolescence is a product of culture. Kroger (1989:1) agrees with this statement by saying that adolescence is a product of social conditions and historical

circumstance.

Adolescence in highly industrialized, westernized and modern societies differs from adolescence in traditional and rural societies. The needs and expectations differ, and therefore the demands that are made on the adolescents will differ.

4.2.1.1. Adolescence in modern societies

In modern, westernized and industrialized countries, the transition from childhood to adulthood is a prolonged process. Specht and Craig (1982:185) say that in such societies, long years of education are required while technical skills are learned, and large numbers of relatively unskilled youth are kept in school and out of the labour force. As a result, the age at which youth achieve full adult status has been delayed beyond the age of physical maturity.

In modern societies, adolescence is a long period of preparing the young people for their future. The adolescents acquire gradual independence. They learn to make their own choices and show their

individuality. Being able to make a responsible choice of subjects signifies that the child is learning to stand on his own.

4.2.1.2. Adolescence in rural societies

Adolescence in rural societies is a relatively short period. Siann and Ugwuegbu (1980:27) found that in some societies children move slowly and imperceptibly into the adult world in an even, continuous progression. Different societies have regarded the movement from childhood to adulthood in different ways and not all cultures have seen the adolescent as presenting particular psychological characteristics and needs.

In this regard, Newman and Newman (1986:112) say that children in these societies move gradually towards adulthood, building slowly on the roles and responsibilities already introduced in childhood. In other cultures, after puberty the young person is regarded as an adult and he has to struggle according to changing expectations.

In such societies then, the young person is not faced with making many choices and therefore the transition to adulthood is less strenuous. It is a period of coming of age ceremonies which symbolize an abrupt change from childhood to adulthood.

4.2.1.3. Adolescence in Venda

In Venda, where the study will be undertaken, the society is not completely westernized or modernized, but at the same time it is not completely traditional. Its a combination of the traditional way of life and the more modern way of life

Dreyer (1980:13) differentiates traditional and modern ways of life in the following manner. He says that traditional way of life is

"life under tribal conditions, with very little influence of modern, western, Christian, industrialized and urban conditions".

On the other hand he says that modern societies are

"those people who, after decades of Christianisation, industrialization and westernisation, have become detribalized, and have almost completely accepted the western way of life"(Dreyer 1980:13).

In Venda we have adolescents who live in the modern, town areas, where they do not actually fall under the jurisdiction of a particular chief or headman. The people who live in these areas have adopted the modern, westernized way of life. They earn a living through jobs just like in any other industrialized society.

The adolescents in these modern areas need to be prepared for a long time in order to take up their places in society. This preparation includes making a successful study in secondary school, together with making the necessary subject choices. The type of society where the adolescent lives, will influence his attitude towards mathematics. If he sees its importance, by having the opportunity to see it being utilized, he may choose to study it at senior secondary level.

There is also a large number of adolescents who live in the rural areas in Venda. Their way of life is still, to a great extent, traditional. They are under the jurisdiction of a chief or headman. Most of them still attend initiation schools, especially the traditional circumcision for boys. The girls also attend their own initiation ceremonies, including the popular "domba" or "snake" dance. These rural adolescents also attend school, and go to church just like their counterparts in the more modern areas.

The adolescents who live in the modern, town areas, also attend initiation ceremonies if their parents still regard them as important. In most cases the people who live in the modern areas have not lost touch with their relatives in the more traditional areas. That is the reason why the writer is of the opinion that even those who live in modern areas are not completely westernized. But there are some who have almost completely lost touch with the traditional way of life and have almost completely been westernized.

After attending the initiation school the young people

are regarded as adults; yet at school they are regarded as young people who still need guidance. Sometimes they are confused by the two roles. At times they feel that they do not need guidance even in school matters such as the choice of subjects. This, then may influence the choice of mathematics as a subject at senior secondary school.

4.2.1.4. Adolescence in secondary school

Being in secondary school shapes the life of an adolescent in a specific way. Jersild, Brook and Brook (1978:466) say that the high school has, or might have, a powerful influence in shaping adolescents' concepts of what they are and what they might be. It impinges on most facets of young persons' lives in their transition from childhood to adulthood. In many respects the high school is in a more strategic position than the home to influence the lives of adolescents.

Adolescents at high school or secondary school are all subjected to the same influences at school, irrespective of whether they come from modern homes, traditional homes, semi-modern homes or homes that are

in a state of changing from traditional to modern, which Dreyer (1980) refers to as transitional.

The children under investigation in this study are in secondary schools in Venda. The climate, relationships and activities at secondary school affect them and influence them in whatever they do, even in choosing to continue or discontinue with mathematics.

At this point in time, the secondary school children in Venda are politically aware and motivated. They are no longer passive recipients of subject matter, but they enquire and want to be involved in their own education. As an educational goal, this is desirable. However, sometimes, because these children are young, they lose sight of their true objective, that is, the improvement of the black education system, and involve themselves in delinquent behaviour that ultimately disturbs their own education. This will in turn affect the decisions that they will make and the subjects that they will choose.

The relationships of the adolescents with friends and adults at school will also influence them. If the

relationship of the adolescent with the mathematics teacher is healthy, then the possibility is that the young person will choose to study the subject in higher standards. The manner in which mathematics is regarded in a particular school may also encourage or discourage pupils from choosing to continue with it.

The guidance teacher is also important in influencing the choice of mathematics at senior secondary school level. If the guidance teacher impresses upon the pupils the importance of mathematics in their everyday life and also in their future, the pupils may decide that it is worthwhile to take mathematics as one of their subjects in the senior secondary school.

In some schools in Venda however, guidance is not regarded as the important subject it is. Some teachers even teach other subjects rather than guidance during that period, which means that the pupils do not get the educational guidance that they so need. This in turn, affects their subject choices.

The activities that pupils indulge in will influence them in as far as these activities are affected by

particular subjects. For example, if being involved in too many extra curricular activities leaves little time for practising mathematics theorems, the adolescent may choose not to continue with mathematics, depending on the value he or she places on it. The secondary school setting will therefore influence the choice of mathematics at senior secondary level.

4.3. PHYSICAL DEVELOPMENT OF THE ADOLESCENT

Adolescence is a period of great physical changes. Fein (1978:439) states that because of the immense change in the velocity or rate of growth that occurs during this period, adolescents are said to experience a growth spurt. The age at which this peak occurs varies according to environmental conditions such as socioeconomic class, nutrition, diseases and psychological disturbances, as well as genetic differences.

During this stage the adolescent is concerned about his body to a very great extent. This may even affect him psychologically and will influence other tasks and

activities that he has to perform.

According to Papalia and Olds (1981:34) most teenagers are more concerned about their physical appearance than about any other aspect of themselves. Their self-concepts depend largely on how attractive young people consider themselves.

The idea that a person has about himself, that is, his self-concept, will determine whatever decision he will take. The decision may be required at a time when the adolescent is undergoing a particularly difficult patch of the physical changes, when his self - concept is particularly negative, and this may affect the choice negatively.

The way in which other people, for example, his family and peers, view the physical changes he is experiencing, plays a determining role in how the adolescent will perceive himself. If their attitudes are positive, this will contribute to a positive self-concept, and vice versa, and this in turn will influence the choice of mathematics as a senior secondary school subject.

The changes that occur during adolescence occur at a different age for each adolescent. There are early, normal and late maturers, and as a result there are different implications for these children.

Berzonsky (1983:215) says that evidence reveals that pubertal timing is correlated with adolescent stress, and the relationship differs for males and females. Early maturing males for instance, tend to experience fewer problems and a less stressful adolescence than their later maturing cohorts. A reverse trend has been found for females, early maturers tend to experience comparatively more difficulties and greater stress.

Cronbach (1977:157) supports this by saying that early maturers become smoother socially, each success gives confidence and prestige, which helps them further. The early maturer is physically ready in adolescence to take a full part in a new social environment and to learn from it.

Early and late maturation will therefore have an effect on the adolescents when they make their choices. The early maturer, who is confident and more

mature behaviourally, will not have difficulties in making a decision as much as the late maturer. By the time the early maturer reaches the end of the standard seven year, he or she has long passed puberty and has more or less accommodated its changes and is more at ease. He or she is therefore better able to weigh up the alternatives open to him or her and come up with a choice.

It is not physical development per se that influences the secondary school child when he or she decides whether to continue with mathematics at senior secondary level or not, but the psychological effects of this development on the adolescent concerned.

4.4. COGNITIVE DEVELOPMENT OF THE ADOLESCENT

Cognitive development refers to the development of the intellect and all that goes with it. Mwamwenda (1989:337) defines cognitive development as the development of a person's mental capacity, involving reasoning and dealing with various problems calling for objective thinking.

In his study of the Zulu adolescent, Dreyer (1980:32-33) states that adolescence is characterized by a noteworthy progress towards intellectual maturity. A fundamental characteristic of this progress is heightened sensitivity, which results in an increase in the ability to think in general terms and to apply abstract ideas; to comprehend meaning; to weigh values objectively in the forming of judgements; to grasp new relationships; and to reason clearly and constructively for the purpose of achieving insight into increasingly complex situations.

The Venda adolescent is not an exception to Dreyer's observations.

Sigel and Cocking (1977:89) say that the young person can now create hypotheses and deduce logical conclusions. The ability to think in formal terms enables the adolescent to adopt adult roles. They also use their new found skills to develop a detailed philosophy of life and plan of society.

This means that the adolescent now has an idea about the kind of life he or she wants, this will include

his future career. As he can think in an abstract manner, he can see the advantages and/or disadvantages of a particular thing even in the absence of concrete evidence. As a result he can see the pros and cons of studying mathematics at senior secondary level even when the evidence is not there yet. Thus the decision to continue or discontinue with mathematics will be influenced by the intellectual state of the young person, together with his cognitive style.

Each child has his or her own cognitive style, and therefore we cannot expect them to decide in the same way. Cognitive style, according to Hadfield (1988:76), is the individual's preferred method of perceiving, thinking and retaining information. It deals with methods of performance of intellectual tasks rather than with intelligence. It is a characteristic approach a person brings with him to a wide range of situations.

Some children when they have to decide, will look at the alternatives open to them first, then weigh them up carefully and come out with a decision. Some will make a hasty decision that is emotionally charged on

the basis of one or more events connected with mathematics in the past. Others will rely on other people to encourage them or actually make the choice for them.

4.5. EMOTIONAL DEVELOPMENT OF THE ADOLESCENT

Adolescents experience many emotions as they relate to their parents, their peers, their teachers and society at large. These emotions may be joyous in nature or aggressive and inhibitory, for example, fear, anxiety and worry. Outbursts of anger are also common during early adolescence.

The adolescents in Venda also experience the emotions as described in the preceding paragraph. If things go their way, they become very happy, but may become aggressive when things do not go their way. Defiance to authority is also a common emotion among the adolescents in recent years. This may partly be because of the fact that in most homes, especially those in the rural and traditional backgrounds, the father is often away from home and works in the city, and consequently the children may undermine the

authority of the mother.

Another reason for this defiance may be because of the fact that extended families are fast becoming a thing of the past. Even in the rural areas, it is very rare to find a traditionally extended family as was the case in the past. The result is that when the father is away from home, the children lack his advice, even in matters pertaining to school.

Dreyer (1980:31) states that because of the increasing independence, many adolescents are in frequent conflict with their parents. They begin to look at parents and teachers more objectively, and a frequent reaction of adolescents to the discovery that adults are fallible is defiance of adult authority.

It is during this stage, when adolescents are aware of the fallibility of adults, that they have to make important decisions such as the choice of subjects, which in turn will affect their future careers. When they have to choose whether to continue or discontinue with mathematics at senior secondary level, they may tend to reject the valuable advice given by adults.

4.6. MORAL DEVELOPMENT OF THE ADOLESCENT

Moral development refers to the way children learn to determine what is right and what is wrong.

According to Galloway (1976:354-356) moral development is closely associated with personal values, beliefs and standards. The moral values derive from universal principles and from internal decisions of conscience. The person now recognizes that rules and expectations contain an arbitrary element. Usually for the sake of agreement he respects the right or will of others for the good of the whole society, but recognizes the possibility of changing rules or contracts.

In this regard, Papalia and Olds (1981:355) say that every society comes up with its own definition of right and wrong. What is totally acceptable in one culture may be considered a grave sin in another.

What may be right for the Venda adolescent, may be totally wrong for the American adolescent. In the

traditional Venda home, for example, it is wrong for the girl to answer back when her father tells her to do something even if she is not in agreement. Even in matters pertaining to school, the child could be told to do a teacher's course or even to leave school without having attained her aspirations.

The idea of right or wrong therefore depends on the culture or society in which a person lives. The adolescent is now at an age where he can differentiate between right and wrong, and therefore he can make decisions. Besides culture, what is right or wrong is also determined by the conscience of the particular person. What is right behaviour for a particular child, may be regarded as wrong by the next. All this also affect the children when they choose subjects at school.

4.7. SOCIAL DEVELOPMENT OF THE ADOLESCENT

By social development, Selman (in Sprinthall and Sprinthall 1981:561-562) refers specifically to interpersonal relations, that is, how we view ourselves and others at the same time.

This means that social development refers to all our social interrelationships. Brion-Meisels and Selman (1984:278) go a step further to state that the development of social competence in early adolescence involves the construction of new strategies for dealing with changes in interpersonal relationships, and for redefining the adolescent's sense of self in the light of new social and societal realities.

Secondary school children's interpersonal relationships change. The family is no longer the only significant socialization agent, the peer group and other people in the community and school join in as socialization agents during this period. All these people, with whom the children associate, may influence them in making their choices.

Among the Venda adolescents it may happen that the relationships and behaviour that is expected at school differs with the one expected at home, especially in traditional homes. For example, being outspoken is a desirable virtue at school, but in the traditional home it may be regarded as lack of respect and therefore undesirable.

4.7.1. Identity in adolescence

The growth spurt of adolescence, together with the remarkable intellectual development, disrupt the child's sense of continuity and personal wholeness. The young person has changed so much that he or she has a problem of understanding the continuity of experience across time.

According to Woolfolk and McCune-Nicolas (1984:90) the individual has been developing a sense of self since infancy, but at adolescence there is for the first time, a conscious effort to answer the question, who am I?

Identity formation helps to provide continuity between the individual's past, present and future. It helps to protect the individual against sudden discontinuities in his or her life. This inner sense of identity also helps to give direction, purpose, and meaning to one's future life.

Besides the discontinuity that may be caused by the great changes that occur in the child at this stage,

the Venda adolescent is also faced with the discontinuity that is caused by the differences between the school and the home.

At home the parents may be traditional and raise the child in a manner that is right and suitable according to them; whereas the school is modernized and westernized. For example, at home the child may be told that kneeling or sitting down when speaking to elders is a sign of respect; but at school the opposite is the case, the pupil must stand up to show respect. The differing roles that the child must always play may confuse him and cause serious discontinuities in his or her life.

Because the sense of identity gives direction to a person's life, it means that it will help the young person when he considers what he would like to become in future, that is, his vocation. If he has an idea about what he would like to become, then this will affect his subject choices. This implies that the choice of mathematics at senior secondary school will be facilitated by the fact that the child has defined himself or herself.

4.7.2. Reflecting on self

Adolescents spend considerable time examining themselves psychologically and physically. They think about themselves, exactly who they are and where they are heading for. This will obviously influence the decision that they will make. The decisions that they will make will be in accordance with who they think they are and how they regard themselves.

Hansell, Mechanic and Brondolo (1986:115-116) regard this self reflection as introspectiveness, that is the tendency to devote diffuse attention to thoughts and feelings about the self. This tendency increases during adolescence and may be stimulated by discontinuities and parental introspectiveness. Introspectiveness may also affect other processes such as the formation of life goals and activity patterns.

If pupils think that they are good in mathematics, they will most probably choose to study the subject; but if their self evaluations lead them to believe that they are bad in mathematics, this may lead them to choose to discontinue with the subject.

4.7.3. Peers as agents of socialization during adolescence

A peer group is very important during adolescence. Craig (1989:357) defines a peer group as

"a stable group of two or more children who interact, share norms and goals, and, with respect to age, level or social status, are considered equals".

During adolescence, according to Dreyer (1980:32), the peer group becomes the source of general rules of behaviour. Because the peer culture is more demanding than - and frequently in direct opposition to - family control, a conflict may arise between the peer code and the adult one.

The standard seven child belongs to one or other peer group, and is therefore susceptible to peer influences in his or her daily life. The peer group also influences the decisions that the young person will make. Whether to continue with mathematics or not, is

also a decision that will be influenced by peers as agents of socialization during adolescence.

According to Myburgh and Anders (1989:124) the peer group often creates opportunities for new sprung interpretations of existing principles and thus plays the role of sounding board to the maturing adolescent. It is in the peer group that the adolescent gradually starts distancing himself from the concrete and becomes increasingly willing to hold an own point of view. The opinion of the peer group during adolescence often carries more weight than does the criticism of the parents.

This means that during adolescence the opinion of friends is more valuable than that of parents because of the need to conform. In his studies Dreyer (1980:32) found that junior high school pupils display enthusiasm and pride in group activities and want to be part of the crowd. Conformity and loyalty to group standards are demonstrated even to the point of adopting bizarre fashions in dress, speech, appearance and attitudes, and in the formation of adolescent

cliques.

Worell and Stilwell (1981:112-113) are of the opinion that conformity is a kind of modelling behaviour practised in groups. Students will try to match their behaviour to what some or most of their peer group are doing. Non-conforming students are likely to become social isolates or rejected members of the group.

The Venda adolescent also places great significance on conformity. The adolescents will do almost anything in order to be accepted by their peers. Conformity may, in some instances, result in the adolescent choosing to continue or to discontinue with mathematics at senior secondary level, if the choice will make him or her acceptable in the particular peer group.

The peer group is an important source of influence during the adolescent years. It influences the adolescent in almost all matters, because it is in the peer group where the young person will have an opportunity to express ideas about himself or herself, parents, teachers, persons in authority, personal problems and other issues. In whatever the adolescent

does, including choice of subjects, the peer group will exert pressure and influence to a greater or lesser extent.

4.7.4. The family as an agent of socialization during adolescence

Although the standard seven child is an adolescent, and is greatly influenced by the peer group, he or she is still under the influence of the family to a very large extent. The young person is not yet completely independent, therefore he or she cannot disregard the advice given by family members completely, especially the parents. Most of the time family members continue to influence adolescents' beliefs, and also the behaviour of these young people.

For most adolescent children, parent-child relationships are strong and essentially positive (Gordon 1975:304). He goes on to say that by and large these children accept the adult values and internalize the way of life of the family. This however does not mean a lack of conflict, but it does mean that friction is kept within bounds and does not

lead to the great mass of children becoming rebels without cause.

The style of parental authority, especially, will have an impact on the adolescent, and will influence the choice of mathematics at senior secondary school.

4.7.4.1. Permissive parents

Permissive parents allow adolescents virtually unlimited freedom to make their decision without parental constraints. According to Turner and Helms (1983:295) adolescents from these homes are frequently allowed to come and go as they please.

Parents of some of the adolescents in Venda are permissive. Sometimes the parents appear to be permissive because of their total ignorance of school matters, especially those parents who were themselves raised in traditional homes, but are now trying to raise their children in the rapidly changing Venda society.

Some parents are not actually permissive, but are made

so by circumstances, for example fathers who work under the migratory labour system. Most of the time they are away from their homes and children, therefore the children end up doing as they wish, without proper guidance.

Permissive parents will show no interest in the decision that will be made by the adolescent in connection with mathematics. Because children from such families are usually not self reliant, they may be influenced by any person outside the family in choosing whether to study mathematics in the senior classes or not.

4.7.4.2. Democratic households

Hopkins (1983:211) says that in democratic households there is group discussion of issues and problems and group decision about courses of action. Parents encourage adolescents to co-operatively arrive at solutions with them. As a result self - confidence and independence will be higher in adolescents from such households.

Some parents in Venda are democratic, especially those who are educated and those who are in a state of transition from the traditional household to the more modern household. When such children make their decisions, they do it confidently, knowing that if they have any problem they can discuss it with their parents and arrive at a conclusion and decision together.

4.7.4.3. Autocratic parents

Autocratic parents simply tell their children what to do. According to Hopkins (1983:211) they produce the least amount of autonomy. This type of parental authority does not allow much room for independent thinking by their adolescent offspring.

In his studies of Zulu children, Dreyer (1980:66) found that the adolescent growing up in traditional Zulu society was subjected to an education in conservatism and conformity, in acceptance of and loyalty to the traditional way of life. The atmosphere and general practice in his home is marked by complete submission to parental authority. The child simply has

to conform to the values, wishes and norms of his superiors.

In Venda we still have such autocratic parents who want their children to do as they are told and not to ask questions. Adolescents from such families will not make their own decisions, but will depend on their families to decide for them. Thus the parents will decide whether the child should continue with mathematics or not. The problem lies where the autocratic parents are not educated and therefore not in a position to make such a decision, the child will be stranded and may take advice from just anybody.

4.8. VOCATIONAL ASPIRATIONS OF THE ADOLESCENT

Black adolescents are concerned about their future, more than they have ever been before. According to Hickson and White (1989:77), South Africa is in the process of changing into a technological and industrialized society. A major implication of this change is the demand for more skilled manpower. Additionally, because of sweeping social changes now taking place and the ultimate dismantling of an

apartheid system, underprivileged groups will have to make rapid adjustment in order to be prepared to enter occupations previously denied to them.

These changes that are taking place in the social and economic structure of society also bring about changes in adolescent views, including their vocational aspirations. The Venda adolescent's vocational aspirations have changed greatly in recent years. In the past most school leavers ended working in the civil service or being trained as teachers or nurses. This was because of a couple of reasons. Nel and Mkhabela (1987:1) give the following reason

"it is well known that until a few years ago only a limited number of vocations were open to blacks. Since the appearance of the Wiehahn report the entire spectrum of vocations has been opened to all race groups in South Africa".

Another reason for the limited choice was that there was no, and in most instances still no, careers guidance for black children. Another reason which

still dominates, was the premature closure of options because of not having studied some vital subjects for most careers, for example mathematics and science.

The Venda adolescent is now aware of occupations that his or her predecessors did not know. Children are now aspiring to higher goals than ever before. Most of the careers aspired to, need a knowledge of mathematics. As a result career and vocational guidance is needed more than ever before so that the pupils can make relevant choices of subjects as early as from standard seven.

In this rapidly changing South Africa, pupils will need mathematics in order to cope and be trained for relevant occupations. Now, more than ever before, more black pupils should be encouraged to study mathematics at senior secondary level.

Making a choice of career gives the adolescent an early start in his quest for economic security and independence by setting a tangible goal towards which he can immediately direct his efforts and training, and thereby acquire appropriate competencies (Ausubel

et al 1977:399).

In Venda children are not actually encouraged to make early career choices. When they choose whether to study mathematics or not, it is not with a particular vocation in mind. Some pupils end up realizing that they should have studied mathematics when it is too late to do anything about it, that is, when they actually need it in order to get a chance to be trained for a particular profession. For those adolescents who have an idea, or who already aspire towards certain careers, these aspirations will influence their choices of mathematics as a subject at senior secondary level.

4.9. PROBLEMS OF ADOLESCENTS

Adolescents in general, and black adolescents in particular, experience similar types of problems. Some of the problems are the following:

4.9.1. Independence-dependence conflict

Dreyer's study of the Zulu adolescents revealed that

as a result of changes in the economic and social structure of society, present day Zulu adolescents experience needs and problems similar to those of their white counterparts. An increasing desire for education and the resultant lengthy adolescence has caused a craving for independence but at the same time a realization of dependence upon parents (from whom they often differ), teachers and other adults (Dreyer 1980:94).

Venda adolescents also face this problem. While they may have differences with their parents, they, at the same time realize that there is nothing that they can do as they depend upon them, in order that they enjoy the support needed to go through the lengthy school years.

4.9.2. Migratory labour

Black adolescents, including Venda adolescents, especially those in the rural areas, are affected to a very great extent by this problem. Fathers work in places that are very far away from home, and because of this, ties with fathers are loosened and fatherly

advice lacks. Most often in such cases the authority of the mother is not taken into consideration. This problem affects the adolescents in all sheres, including making all the important decisions, at home and at school.

4.9.3. Vocational guidance

In a study by Holtzhausen, Swanepoel and Groenewald (1987:28) of a group of black adolescents from Soweto and Cape Town, the adolescents were most interested in the selection of school subjects that exist and the requirements and background information needed for entrance to specific professions.

This means that black adolescents, including Venda pupils, are interested in knowing about the different professions and the necessary preparation needed to enter such professions. Adolescents need this service but unfortunately it is not readily available for adolescents in Venda

4.9.4. Changes in socio-economic structure

In Venda the socio-economic structure has changed to a very large extent. People who were formerly regarded as being of a high status are no longer regarded as such, for example, teachers, nurses and clerks in the civil service. There are so many teachers in Venda at this point in time that some are walking the streets because there are no vacant posts.

Pupils are aware of this and they are now aspiring towards other professions. Hence the choice of relevant subjects has come under the spotlight.

4.9.5. Lack of properly qualified teachers

Although there are more than enough teachers in Venda at this point in time, there is a lack of properly qualified mathematics and science teachers. This may be a contributory factor that discourages pupils from choosing to continue with mathematics. If the teacher knows his subject and is self - confident, then the pupils will be interested and will most probably choose to continue with that subject in higher

standards.

4.9.6. Communication between parents and children

Holtzhausen et al (1987:27) say that the higher average educational level of black adolescents in comparison with black adults may contribute to the already existing communication gap between black parents and their children. Factors such as urbanization and the recent unrest may also be contributing factors.

There is also a communication gap between parents and children, even in Venda. The numerous changes in social conditions have exaggerated the differences between adolescents and adults. Not really being able to talk with one's parents gives rise to problems when the young person needs the advice of his parents. This throws the young person into the hands of the peer group which may not give desirable and proper advice.

4.9.7. Improvement of achievement at school

According to Mickelson (1990:44) many black youths

express a high regard for education even though their academic performance is poor. Blacks are often excluded from the most desirable jobs or do not receive rewards commensurate with their educational credentials. Black children have come to realize that efforts in school often do not have the same outcome for members of their group as do similar efforts for members of socially dominant groups.

This may act as a demotivating factor for the black adolescent, who may conclude that qualifications will not work for him. However, because of the changes that are taking place now, black adolescents now realize that they need education in order to take their place in society, thus the need to improve their achievement at school.

4.10. SUMMARY

The life-world of the adolescent differs from the life-world of the adult because their circumstances differ. At the same time the life-world of the black Venda child is unique because of his unique circumstances.

Adolescence is a period of great changes in the physical, intellectual, emotional, moral and social development of the young person. His vocational aspirations also change and he is faced with new challenges and problems which he did not have when he was younger.

While the young person tries to cope with these changes, he also has to make important decisions at school. One of these important decisions is the choice of mathematics as a subject at senior secondary level.

In the next chapter, the planning and execution of the empirical investigation will be conducted.

CHAPTER 5

EMPIRICAL INVESTIGATION: PLANNING AND EXECUTION

5.1. OBJECTIVES OF THE EMPIRICAL INVESTIGATION

The problem to be investigated in this research is: what are the different factors that can be identified as having an influence upon the standard seven pupils when they have to make a choice whether to study mathematics at senior secondary level or not?

The empirical investigation is mainly aimed at identifying the relative importance or contributions of the different factors in influencing the standard seven child when he makes the choice.

In order to achieve this objective, the following procedure is followed:

(i) A literature study is conducted concerning the nature, meaning and uses of mathematics; the variety of factors that may influence the child; and the life-world of the secondary school child, that is, the

child who is going to make a choice.

(ii) An own data-gathering instrument, that is, the questionnaire is designed in order to determine the relative importance of the factors that influence the child. From a study of the relevant literature in chapters two, three and four, a number of factors were identified as being relevant to this study. The questionnaire items for each factor were constructed as a logical result of the literature study, operational constructs were identified for each factor and expressed as items.

(iii) An appropriate research group is compiled and a pilot study is conducted.

(iv) Certain statistical techniques are applied to test the stated null hypotheses, and conclusions are drawn and recommendations made.

5.2. PLANNING OF THE EMPIRICAL INVESTIGATION

5.2.1. The research group

The study is limited to standard seven pupils, both boys and girls. Standard seven are chosen because at the end of the standard seven year mathematics ceases to be compulsory. The pupils have to decide by the end of that year whether they would like to continue with mathematics at the senior secondary level or not.

All the standard seven pupils in two secondary schools in Venda were involved in the study. Initially 225 pupils answered the questionnaire, but 24 questionnaires had to be excluded because they were either incomplete or had other discrepancies. Thus 201 pupils were involved in the study, 112 boys and 89 girls.

5.2.2. Official permission to do research

Official permission to undertake the research was sought and granted by the Department of Education in Venda. Permission was granted under the condition that

the area managers in charge of the schools should be informed. The researcher also made the necessary arrangements with the principals of the schools involved in the research.

5.2.3. The data-gathering instrument

A questionnaire comprising 77 close-ended items was constructed (Appendix). Pupils were given two alternatives, that is, "YES" or "NO". They had to mark the answer of their choice with a cross in the appropriate space.

According to Bailey (1982:123-124) the advantages of fixed-alternative or close-ended questions are that the answers are standard and can be compared from person to person; the answers are much easier to codify and analyse, and often can be coded directly from the questionnaire; the respondent is often clear about the meaning of the questions and it is easier to answer close-ended questions because the respondent merely has to choose a category.

The researcher also realized that it is appropriate to

use close-ended questions for the research group concerned, that is, standard seven pupils whose mother tongue is not English. They will not have to answer in sentences but will only indicate the appropriate answer by merely making a cross.

In answering items 1 to 75, the pupils had to choose "YES" or "NO". Item 76 is a gender question, the alternatives being "boy" or "girl". The last item, item 77, is the only item without alternatives. The pupil has to state his or her mathematics mark in the last school report. The questionnaire could be completed in about 40 minutes.

The questionnaire items are classified into five categories which correspond with the factors identified from the literature study. These categories are shown in table 5.1. (The rationale of these categories are given in section 5.2.6).

Table 5.1

CATEGORIES OF QUESTIONNAIRE ITEMS

CATEGORY	ITEMS	TOTAL
Attitude towards mathematics	1, 2, 3, 10, 13, 14, 15 17, 20, 29, 31, 32, 38, 40, 41, 44, 47, 48, 57, 68	20
Utility of mathematics	5, 7, 9, 11, 12, 21, 23, 24, 26, 30, 39, 43, 67, 72, 74	15
Influence of the peer group	6, 18, 25, 35, 45, 54 59, 61, 63, 73	10
Influence of family members	8, 28, 34, 37, 42, 51, 52, 53, 55, 64, 65, 69	12
Influence of the mathematics teacher	4, 16, 19, 22, 27, 33, 36, 46, 49, 50, 56, 58, 60, 62, 66, 70, 71	17
		74

5.2.4. Pilot study

A pilot study was undertaken with a class of standard seven pupils from a nearby secondary school. From the pilot study it was found that there were no technical mistakes in the questionnaire. However, because the pupils who answered the questionnaire were in standard seven, and the questionnaire items were written in English which is the pupils' second language, some words like "confused" and "opportunities" had to be explained to them. The researcher then realized that she had to be present to administer the questionnaire to the research group.

The school in which the pilot study was undertaken was not included in the sample.

5.2.5. Scoring

The scoring of questionnaire results was done by allocating one point for the "YES" response, and nil for the "NO" response. The research group was divided into two groups. Group 1 is the group that chose to continue with mathematics and group 2 the group of

pupils that chose not to continue with mathematics.

For each category, in each group, the responses were scored. If the item in the questionnaire is positive in nature, the "yes" alternative will denote a positive response and the "no" alternative a negative response. On the other hand if the questionnaire item is negative in nature, the "yes" alternative will indicate a negative response and the "no" alternative a positive response; the scoring was reversed for these items.

The total score was divided by the total number of pupils in that particular group, and the mean score for each group and category was arrived at.

5.2.6. Rationale of the questionnaire categories

5.2.6.1. Attitude towards mathematics

From the literature study it was found that attitudes are composed of beliefs, emotions and actions directed towards a particular thing (refer paragraph 3.2.2.1).

Mtetwa and Garofalo (1989:611-615) and Smith (1973:2)

list a number of unhealthy beliefs that pupils have towards mathematics. Pupils who have unhealthy beliefs and unpleasant emotions about mathematics choose not to study it if they are given a choice. Those who have positive attitudes towards mathematics choose to continue with it when they are given a choice. From the literature survey then, it seemed that attitude towards mathematics would be a factor that could influence the choice.

The literature study revealed that attitude towards mathematics can be observed by, for example, the way in which the pupil speaks about it, whether positively or negatively; whether the pupil has phobias with regard to it; the pupil's eagerness for the mathematics lesson that indicates interest in it or the reluctance that shows that the pupil is not interested; and others. A total of 20 items were constructed in terms of these observable attributes. The "yes" or "no" responses to these items give an indication of the pupil's attitude towards mathematics

5.2.6.2. Utility of mathematics

From the literature study it was found that mathematics is useful in many areas of life (refer paragraph 2.5). Lamon (1972:36) and Davis and Hersh (1981:79-80) found many areas in which mathematics could be used. If the pupils are aware of the usefulness of mathematics they are likely to choose to continue with it. Thus utility of mathematics seemed to be a factor that could influence the choice of mathematics.

A pupil's idea about the utility of mathematics is observed by the way in which he relates mathematics to his future career and his daily life situations, for example, when a pupil says that mathematics will help him in his other school subjects, or that it helps him in working out the correct change when he buys goods at the shops. A total of 15 items were constructed in terms of these observable attributes. The "yes" or "no" responses give an indication of the pupil's awareness of the utility of mathematics.

5.2.6.3. Influence of the peer group

The literature study revealed that the peer group plays an important role during the adolescent years (refer paragraph 3.3.3). Seltzer (1982:53-54); Coleman (1979:96) and Hetherington and Parke (1979:507) found that the adolescent is susceptible to peer influences because of the fear of rejection. The researcher then assumed that even in making this choice the young person may be influenced by the peer group. Thus peer group influence could be a factor that affects the choice of mathematics as a subject in the senior secondary school.

Peer influence can be observed by the reluctance of the pupil to be separated from friends; discussion with friends on a lot of matters and a variety of topics, including the choice of subjects; and eagerness to please friends. A total of 10 items were constructed in terms of these observable attributes. The "yes" or "no" responses to these items give an indication of the influence exerted upon the pupils by the peer group on the choice of mathematics as a senior secondary school subject.

5.2.6.4. Influence of family members

In the literature study (refer paragraph 3.3.2), Youniss and Smoller (1982:72-73) found that adolescents view their parents as having the right to monitor, direct and control their behaviour and to present expectations for performance in matters such as school work. Adolescents seek advice from their parents, especially about their plans for the future. Thus, family members' influence was regarded as a factor that may influence the choice of mathematics as a subject at senior secondary school.

Pupils can be influenced by their families as observed by their need to discuss or ask their families first before making a decision, and verbalizing ideas they get from home regarding mathematics, for example, "my parents say that mathematics was difficult for them when they were at school". A total of 12 items were constructed in terms of these observable attributes. The "yes" or "no" responses to these items give an indication of the family members' influence on the choice of mathematics as a secondary school subject.

5.2.6.5. Influence of the mathematics teacher

The literature study (refer paragraph 3.3.1) revealed that the teacher is a significant adult in the pupil's life. The way in which he presents the subject matter will have an influence on the attitude that the pupils will form towards that subject. Thus, the mathematics teacher's influence was regarded as a factor that may influence the choice of mathematics as a subject at senior secondary school.

Pupils can be influenced by their mathematics teacher as observed by the way in which they relate to him or her; enjoy the teacher's lessons; and show interest in his or her classes. A total of 17 items were constructed in terms of these observable attributes. The "yes" and "no" responses to these items give an indication of the teacher's influence on the pupil's choice.

5.2.6.6. Summary

The most important factors that influence pupils when they choose whether or not to continue with mathematics at senior secondary level, were identified

from the literature study. On the basis of the factors, operational constructs were identified and expressed as items.

5.3. RESEARCH HYPOTHESES

5.3.1. Research hypothesis 1

Rationale: From the literature study (chapter 3) it was concluded that attitude towards mathematics is an important factor that may influence the choice of mathematics as a subject at senior secondary school. Consequently, the following research hypothesis is formulated:

"There is a significant difference in the attitude towards mathematics of a group of pupils who choose to study mathematics in the senior secondary level and a group of pupils who choose not to do so".

5.3.2. Research hypothesis 2

Rationale: From the literature study (chapters 2 and 3) it was found that the perception of the utility of mathematics by the pupils is an important factor that may influence the pupils when they decide whether to continue with mathematics at senior secondary level or not. Consequently, the following research hypothesis is formulated:

"There is a significant difference in the perception of the utility of mathematics of a group of pupils who choose to study mathematics in the senior secondary school and a group of pupils who choose not to do so".

5.3.3 Research hypothesis 3

Rationale: From the literature study (chapters 3 and 4), it was found that peer group influence is an important factor that may influence the standard seven pupils when they choose whether to continue with mathematics at senior secondary level or not. As a

result the following research hypothesis was formulated:

"There is a significant difference in the influence exerted by the peer group towards a group of pupils who choose to study mathematics in the senior secondary school and a group of pupils who choose not to do so".

5.3.4. Research hypothesis 4

Rationale: From the literature study (chapters 3 and 4), it was found that family members' influence is an important factor that may influence the standard seven pupils when they choose whether to continue with mathematics at the senior secondary level or not. Consequently, the following research hypothesis is formulated:

"There is a significant difference in the influence exerted by family members on a group of pupils who choose to study mathematics in the senior secondary school

and a group of pupils who choose not to do so".

5.3.5. Research hypothesis 5

Rationale: From the literature study (chapters 2 and 3), it was concluded that the influence of the mathematics teacher is an important factor that may influence the standard seven pupils when they choose whether to continue with mathematics at senior secondary level or not. As a result, the following research hypothesis is formulated:

"There is a significant difference in the influence exerted by the mathematics teacher towards a group of pupils who choose to study mathematics in the senior secondary school and a group of pupils who choose not to do so".

5.3.6. Research hypothesis 6

Rationale: From the literature survey (Chapter 3), it was found that for more than two decades psychologists

have observed that many people, after having failed repeatedly at a designated task, abandon the activity and conclude that they can do nothing to effect a more positive outcome. The implication is that if achievement is generally poor, the pupil may feel discouraged and therefore decide to abandon the subject, in this study, mathematics. If the achievement is good the pupil will be encouraged to continue with mathematics.

Thus, achievement in mathematics was regarded as a factor that may influence the choice of mathematics as a subject at senior secondary level. Consequently, the following research hypothesis is formulated:

"There is a significant difference in the achievement in mathematics of a group of pupils who choose to continue with mathematics at the senior secondary level and a group of pupils who choose not to continue with it".

5.3.7. Research hypothesis 7

Rationale: From the literature study (Chapter 3), it

was found that parents are more likely to push boys to study and do well in mathematics than girls. Maqsd and Khalique (1991:379) corroborate this when they state that girls are more vulnerable to mathematics phobia than boys.

From the researcher's experience also, it was found that in the society in which the research was undertaken, boys are expected to study for professions such as engineering, electronics, medicine, geology and others which require a knowledge of mathematics. Gender may therefore be regarded as an important factor that affects the choice of mathematics as a subject at senior secondary level. Consequently, the following research hypothesis is formulated:

"There is a significant difference between the number of boys and girls with regard to the choice of mathematics as a subject at senior secondary level".

5.4. STATISTICAL TECHNIQUES

The data that is gathered will be processed by means

of statistical techniques, and tables will be drawn.

The reliability coefficient will be calculated for each category of the questionnaire. The correlation between each item and the total of that particular category will also be determined. Where the correlation is found to be very low positive or negative, the item is removed from the questionnaire.

In section 6.3, several null hypotheses are formulated. The t-test is used to ascertain whether there are significant differences between the means of the group of pupils who choose to continue with mathematics at senior secondary level, and the group of pupils who choose not to continue with mathematics (null hypotheses 1 to 6).

To test null hypothesis 7, the chi-square test will be used to determine whether there is a significant difference between the number of boys and girls with regard to the choice of mathematics.

A regression analysis will be used to analyse the varying influences of the seven independent variables,

that is, attitude towards mathematics, utility of mathematics, influence of family members on the pupils, influence of the peer group on the pupils, influence of the mathematics teacher, gender and achievement in mathematics.

In the next chapter, the results of the investigation will be analysed and conclusions drawn.

CHAPTER 6

FINDINGS AND CONCLUSIONS OF THE EMPIRICAL
INVESTIGATION

6.1. INTRODUCTION

This chapter deals with the statistical processing and interpretation of the data of the empirical investigation.

An item analysis was done to evaluate the suitability of each item. This was done for each category of the questionnaire.

To test hypotheses 1,2,3,4,5 and 6, t-tests were used to ascertain whether the differences between the particular means were significant or not. To test hypothesis 7, the chi-square test was used to ascertain whether the difference between the number of boys and girls who choose mathematics was significant or not.

A regression analysis was done to determine which

variables were the most important in explaining why standard seven pupils chose to continue or discontinue with mathematics at senior secondary school level.

6.2. ITEM ANALYSIS AND RELIABILITY OF THE QUESTIONNAIRE

An item analysis was done for each category of the questionnaire, namely, attitude towards mathematics, utility of mathematics, family members' influence, influence of the peer group and the influence of the mathematics teacher .

For each item the correlation with the total category was calculated to determine whether the item made a significant contribution to the total of the particular category. If the item-total correlation is very low positive or negative, the item was omitted. Besides the item-total correlation, the Alpha Cronbach reliability coefficient was also considered. If the omission of an item will increase the reliability of that category, the item was omitted.

6.2.1. Item analysis of the category "attitude towards mathematics"

According to table 6.1, item 20 showed a very low positive correlation with the total of the category, and is therefore excluded. The reliability coefficient was 0,79; after item 20 was removed it became 0,80. Consequently, 19 items were retained in this category.

Table 6.1

ITEM ANALYSIS AND RELIABILITY OF THE ATTITUDE CATEGORY

Number of subjects : 201		
Number of items :20		
Cronbach alpha coefficient : 0,79		
Items	Correlation with total of category	Alpha if item is omitted
1	0,552	0,767
2	0,425	0,776
3	0,336	0,781
10	0,519	0,770
13	0,200	0,790
14	0,434	0,775
15	0,318	0,782
17	0,285	0,785
20	0,009	0,802
29	0,598	0,764
31	0,172	0,790
32	0,539	0,768
38	0,269	0,786
40	0,368	0,780
41	0,333	0,782
44	0,429	0,775
47	0,259	0,786

Table 6.1 continues overleaf.

48	0,126	0,794
57	0,395	0,778
68	0,486	0,772

6.2.2. Item analysis of the category "utility of mathematics"

According to table 6.2, item 74 showed a very low positive correlation with the total of the category, and is therefore excluded. The reliability coefficient was 0,78; after item 74 was removed the reliability coefficient became 0,79. Fourteen items were retained in this category.

Table 6.2

ITEM ANALYSIS AND RELIABILITY OF THE UTILITY CATEGORY

Number of subjects :201		
Number of items : 15		
Cronbach alpha coefficient: 0,78		
Items	Correlation with total of category	Alpha if item is omitted
5	0,308	0,769
7	0,453	0,757
9	0,324	0,768
11	0,312	0,769
12	0,502	0,752
21	0,361	0,765
23	0,546	0,749
24	0,377	0,765
26	0,354	0,765
30	0,426	0,760
39	0,515	0,751
43	0,372	0,764
67	0,407	0,761
72	0,379	0,763
74	0,083	0,788

6.2.3. Item analysis of the category "peer group influence"

According to table 6.3, item 25 showed a negative correlation with the total, and therefore it can be removed. The reliability coefficient was 0,53; after item 25 was removed the reliability coefficient became 0,59. Consequently, 9 items were retained in this category.

Table 6.3

ITEM ANALYSIS AND RELIABILITY OF THE PEER GROUP
INFLUENCE CATEGORY

Number of subjects :201		
Number of items :10		
Cronbach Alpha coefficient:0,53		
Items	Correlation with total of category	Alpha if item is omitted
6	0,133	0,532
18	0,319	0,479
25	-0,054	0,593
35	0,302	0,485
45	0,210	0,512
54	0,384	0,460
59	0,234	0,505
61	0,351	0,474
63	0,359	0,466
73	0,119	0,538

6.2.4. Item analysis of the category "family members' influence"

According to table 6.4, item 53 displayed a very low positive correlation with the total of the category, and is therefore excluded. The reliability coefficient was 0,69; after item 53 was removed the reliability coefficient became 0,71. Eleven items were retained in this category.

Table 6.4

ITEM ANALYSIS AND RELIABILITY OF THE FAMILY MEMBERS'
INFLUENCE CATEGORY

Number of subjects : 201		
Number of items : 12		
Cronbach alpha coefficient : 0,69		
Items	Correlation with total of category	Alpha if item is omitted
8	0,401	0,653
28	0,476	0,640
34	0,305	0,669
37	0,244	0,678
42	0,545	0,629
51	0,385	0,656
52	0,258	0,676
53	0,027	0,711
55	0,156	0,692
64	0,331	0,665
65	0,300	0,670
69	0,474	0,643

6.2.5. Item analysis of the category "mathematics teacher's influence"

According to the item-total correlations displayed in table 6.5, no item is excluded from the mathematics teacher's influence category. The reliability coefficient is 0,80.

Table 6.5

ITEM ANALYSIS AND RELIABILITY OF THE TEACHER CATEGORY

Number of subjects : 201		
Number of items :17		
Cronbach alpha coefficient :0,80		
Items	Correlation with total of category	Alpha if item is omitted
4	0,450	0,787
16	0,302	0,796
19	0,481	0,784
22	0,425	0,788
27	0,250	0,800
33	0,385	0,791
36	0,364	0,792
46	0,455	0,786
49	0,419	0,788
50	0,119	0,810
56	0,604	0,778
58	0,255	0,799
60	0,307	0,796
62	0,506	0,783
66	0,441	0,788
70	0,438	0,787
71	0,504	0,782

6.2.6. Summary

The suitability of each item in each category of the questionnaire was evaluated. One item each was removed from the attitude towards mathematics, utility of mathematics and family members' influence categories respectively because they showed a very low positive correlation with the total of the particular category. One item was removed from the peer group influence category because it showed a negative correlation with the total. All items in the mathematics teacher's influence category were retained.

The final number of items in each category, as well as the reliability, are given in table 6.6.

Table 6.6

SUMMARY OF THE DIFFERENT CATEGORIES, NUMBER OF ITEMS
AND RELIABILITY

Category	Number of items	Reliability
Attitude towards mathematics	19	0,80
Utility of mathematics	14	0,79
Peer group influence	09	0,59
Family members' influence	11	0,71
Mathematics teacher's influence	17	0,80

6.3. TESTING HYPOTHESES

6.3.1. Hypothesis 1

With regard to the research hypothesis 1 stated in paragraph 5.3.1, the following null hypothesis was

formulated and statistically tested.

"There is no significant difference in the mean attitude towards mathematics of a group of pupils who choose to study mathematics in the senior secondary level and a group of pupils who choose not to do so".

A t-test was used to determine whether the mean attitude towards mathematics of the group of pupils who choose to study mathematics in the senior secondary school differs significantly with the mean attitude towards mathematics of the group of pupils who choose not to do so. The data is presented in table 6.7.

Table 6.7

THE DIFFERENCE IN THE MEANS OF THE TWO GROUPS
WITH REGARD TO ATTITUDE TOWARDS MATHEMATICS (t-test)

Group	Number	Mean	S	t	df	p
Pupils who choose math	109	13,16	3,67			
Pupils who do not choose math	92	8,59	3,58	8,89	199,0	p<0,01

The data in table 6.7 indicates that the null hypothesis can be rejected at the 1% level of significance. This means that the mean attitude toward mathematics of the group of pupils who choose to continue with mathematics is significantly higher than the mean attitude towards mathematics of the group of pupils who choose not to continue taking mathematics.

The deduction can therefore be made that attitude towards mathematics is an important factor which can

influence the choice of senior secondary school pupils with regard to mathematics as a possible subject.

As already mentioned in paragraph 3.2.2.1, attitudes relate to pleasant and unpleasant emotions. It seems that where the emotion is pleasant, the pupil will find the subject enjoyable and might consider to continue with it; but where the emotion is unpleasant, the pupil will find the subject uninteresting and will therefore not prefer to continue with it when he is given a choice.

6.3.2. Hypothesis 2

With regard to the research hypothesis stated in paragraph 5.3.2, the following null hypothesis was formulated and statistically tested.

"There is no significant difference in the mean perception of the utility of mathematics of a group of pupils who choose to study mathematics in the senior secondary school and a group of pupils who choose not to do so".

A t-test was used to determine whether the mean perception of the utility of mathematics of the group of pupils who choose to study mathematics in the senior secondary school differs significantly with the mean perception of the utility of mathematics of the group of pupils who choose not to study mathematics. The data is presented in table 6.8.

Table 6.8

THE DIFFERENCE IN THE MEANS OF THE TWO GROUPS
WITH REGARD TO THE PERCEPTION OF THE UTILITY OF
MATHEMATICS (t-test)

Group	Number	Mean	S	t	df	p
Pupils who choose math	109	10,69	2,71			
Pupils who do not choose math	92	7,39	3,22	7,87	199,0	$p < 0,01$

The data in table 6.8, shows that the null hypothesis can be rejected at the 1% level of significance. This

means that the mean perception of the utility of mathematics of the group that choose to continue with mathematics is significantly higher than the mean perception of the utility of mathematics of the group that chooses not to continue taking mathematics.

The deduction can therefore be made that the perception of the utility of mathematics is an important factor which can influence the choice of the senior secondary school pupil with regard to mathematics as a possible school subject.

As already mentioned in paragraph 2.5, mathematics is useful, and it can be utilized in various areas of life. If the pupil is aware of the importance and usefulness of mathematics, he will be motivated to continue with it.

6.3.3. Hypothesis 3

With regard to the research hypothesis 3 stated in paragraph 5.3.3, the following null hypothesis was formulated and statistically tested.

"There is no significant difference in the mean influence exerted by the peer group towards a group of pupils who choose to study mathematics in the senior secondary school and a group pupils who choose not to do so".

A t-test was used to determine whether the mean influence exerted by peer group towards pupils who choose to study mathematics in the senior secondary school differs significantly with the mean influence of the peer group towards a group of pupils who choose not to do so. The data is presented in table 6.9.

Table 6.9

THE DIFFERENCE IN THE MEANS OF THE TWO GROUPS
WITH REGARD TO THE INFLUENCE EXERTED BY THE PEER
GROUP (t-test)

Group	Number	Mean	S	t	df	p
Pupils who choose math	109	5,80	1,76			
Pupils who do not choose math	92	4,15	2,11	6,03	199,0	$p < 0,01$

The data in table 6.9 demonstrates that the null hypothesis can be rejected at the 1% level of significance. This means that the mean influence exerted by the peer group upon the group of pupils who choose to continue with mathematics is significantly higher than the mean influence exerted by the peer group upon the group of pupils who choose not to continue taking mathematics.

The deduction can therefore be made that the influence exerted by the peer group is an important factor that may influence the choice of mathematics as a possible subject at the senior secondary level.

As already mentioned in paragraph 3.3.3, when the child enters secondary school, he or she becomes susceptible to peer influences. The child has the irresistible urge to behave as members of his peer group do, in order to avoid rejection. Therefore, when he makes his choice, he also takes into consideration the opinion of his peers.

6.3.4. Hypothesis 4

With regard to the research hypothesis 4 stated in paragraph 5.3.4, the following null hypothesis was formulated and statistically tested.

"There is no significant difference in the mean influence exerted by family members on a group of pupils who choose to study mathematics in the senior secondary school and a group of pupils who choose not to do so".

A t-test was used to determine whether the mean influence exerted by family members towards the group of pupils who choose to study mathematics in the senior secondary school differs significantly with the mean influence of family members towards the group of pupils who choose not to continue with mathematics. The data is presented in table 6.10.

Table 6.10

THE DIFFERENCE IN THE MEANS OF THE TWO GROUPS
WITH REGARD TO THE INFLUENCE OF FAMILY MEMBERS
(t-test)

Group	Number	Mean	S	t	df	p
Pupils who choose math	109	8,17	2,23			
Pupils who do not choose math	92	5,36	2,30	8,76	199,0	$p < 0,01$

The data in table 6.10 shows that the null hypothesis can be rejected at the 1% level of significance. This

means that the mean influence exerted by the family members towards the group of pupils who choose to continue with mathematics is significantly higher than the mean influence exerted by family members towards the group of pupils who choose not to continue studying mathematics.

The deduction can therefore be made that the influence exerted by family members is an important factor that may influence the choice of mathematics as a possible subject at senior secondary level.

The results of the research in this regard support the findings as noticed in the literature study (refer paragraph 3.3.2). According to Parsons et al (in Pedersen 1986:49), there is a positive correlation between parents and students' attitudes towards mathematics. When the child has to make a decision in matters relating to his future he seeks and takes the advice of his parents. Thus if the parents or family members' attitudes towards mathematics are positive, the possibility is that the pupils' attitude will be positive, and vice versa, and therefore the choice will be affected.

6.3.5. Hypothesis_5

With regard to the research hypothesis 5 state in 5.3.5, the following null hypothesis was formulated and statistically tested.

"There is no significant difference in the mean influence exerted by the mathematics teacher towards a group of pupils who choose to study mathematics at the senior secondary level and a group of pupils who choose not to do so ".

A t-test was used to determine whether the mean influence exerted by the mathematics teacher upon the group of pupils who choose to study mathematics in the senior secondary school differs with the mean influence exerted by the mathematics teacher upon the group of pupils who choose not to continue with mathematics. The data is presented in table 6.11.

Table 6.11

THE DIFFERENCE IN THE MEANS OF THE TWO GROUPS
WITH REGARD TO THE INFLUENCE EXERTED BY THE
MATHEMATICS TEACHER (t-test)

Group	Number	Mean	S	t	df	p
Pupils who choose math	109	13,45	2,81			
Pupils who do not choose math	92	9,65	3,76	8,18	199,0	$p < 0,01$

The data in table 6.11 indicates that the null hypothesis can be rejected at the 1% level of significance. This means that the mean influence exerted by the mathematics teacher upon the group of pupils who choose to study mathematics in the senior secondary school is significantly higher than the mean influence exerted by the mathematics teacher upon the group of pupils who choose not to do so.

The deduction can therefore be made that the influence of the mathematics teacher is an important factor that may influence the choice of mathematics as a possible subject at senior secondary level.

As already mentioned in paragraph 3.3.1, it was found that pupils generally associate a subject with the teacher who teaches that specific subject. Whether the pupils will find mathematics an interesting subject will depend to a great extent on the teacher. Pupils who perceive the mathematics teacher as likeable and positive will probably choose to continue studying the subject; whereas, pupils who regard the mathematics teacher as being difficult to deal with will choose not to go on with the subject when they are given the choice.

6.3.6. Hypothesis 6

With regard to the research hypothesis 6 stated in paragraph 5.3.6, the following null hypothesis was formulated and statistically tested.

"There is no significant difference in the mean achievement in mathematics of a group of pupils who choose to continue with mathematics at the senior secondary level and a group of pupils who choose not to continue with it".

A t-test was used to determine whether the mean achievement in mathematics of the group of pupils who choose to study mathematics at the senior secondary school differs significantly with the mean achievement in mathematics of the group of pupils who choose not to continue studying mathematics. The data is presented in table 6.12.

Table 6.12

THE DIFFERENCE IN THE MEANS OF THE TWO GROUPS
WITH REGARD TO ACHIEVEMENT IN MATHEMATICS (t-test)

Group	Number	Mean	S	t	df	p
Pupils who choose math	109	54,66	15,03			
Pupils who do not choose math	92	32,93	14,65	10,33	199,0	$p < 0,01$

The data in table 6.12 shows that the null hypothesis can be rejected at the 1% level of significance. This means that the mean achievement in mathematics of the group of pupils who choose to continue with mathematics at the senior secondary school is significantly higher than the mean achievement of the group of pupils who choose not to continue taking mathematics.

The deduction can therefore be made that achievement in mathematics is an important factor that may influence the choice of mathematics as a possible subject at the senior secondary level.

As already mentioned in paragraph 3.2.1.3, Powell (1990:294) found that when people fail repeatedly at a designated task, they abandon the activity and decide that they can do nothing to effect a more positive outcome. The results in this regard support these findings because those students whose marks were low tended to choose not to continue with mathematics, while those who had high marks tended to choose to continue with mathematics.

6.3.7. Hypothesis 7

With regard to the research hypothesis 7 stated in paragraph 5.3.7, the following null hypothesis was formulated and statistically tested.

There is no significant difference between the number of boys and girls with regard to the

choice of mathematics as a subject at senior secondary level".

The chi-square test was used to determine whether there is a significant difference between the number of boys and girls with regard to the choice of mathematics. The data is presented in table 6.13.

Table 6.13

DETERMINATION OF SIGNIFICANT DIFFERENCES BETWEEN THE
THE NUMBER OF BOYS AND GIRLS WITH REGARD TO THE CHOICE
OF MATHEMATICS(chi-square)

Choice \ Gender	Boys	Girls	Total
YES	56	53	109
NO	56	36	92
Total	112	89	201

$$\chi^2 = 1,46 ; df = 1 ; p > 0,05$$

The calculated chi-square value is 1,46 with $p > 0,05$ and therefore the null hypothesis cannot be rejected. This means that there is no significant difference between the number of boys and girls with regard to the choice of mathematics as a subject at senior secondary level.

The deduction can therefore be made that the popularity of mathematics is the same among boys and girls.

The result does not support the findings in the literature study (refer paragraphs 3.3.2 and 5.3.5). According to the findings proportionally more boys than girls tend to study mathematics in the senior classes. A possible explanation for this inconsistency may be that nowadays more girls are studying and becoming successful in professions that were previously regarded as male territory, for example, engineering, medicine, architecture and others. As a result girls also see the advantages of furthering

their studies in mathematics at senior secondary classes because it is the key to most professions.

6.4. FACTORS WHICH EXPLAIN THE VARIANCE OF PUPILS' CHOICES

A regression analysis was done in order to determine which variables were the most important in explaining why pupils chose to continue or discontinue with mathematics at senior secondary school. The independent variables that were used were: attitude towards mathematics, utility of mathematics, family members influence, peer group influence, mathematics teacher's influence, achievement in mathematics and gender. The dependent variable was the choice of the pupils. The data is presented in table 6.14.

Marks or achievement in mathematics was found to be the most important variable that influences the choice. It was the first variable which was entered in the regression analysis. The r-square was found to be 0,35. This means that 35% of the variance in the choice of mathematics can be attributed to the pupil's

achievement in mathematics.

When achievement was combined with the influence of family members, the r-square value became 0,43, which means that the family members' influence explained an additional 8% of the variance of the pupils' choices. Thus, the family members category was found to be the second most important factor in explaining the variance of pupils' choices with regard to mathematics.

The third variable to be entered in the analysis was attitude towards mathematics. Jointly, the three independent variables explained 46% of the variance of the pupils' choices.

When the mathematics teacher related factor was entered, the r-square became 0,47. This means that the mathematics teacher's influence explained 1% more of the variance already explained by achievement in mathematics, family members' influence and attitude towards mathematics. Thus, the mathematics teacher's influence can be considered the fourth most important

factor in explaining the variance of pupils' choices. Jointly, the four independent variables explain 47% of the variance of pupils' choices.

The addition of anyone of the other variables did not explain a significantly larger proportion of the variance already explained by the previous combination of variables. Therefore, achievement in mathematics, family members' influence, attitude towards mathematics and mathematics teacher's influence, are in combination, important factors in explaining the variance of the standard seven pupils with regard to mathematics as a senior secondary school subject. Table 6.14 indicates this variance.

Table 6.14

PROPORTION OF THE VARIANCE OF FACTORS THAT INFLUENCE
THE CHOICE OF MATHEMATICS

VARIABLE	R ²	F	df	p
1. ACHIEVEMENT	0,3490	106,66	1, 199	p,0,01
2. FAMILY	0,4267	73,68	2, 198	P<0,01
3. ATTITUDE	0,4627	56,54	3, 197	p<0,01
4. TEACHER	0,4746	44,24	4, 196	p<0,01

6.5. SUMMARY OF RESULTS

The present chapter looked at the statistical processing and interpretation of the data obtained from the empirical investigation. The following results were obtained.

6.5.1. Attitude towards mathematics

The attitude towards mathematics of the pupils who chose to study mathematics in the senior secondary level is significantly higher than the attitude towards mathematics of the pupils who chose to discontinue with it ($t= 8,89$; $p < 0,01$).

6.5.2. Utility of mathematics

The perception of the utility of mathematics of the pupils who chose to study mathematics is significantly higher than the perception of the utility of mathematics of the pupils who chose not to continue taking mathematics ($t= 7,87$; $p < 0,01$).

6.5.3. Peer group influence upon the choice

Peer group influence upon the pupils who chose mathematics is significantly higher than the peer group influence upon the pupils who chose not to continue taking mathematics ($t = 6,03$; $p < 0,01$).

6.5.4. Family members' influence upon the choice

Family members' influenceⁿ upon the pupils who chose to continue with mathematics is significantly higher than the family members' influence upon the pupils who chose not to continue with mathematics ($t = 8,76$; $p < 0,01$).

6.5.5. The mathematics teacher's influence

The influence of the mathematics teacher upon the pupils who chose to study mathematics is significantly higher than the influence of the mathematics teacher's upon the pupils who chose not to continue with mathematics ($t = 8,18$; $p < 0,01$).

6.5.6. Achievement in mathematics

The achievement in mathematics of pupils who chose to study mathematics is significantly higher than the achievement in mathematics of pupils who chose not to continue with mathematics ($t = 10,33$; $p < 0,01$).

6.5.7. Popularity of mathematics among boys and girls

No significant difference is found between the number of boys and girls with regard to the choice of mathematics as a subject at senior secondary level. Mathematics seems to be equally popular among the two sexes.

6.5.8. Variance of pupils' choices

The variable which explained the largest proportion of the variance of pupils' choices was achievement in mathematics. It explained 35% of the variance. It was followed by family members' influence, attitude towards mathematics and the influence of the mathematics teacher. The four variables jointly explain 47% of the variance of pupils' choices.

The next chapter will, besides giving an overview of the study, also deal with the recommendations and implications which stem from the findings.

CHAPTER 7

OVERVIEW OF THE RESEARCH, CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

7.1. OVERVIEW OF THE RESEARCH

7.1.1. Motive for the study

The motive for pursuing this study lies in the fact that many pupils do not choose mathematics as one of their subjects at senior secondary level. Therefore they are ill-prepared to study for a number of careers that are necessary for the economic advancement of our country.

Furthermore, mathematics is regarded as an admission requirement and a prerequisite for most courses that are studied at technikons and universities. These include engineering, architecture, geology, computer science and others. A pupil who has not studied mathematics at senior secondary school level faces serious problems when it becomes necessary to choose a career or when seeking admission in institutions of

higher learning.

The researcher realized that it is important to make a study of the various factors that influence pupils to choose or avoid mathematics as one of their subjects at senior secondary school level. This decision is vital in the career life of a child.

The decision to continue or discontinue with mathematics is made as early as the end of the standard seven year, but the results of this decision will be greatly felt when the child has passed matric, a period during which he has to study for a career or when he has to occupy his place in the work setting.

7.1.2. Analysis and delimitation of the problem

There is a wide spectrum of factors that influence pupils to choose to continue or discontinue with mathematics at senior secondary school level. This study was undertaken to identify some of these factors and to determine their relative importance.

It became clear to the researcher, after having studied the relevant literature, that the factors that influence the pupils can be divided into three broad categories, namely, cognitive, non-cognitive and external factors. These factors, or a combination of these factors, exert influence on the pupil when he or she has to choose whether or not to continue with mathematics.

7.1.3. Purpose of the study

The research undertaken can be divided into two areas, namely, the literature study and an empirical study.

7.1.3.1. Objectives of the literature study

The literature survey pursued the following objectives:

- (a) A discussion of the meaning, nature and uses of mathematics. From the literature study it was found that mathematics is an important and useful subject.

(b) Determination of some of the factors that may influence the pupil when he makes the choice whether or not to continue with mathematics at senior secondary school. The factors were then classified into five categories, that is, attitude towards mathematics, utility of mathematics, peer group influence, family members' influence and the mathematics teacher's influence. As a whole the factors led to the seven independent variables that were used in this study, the five categories, achievement and gender.

(c) A discussion of the life-world of the secondary school child in general, and the secondary school child in Venda in particular.

7.1.3.2. Objectives of the empirical investigation and method of research

Following the literature study, the following objectives were formulated for the empirical investigation.

(a) A questionnaire was compiled, consisting of five

categories embracing the factors that may influence the pupils' choice of mathematics as a senior secondary school subject. These categories (independent variables) were:

- * Attitude towards mathematics.
- * Perception of the utility of mathematics at school and in daily life.
- * The family members' influence upon the pupils' choice.
- * The peer group influence upon the pupils' choice.
- * The influence of the mathematics teacher upon the pupils' choice.
- * Achievement in mathematics and gender were also included as factors that may affect the pupils' choice.

(b) The draft questionnaire was presented to a group

of students and certain changes were administered (pilot study).

(c) It was also determined which of the independent variables was the most important in explaining why pupils chose to continue or discontinue with mathematics.

(d) Appropriate statistical techniques were used to determine whether significant differences occur between the group of pupils who chose to study mathematics and the group of pupils who chose not to study mathematics with regard to the seven independent variables.

(e) Permission to do research was granted by the Director General of the Department of Education in Venda. The Area Managers were informed and arrangements made with the headmasters of the schools involved.

7.1.4. The research group

The research group consisted of 201 standard seven

pupils from two secondary schools in Venda. There were 112 boys and 89 girls.

7.2. FINDINGS AND CONCLUSIONS BASED ON THE LITERATURE STUDY

The most important findings which emanated from the literature survey and the conclusions drawn are the following:

7.2.1. The importance of mathematics

It was found that mathematics is an important subject in this modern technological world. It is a key subject that is applied to a large number of subjects in one form or another. Mathematics is regarded as an admission requirement for most careers and courses that may be studied at universities and technikons. A pupil who has not studied mathematics at senior secondary level does not have as much of a chance of satisfying admission requirements or have a wide choice of career as the one who has studied mathematics.

It was also found that mathematics is important for the child's self-actualization. It develops logical thinking and habits of systematic, accurate and efficient methods of working. It helps to teach pupils to think and apply knowledge gained in school to solve problems in daily life.

Because of the importance of mathematics in the world today, as many pupils as possible should be encouraged to study mathematics at senior secondary school and thereafter.

7.2.2. Achievement as a factor influencing the choice of mathematics

From the literature survey it was found that achievement in mathematics can influence pupils to like or dislike mathematics. It was found that even though lack of comprehension and poor performance is often due to poor education and preparation, many pupils place the blame on themselves and conclude that the failure is caused by low intelligence. Once this happens, it results in reduced motivation and the

pupils concerned will want to avoid the subject.

It was therefore deduced that achievement in mathematics will influence the choice of mathematics at senior secondary level.

7.2.3. Attitude towards mathematics as a factor that influences the choice

The literature study revealed that the feelings, ideas and emotions that the child has towards mathematics will influence his choice. The belief or feeling may be realistic or unrealistic, but it will have an influence on whether the pupil will want to continue studying mathematics or not. One could therefore conclude that where the emotion with regard to mathematics is pleasant, the pupil will want to continue with mathematics; where the emotion is unpleasant, the pupil will not want to continue taking mathematics.

7.2.4. The utility of mathematics

It was found that mathematics is useful, it satisfies

human needs, and it can be applied either directly or indirectly in almost all areas of life. If the pupil realizes that mathematics is useful and important, he will be motivated enough to continue studying it; but if he does not perceive its usefulness he may decide not to continue studying it in the senior secondary level.

Therefore the deduction can be made that the perception of the utility of mathematics by the pupils is a factor that influences its choice as a subject at senior secondary school.

7.2.5. Peer group influence

It was found that during the secondary school years the child gradually yields to the influence of his peers. He fears rejection and isolation, and as a result he would like to do as his peers do. If his peers make disparaging remarks about mathematics or the mathematics teacher, he may be influenced negatively, but if they appreciate it, he may be influenced positively.

It was therefore concluded that even in school matters the child will be influenced by the peer group. Thus peer group is a factor that influences the choice of mathematics.

7.2.6. Family members' influence

The literature study revealed that parents and other family members can exert influence on the pupils' choices. The influence may be direct, for instance, parents may tell or advise their children to choose mathematics; or, it may be indirect, for instance, the attitude of the parents or family members may influence the children.

It was then concluded that in the choice of subjects at school, and therefore the choice of mathematics, young people will seek the advice of their parents. Thus, family members' influence is a factor that influences the choice of mathematics as a senior secondary school subject.

7.2.7. The mathematics teacher's influence

The mathematics teacher can influence the choice of mathematics because of the way in which he handles the subject in the classroom. If he is confident, positive and knows the subject matter well, the pupils will like mathematics and the choice will be affected positively. If the teacher is incompetent, negative and ill qualified, the pupils will not like the subject and the choice will be affected negatively.

Therefore it can be deduced that the mathematics teacher is a significant adult who can influence the choice of mathematics as a senior secondary school subject.

7.3. FINDINGS AND CONCLUSIONS BASED ON THE EMPIRICAL INVESTIGATION

The findings of the empirical investigation are the following:

7.3.1. Attitude towards mathematics

The attitude towards mathematics of pupils who chose

mathematics was significantly higher or better than the attitude towards mathematics of the pupils who did not choose mathematics.

It can therefore be concluded that no effort should be spared in the quest for fostering a more positive attitude towards mathematics amongst pupils, which in turn should result in a greater number of them choosing mathematics.

7.3.2. Perception of the utility of mathematics

The perception of the utility of mathematics was significantly higher for pupils who chose mathematics than pupils who did not choose mathematics. This means that the more perceptive of the utility of mathematics the pupil is, the more likely he or she is to choose to continue with mathematics. If the pupil is not aware of the utility of mathematics, he or she may decide not to continue with it.

It was therefore concluded that the perception of the utility of mathematics is a factor that influences the choice of mathematics.

7.3.3. Peer group influence

The peer group influence for the pupils who chose to continue with mathematics was found to be significantly higher than the peer group influence for the pupils who chose not to continue with mathematics.

It can therefore be concluded that peer group influence can affect the choice of mathematics as a subject in the senior secondary school, and efforts should therefore be made to foster a positive attitude amongst the young pupils so that they can influence one another positively.

7.3.4. Family members' influence

The influence of family members was found to be significantly higher for the pupils who chose to continue with mathematics than for the pupils who chose not to take mathematics.

Therefore it can be concluded that family members play a no lesser role in influencing the decision whether to continue with mathematics or not. Parents should become more involved in their children's school activities and be made aware of the importance and uses of mathematics.

7.3.5. The mathematics teacher's influence

The influence of the mathematics teacher was found to be significantly higher for pupils who chose mathematics than for pupils who did not choose mathematics.

This means that the teacher also has a tremendous influence on pupils and can lead them to choosing mathematics as a subject at the senior secondary school or not to do so.

7.3.6. Achievement in mathematics

The mathematics achievement of standard seven pupils who chose to take mathematics in the senior secondary was significantly higher than the achievement of the pupils who did not choose mathematics.

It can therefore be concluded that achievement in mathematics and the experiencing of success in the subject, play a significant role in influencing the pupil when he decides on whether to continue with mathematics or not. The higher the mathematics marks

are, the more likely the pupil is to choose to continue with mathematics.

7.3.7. Gender

It was found that there was no significant difference in the number of boys and girls who chose or did not choose to study mathematics. Therefore it can be concluded that the popularity of mathematics is the same among boys and girls.

7.3.8. The relative importance of the respective independent variables

According to the regression analysis results, marks or achievement in mathematics was found to be the most important factor that influenced the choice of mathematics as a subject at the senior secondary school.

Family members' influence was found to be the second most important factor; attitude towards mathematics was found to be the third most important factor; and

the mathematics teacher's influence was found to be the fourth most important factor that influences the choice of mathematics as a senior secondary school subject.

The other independent variables, that is, peer group influence, perception of the utility of mathematics and gender did not show a significantly larger proportion of the variance already explained by the previous variables.

7.4. RECOMMENDATIONS AND IMPLICATIONS

A number of recommendations, based on the findings and conclusions of this study regarding the choice of mathematics, are as follows:

7.4.1. Achievement in mathematics

It was found that the higher the marks the pupil obtains in mathematics tests and examinations, the more likely he or she is to want to continue studying it in senior classes. If the marks are low, the pupil concludes that he or she is dull or weak in

mathematics and therefore chooses not to continue with it when he is given a choice.

There are numerous reasons why pupils get low marks in mathematics other than being dull or weak in mathematics. For some pupils it may be demotivation, lack of interest, too abstract subject matter, inadequate preparation when the test or examination is written, and other factors.

The researcher recommends that the teacher/educator should be aware that the marks the pupils get in a test or examination have an effect on the decision that he will take concerning mathematics. To improve the pupils' achievement in mathematics, the subject should be made more practical and less theoretical, with examples given of its application in the world outside the four walls of the classroom; homework and classwork should be given regularly and tests should not be far apart so as to facilitate the retention of information in memory, and therefore improve on the achievement.

The mathematics teacher should encourage the pupils to set realistic goals and expectations for themselves on an individual basis. The teacher should also strive to associate mathematics with success and not failure, by not expecting pupils, before they even write the test or examination, to fail.

The teacher/educator could also make the pupils be aware of the fact that mathematics can, and has been passed before. In other words, attention should be drawn to successes rather than failures, in order to motivate pupils and therefore improve on their achievement.

The researcher also recommends that the mathematics teacher should also encourage weaker students now and then by giving them and other pupils "easy" tests that they can all pass. The experience of success will help to build up self-confidence and a positive attitude towards mathematics.

7.4.2. Family members' influence

The study revealed that family members also play an

important role in influencing the choice of mathematics, because pupils do take their advice in such matters.

The researcher recommends that parents must be involved in the school life of their children through organized parents' days or evenings and parents-teachers associations. Parents and other family members could therefore be reached and be involved in the choice of subjects. Their attention could be drawn to the importance and uses of subjects, among others, mathematics. They could then be in a better position to advise their children when it comes to making this choice.

7.4.3. Attitude towards mathematics

The more positive the attitude of the pupil is towards mathematics, the more likely he or she is to choose mathematics. The more negative the attitude towards mathematics is, the more likely he or she is to choose avoiding mathematics.

The attitudes of pupils towards mathematics should therefore be changed from negative to positive or be kept positive if it already is. The pupils may have negative attitudes towards mathematics mainly because of ignorance concerning its uses, nature and importance. A negative attitude may also be the result of repeated failure or low marks in the subject.

The teacher/educator should try to eradicate the unhealthy beliefs from the pupils' minds, thereby making way for the cultivation of healthy ones.

The pupils should be given all the relevant information about mathematics, its meaning, nature, use and wider range of job opportunities, so that the pupils themselves can get rid of some of their fears or unhealthy beliefs that they have. The pupils should also not be given the fallacious notion that mathematics is for intelligent people only.

7.4.4. Mathematics teacher

Pupils often associate mathematics with their teacher.

They like and respect a teacher who is confident, comes to class regularly and well-prepared, knows his subject matter and is interested in both the subject and the pupils.

It has almost become a custom in some secondary schools that inexperienced, new and times ill-qualified teachers are given standard six and seven to teach mathematics. It is recommended that skilled and well-qualified teachers should be given the lower standards to teach so that the standard seven pupils should get a chance to associate mathematics with such teachers at an early stage. This arrangement will help pupils to maintain their interest in mathematics. The teacher must be enthusiastic and pay equal attention to bright and dull pupils.

7.4.5. Synthesis

Mathematics is an important subject and is used more and more as an admission requirement in tertiary institutions. As a result, as many pupils as possible should be encouraged to choose to study mathematics at

senior secondary school. Teachers, parents, family members and other significant people in the pupils' life, and the pupils themselves, should regard the choice of mathematics as a very important task which will eventually shape the life of the child as it may determine his career. It will also affect the child's self-actulization as a whole.

7.5. LIMITATIONS OF THE STUDY

(a) The respondents involved in this study were relatively few in number, totalling only 201 pupils. Furthermore, the study was limited to standard seven pupils in Venda only. Thus the findings cannot be generalized to all the standard 7 pupils who have to make the choice.

(b) Assessment of achievement in mathematics was based on one examination result. A year mark would have been better because it would have shown the progress of the child more comprehensively.

(c) There may be other factors that influence the choice of mathematics, which were not identified and studied within the scope of this study.

7.6. RECOMMENDATIONS FOR FURTHER RESEARCH

Further studies must be done in the field of mathematics teacher's education. Teachers play a significant role in influencing the choice of mathematics as a senior secondary school subject. The training of mathematics teachers could be investigated in order to come up with mathematics teachers who inspire confidence and interest in their pupils.

Research must also be undertaken to investigate whether standard seven pupils are not too young and immature to make such a major decision. The presumption here being that attitudes and beliefs change as pupils become older. At standard seven pupils do not have a well-formed idea as to their aspirations and future careers, and therefore cannot really perceive the significance of this choice.

Further studies must be made in the extent of parental or family members' involvement in the choice of mathematics as a senior secondary school subject.

7.7. FINAL WORD

The researcher became aware of the fact that many pupils do not choose to study mathematics at senior secondary school and therefore close their career options prematurely. This may be because of lack of guidance, unhealthy beliefs, negative attitudes that pupils may have about mathematics, low marks that the pupils get in tests and examinations and other reasons.

The study identified some factors that may influence the pupils when they choose whether or not to study mathematics at senior secondary level.

It is hoped that the findings, conclusions and recommendations will help the teacher/educator to understand that when pupils choose whether to continue taking mathematics or not, it is a great and significant decision. It is hoped that the teacher/educator will therefore be in a better position to provide appropriate assistance, encouragement, motivation and guidance to the pupils

so that they can make the choice that they will not regret in future.

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APPENDIX

QUESTIONNAIRE FOR STANDARD SEVEN PUPILS

- (i) The main aim of this questionnaire is to find out what your reasons are for choosing to continue with mathematics in standard eight or not choosing to continue with it.
- (ii) Your answers will be treated as confidential; be honest and sincere and please answer all the questions.
- (iii) As you are not asked to give your name, it means that the answers you give will not be used against you in any way.
- (iv) Thank you for your co-operation.

Please cross the appropriate box, e.g.

YES	NO
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Office
use

1. Mathematics is an easy subject
for me

YES	NO
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 k1

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2. Mathematics is an interesting subject for me	YES NO	<input type="checkbox"/> k2
3. I enjoy working with numbers	YES NO	<input type="checkbox"/> k3
4. I like my mathematics teacher	YES NO	<input type="checkbox"/> k4
5. Mathematics teaches me calculations	YES NO	<input type="checkbox"/> k5
6. I will choose mathematics because most of my friends are going to do so	YES NO	<input type="checkbox"/> k6
7. I need mathematics in order to in order to further my studies one day	YES NO	<input type="checkbox"/> k7
8. My guardian/parents expect me to choose mathematics	YES NO	<input type="checkbox"/> k8
9. I think mathematics is a useful subject in daily life situations	YES NO	<input type="checkbox"/> k9
* 10. Mathematics is a boring subject for me	YES NO	<input type="checkbox"/> k10
11. Mathematics teaches me to reason	YES NO	<input type="checkbox"/> k11

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| 12. I will need mathematics in my job
one day | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k12 |
| * 13. I do not like making
calculations | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k13 |
| * 14. I do not like mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k14 |
| 15. I think that mathematics is an
important subject | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k15 |
| 16. Our mathematics teacher tells
us that mathematics is an
important subject | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k16 |
| * 17. Mathematics is a difficult
subject for me | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k17 |
| 18. My friends and I decided together
that we shall continue with
mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k18 |
| 19. My mathematics teacher tries to
to make mathematics enjoyable | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k19 |
| * 20. I think that mathematics is for
intelligent people | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k20 |
| 21. Mathematics teaches me to
measure | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k21 |

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| 22. My mathematics teacher gives us interesting examples to work out | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k22 |
| 23. Mathematics will help me to get a good job one day | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k23 |
| 24. I think that mathematics is used in other school subjects | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k24 |
| 25. I will be separated from my friends if I do not choose to study mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k25 |
| 26. Mathematics helps me to calculate my change when I have bought goods from the stores | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k26 |
| * 27. My mathematics teacher says that I cannot pass mathematics in matric | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k27 |
| 28. My guardian/parents have suggested that I should choose mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k28 |
| 29. I am good in mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k29 |
| 30. Mathematics teaches me to count | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k30 |
| * 31. Mathematics is a subject especially for boys | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k31 |

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| 32. Mathematics is one of my best subjects | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k32 |
| 33. My mathematics teacher gives us opportunities for questions | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k33 |
| 34. My guardian/parents are interested in my performance in mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k34 |
| 35. Most of my friends have decided to study mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k35 |
| 36. My mathematics teacher says I am good in mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k36 |
| * 37. I do not get time to practice mathematics problems at home | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k37 |
| * 38. I am too dull to study mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k38 |
| 39. I would like to use mathematics in my job one day | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k39 |
| * 40. I will not need mathematics as I live in Venda | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k40 |
| 41. I enjoy doing mathematics homework | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k41 |
| 42. My parents and I decided together that I should choose mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k42 |

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| 43. I need mathematics in order to understand other school subjects well | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k43 |
| * 44. I have the habit of failing mathematics tests | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k44 |
| * 45. My friends told me not to choose mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k45 |
| 46. I am happy with the way I am being taught mathematics at the moment | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k46 |
| * 47. Mathematics tests seem difficult for me | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k47 |
| * 48. Mathematics makes me confused | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k48 |
| 49. My mathematics teacher is friendly | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k49 |
| 50. My mathematics teacher is fair when he marks mathematics tests | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k50 |
| 51. My guardian/parents expect me to do well in mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k51 |
| 52. My guardian/parents are interested in my mathematics marks | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k52 |

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| * 53. My guardian/parents told me that mathematics was difficult for them at school | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k53 |
| 54. My friends think that I am good in mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k54 |
| * 55. My guardian/parents do not expect me to pass mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k55 |
| 56. My mathematics teacher is good in mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k56 |
| * 57. I hate mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k57 |
| * 58. My mathematics teacher scolds us unnecessarily | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k58 |
| * 59. My friends think that I cannot pass mathematics at matric level | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k59 |
| 60. My mathematics teacher's comments on my tests scripts encourage me | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k60 |
| 61. My friends think that mathematics is important for our future | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k61 |
| 62. My mathematics teacher likes to explain mathematics to us | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k62 |
| 63. My friends expect me to choose mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k63 |

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| 64. My guardian/parents told me that mathematics is an important subject | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k64 |
| 65. My guardian/parents are happy if I pass mathematics tests | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k65 |
| 66. My mathematics teacher helps us to correct our mistakes after a test | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k66 |
| 67. Mathematics will enable me to handle money in everyday transactions | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k67 |
| * 68. I do not understand mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k68 |
| 69. My guardian/parents encourage me to study mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k69 |
| 70. My mathematics teacher advises me to choose mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k70 |
| 71. My mathematics teacher is interested in me | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k71 |
| 72. Mathematics will enable me to handle my pocket money | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k72 |
| 73. My friends and I discuss mathematics problems together | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k73 |

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| 74. It will be difficult for me to
be admitted in Universities &
Technikons if I have not
studied mathematics | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k74 |
| 75. I will choose to study
mathematics in std. 8 | <input type="checkbox"/> YES <input type="checkbox"/> NO | <input type="checkbox"/> k75 |
| 76. I am a | <input type="checkbox"/> BOY <input type="checkbox"/> GIRL | <input type="checkbox"/> k76 |
| 77. My mathematics mark in my last
school report was | <input type="checkbox"/> % | <input type="checkbox"/> k77 |

Please check again to make sure that you have answered all the question.

Thank you for your co-operation.

* Scoring has been reversed for these items.