THE ROLE OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE ON PUPILS' PERCEPTION OF SCIENCE

by

LEONARD VELENKOSINI MBHEKENI MFUSI

SSTD, B.PAED, B.ED (UZ)

A dissertation submitted to the Faculty of Education

in fulfilment of the requirements for the degree of

MASTER OF EDUCATION

in the

Department of Comparative & Science Education

at the

University of Zululand

Kwa-Dlangezwa

Date submitted	:	January 1999
Supervisor	:	Professor N.V. Magi

Declaration

THE ROLE OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE ON PUPILS PERCEPTION OF SCIENCE

M.Ed 1999

I, Leonard Velenkosini Mbhekeni Mfusi, do hereby declare that this dissertation is submitted to the University of Zululand for the degree of Master of Education has not be previously submitted by me at any other university, that it represents my own work in conception and in execution and that all the sources that I have used and quoted have been indicated and acknowledged by means of complete references.

Signed by me ______________________

On the 27th Day of JANUARY 1999

Acknowledgements

In South Africa, Science Education in particular is in crisis, there are relatively few individuals who are eager or successful in furthering their studies in science. It is perhaps from such a standpoint and motivation that this inquiry has developed and brought together individuals who have been prepared to take time to read and reflect about some of these matters. Thus, I wish to express my sincere gratitude to the following people for their immeasurable and indispensable assistance and contributions:

* My promoter, Professor N.V. Magi, Vice-Dean of the Faculty of Education, Professor and Head of Department of Comparative and Science Education at the University of Zululand for her expert guidance and scholarly advice she gave me throughout this study. My humble indebtedness is due to her for her promptness in marking my drafts and making constructive criticism.

* My co-promoter, Professor B. Spoelstra, Dean of the Faculty of Science, Professor and Head of Physics Department at the University of Zululand for his assistance financially and otherwise.

* Mr D. Fish and A. Tsipa, the manager and the co-ordinator at the University of Zululand Science Centre for giving me the opportunity to let pupils complete questionnaires, and for giving me access to some Science Centre materials and also for their financial assistance.

* Mr N.J. Sibeko, Lecturer in the Department of Educational Planning and Administration at the University of Zululand, who proof-read this work.

* Miss A.S. Mhlongo who typed this work.

* Mr M.M. Sibiya, Principal of Bhekikusasa S.S. School at Nseleni Circuit, who gave me moral support and time to complete this research work.

* All the principals, staff members of schools which were part of the sample deserve a gratitude for their sacrifice.

* All those pupils who completed questionnaires and participated in interviews deserve thanks.

* My loving parents; my father Willie Mbandleni, and my mother Gladys Mfusi, whose advice and motivation provided a firm pedagogical foundation which has proved to be an invaluable pillar of strength for me.

* My special friend, Miss N.G. Mbatha who made it possible for me to complete chapter five of this research work when I had my right hand injured and for her moral support, she also deserves thanks.

* My brothers, Themba, Thamsanqa, Musa, Sipho, Wilmoth and Ephraim, and also my two sisters Phumzile and Zanele also deserve gratitude for their genuine, unrelenting and unfailing understanding and moral support.

* My friends and colleagues at Bhekikusasa High School who gave me moral support.

* The library staff of the University of Zululand also deserve words of

gratitude.

* Last but not least, I thank God the Almighty Father who gave me health, patience, perseverance and endurance which I dearly needed to complete this study.

LVM MFUSI
KWA-DLANGEZWA

DATE: JANUARY 1999

Dedication

I humbly dedicate this work to my parents: my father Willie Mbandleni and my mother Gladys Mfusi, and to my brothers and sisters. With them around me my manhood and self-liberation kept growing from strength to strength, from victory to victory. Their belief in me and constant encouragement to go that extra mile in achieving my desired goals has been a power of strength that has carried me through my life.

Abstract

THE ROLE OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE ON PUPILS PERCEPTION OF SCIENCE

This study is an investigation into the significant role of the University of Zululand Science Development Centre on pupils' perception of Science. It attempts to establish whether the Science Development Centre is effective in achieving its objectives, namely to:

i. Investigate the perceptions of science held by pupils who visit the University of Zululand Science Development Centre (UZSDC).

ii. Determine whether specific difficulties or problems experienced by pupils in learning science were alleviated after attending the University of Zululand Science Development Centre (UZSDC).

iii. Determine whether the University of Zululand Science Development Centre(UZSDC) helps create a more positive attitude towards science and science careers.

The sample was drawn from four schools in the Empangeni-Richards Bay and Babanango area. Questionnaires were administered to Secondary school pupils who were doing science (N=88) from two different grades, that is, grade 10 and 11. Data were statistically analysed to establish frequencies and percentages.

The major findings of the study are: (1) that the University of Zululand Science Development Centre does play a significant role in promoting positive perceptions of science in secondary school pupils. Perceptions of learners showed that:

i. The majority of learners perceived science as valuable knowledge in solving daily problems in society and worth while careers.

ii. An interest in science and positive feelings towards learning science were expressed

iii. Predominant view of learners indicated that the time spent at the centre was limited for them to gain enough knowledge and skills to solve individual problems in science.

Recommendations of this study are based on pupils' perception of the value of science and interest in pursuing of science careers.

Tables

Figures

TABLE OF CONTENTS

CHAPTER ONE

ORIENTATION OF THE STUDY

1.1 INTRODUCTION

"The problems in African education, that is, control and administration, unequal allocation of finance and resources, the explosion in the number of pupils without proper classroom accommodation, the suspect quality and relevance of education, high failure rate in matriculation examinations particularly in science subjects has generated frustration and anger in the African community" (Magi, 1993:44). Although this statment was made five years ago, the situation in African schools has not changed much.

Science skills are absolutely essential in a developing country like South Africa. If one assesses countries throughout the rest of the world who have been successful, it is due mainly to the underlying skills based on science and technology.

South African science education is in a state of flux as the new government embarks on a process of renewal and redress in education policy. Existing curricula reflect priorities that are not relevant to new needs. Patterns of participation testify to systematic neglect of the science education of the mass of the population under apartheid (Lewin, 1995:201). Lewin (1995) further maintains that education policy in South Africa stands at a watershed as the Government of National Unity (GNU) and the recently established Ministry of Eduation begin to grapple with the legacies of the past and the risks and opportunities of the future.

It is through this concern that science educators have come to recognise and accept that what is required is the development of National Science Policy and Science Education Policy. This will see to it that proper curricula materials are developed. Ogunniyi (1993:17) has noted that many South African countries lack coordinating bodies for the natural sciences and for scientific research, and that national science education policies are even more retarded in their development. This is one of the first challenges that confronts the Ministry of Education and the Ministry of Science, Technology and Culture, as they seek to guide new patterns of investment in Human Resources in South Africa.

The Department of Arts, Culture, Science and Technology (1996:15) maintains that a new policy framework will have to take into account the distortions, inequities and failures of the existing Science, Engineering and Technology (SET) system. The policy should include a commitment to reassure all South Africans that the future activities and benefits of the system will support the development agenda set out in the RDP. The values of race, and gender equity, redress, efficiency, effectiveness, excellence, relevance and democracy will form the foundation of the new system. It should also be characterized by greater accessibility to the public from the point of view of both access to information and ability to contribute to decision-making.

In the light of the above, this research study is important in that it seeks to find out what are the perceptions held by secondary school pupils toward science which may determine their successfulness or interest in science.

1.2 STATEMENT OF THE PROBLEM

Development and improvement of science in schools is a challenge facing most educators and the ministry of education in South Africa. The mission of the Ministry of Education is to improve and promote a positive attitude towards science in pupils (Department of National Education, 1995:30). A number of programmes have been introduced by this ministry to instil a positive attitude to students toward science e.g. bursaries offered to college students doing science subjects.

Magi (1993:1) maintains that the call for reform in natural science education arises from the need to reveal natural science as a human activity by emphasising the relationships that exist between natural science, technology and society. The generally accepted viewpoint among advocates of this new orientation in science education is that natural science and its handmaided, science-based technology, are major agents of social change. As such, the aspect of natural science to be considered important is the knowledge that will be useful and relevant to the solution of societal problems. Indeed science is important to all of us. The world is in desperate need of more and better science precisely because it has been one of the dominant forces in our lives and the life of the world for several hundred years.

South Africa is a country with a shortage of science personnel. This has been proved by the Ministry of Health which was forced to recruit Cuban doctors. A number of reasons cited by South African writers for example, Magi (1993) and Hartshore (1985) such as lack of laboratories, libraries and equipment can be contributory to this problem. Some of the reasons could be that most pupils do not take science in school because they view it as a difficult subject or they do not perceive science as an important field to pursue. Trowbridge, L.W. & Bybee, R.W. (1986) state that when teachers were asked about their major concerns about science programmes at their respective schools, responded as follows: the students lack discipline, one always has to be on the lookout for equipment, lack of adequate facilities to conduct their programs, lack of student motivation and lack of personnel.

Another reason for the negative attitude by students toward science or the study of science may be attributed to the teaching of science rather than to the nature of the subject itself. When students express a dislike for science or signify that the subject is boring, it is unlikely that additional mandatory science courses will change their attitudes, particularly if the added work is not different from past experiences. Instead, the teacher should strive to nurture student interests, curiosity and confidence in his/her own ability which seem to be important correlates of student motivation.

To alleviate this problem of lack of interest and poor performance in science the Physics Department at the University of Zululand has embarked on a programme of developing science in KwaZulu-Natal. The University of Zululand Science Development Centre aims at stimulating an interest in and awareness of science and technology amongst secondary school pupils, assisting pupils and teachers with science topics in the syllabus which are perceived to be difficult. The problem which motivated the study is that teaching of science education in Northern KwaZulu-Natal is in a critical condition, with under-qualified teachers, little or no equipment and many schools not even electrified or supplied with water and high failure rate in the sciences by matriculation (grade 12) pupils. The problem which this study set out to investigate was: Does the University of Zululand Science Development Centre improve pupils' perceptions of science?

1.3 MOTIVATION FOR THE STUDY

Historically Black schools have always suffered severe deficits which have manifested themselves in poor matric results and high failure rate in the areas of science, mathematics and technology. This high failure rate in the science subjects results in the limited number of pupils who pursue science at tertiary education level. Pupils seem to lack motivation in taking science and technology oriented subjects. Even if they take science subjects at secondary school they do not do well. So the researcher intends to establish whether the University of Zululand Science Centre contributes to the improvement of interest in science and in encouraging students who visit the University of Zululand Science Centre to pursue science or technology oriented careers.

1.4 AIMS OF THE STUDY

The purpose of this study is to find out whether the University of Zululand Science Development Centre has any impact on pupil's perception of science. The researcher will specifically attempt:

a. To investigate the perceptions of science held by pupils who visit the University of Zululand Science Development Centre (UZSDC)

b. To determine whether specific difficulties or problems experienced by pupils in learning science were solved after attending the University of Zululand Science Development Centre (UZSDC)

c. To determine whether the University of Zululand Science Development Centre (UZSDC) helps to create a more positive attitude toward science and science careers.

1.5 DEFINITION OF TERMS

In this study the following terms will be used and they are defined as follows:

Natural Science or Science: Brown, Cooper, Horton, Toates, and Zeldin (1986:3) maintains that the word "Science" refers to the activity of scientists, to the knowledge held and to the institutions that practices science. Science is an extension of every day observations on the nature of the world; it attempts to provide models and to theorise about how things happen. However, science is not a static body of dogma with time, models get replaced by new models that fit a wider range of phenomena. Such replacement may be gradual or the changes can be so radical that we speak of a conceptual revolution.

-The Oxford English dictionary defines science as: knowledge of the real world ascertained by observation, critically examined and classified systematically under general principles. According to this view, science is accumulated knowledge of the natural world.

According to Trowbridge, & Bybee (1986:38) Science is the body of knowledge, formed by a process of continuous inquiry and encompassing the people who are engaged in the Scientific enterprise. The type of knowledge, the empirical processes of inquiry, and the individuals in science all contribute in various ways to form a unique system called science. These factors differentiate science from other systems such as philosophy, Art, and History that also contribute to knowledge.
The above mentioned definitions of science are complementary. All these definitions emphasise the following aspects: knowledge, methodology, instrumental and vocational aspects.

In the context of this study, science is defined as a body of organised knowledge about natural phenomena, as a means of solving societal problems and and as a method of obtaining reliable information about the natural world.

Perceptions: According to the concise Oxford Dictionary perceptions are the actions by which the mind refers to its sensations to external as cause, that is, the way in which we see and hear things is influenced by a number of external factors. Some of these factors being: our cultural backgrounds, experiences and expections.

Perceptions of science reflect the individual's opinions and dispositional reactions to the scientific enterprise its significance and utility to individuals and societies; the comprehensibility, validity, and reliability of its claims in both knowledge and methodology; the 'should be' functions and roles of science and scientists; and the ethical standards of the scientific community (Hansan, 1985:69(1):3-18).

In this study perception will mean the secondary school pupils' views toward science, for example: "science is easy", "science is enjoyable", "science is fun", etc.

The University of Zululand Science Development Centre will mean the centre and the programmes initiated by the University of Zululand Physics Department with an aim of improving school science in Northern-KwaZulu-Natal Region. In this research study the name University of Zululand Science Development Centre will be used interchangeably with the "Centre" or Science Centre.

1.6 SIGNIFICANCE OF THE STUDY

Several research studies have been conducted around the field of science in general. Such research studies have concentrated on the role of gender differences in student attitudes toward science. Some of the research studies focused on investigating whether there is a sufficient supply of adequately trained teachers and what quality of training is provided for mathematics and science teachers in colleges of education. South Africa appears to have a relatively small proportion of its school population completing secondary school, and an even smaller number graduating with qualifications in science and mathematics. Some recent estimates suggest that gross enrolment rates amongst black South Africans at secondary level were less than 50% through the mid-1980's. The rates almost certainly declined during the late 1980's. In 1990 the overall retention rate to matriculation in the DET was 33%. Moreover, 50% of African students enroling in substandard A were dropping out by standard 4 without significant experience of science (Kahn, 1994). Some recent estimates suggest that though 10% of black children entering schools achieved a school leaving certificate after 12 years, the number who succeed in achieving matriculation exemption in science and mathematics are as small as 1 in 1000 (Kahn, 1994:26). Other estimates suggest that only 1 out 312 African children entering school in 1980 achieved a matriculation pass in 1991 (FRD, 1993:15).

In 1990 only two pupils achieved A grade passes in the standard 10 Department of Education and Training (the former South African system) physical science examinations (NEPI, 1992). Over 75% of all passes in physical science were obtained by Whites, and about 12% by both Indian and Coloureds (NEPI, 1992).

The above outlined statistics clearly indicate that the learning of science is in crisis more especially with Historically Black Schools. Thus the University of Zululand Science Development Centre aims at alleviating this crisis of high failure rates in sciences by Black matriculants (Grade 12) in the northern KwaZulu-Natal region in particular. The research seeks to find out what are the perceptions held by secondary school pupils toward science and the University of Zululand Science Centre and its activities. This study will provide an insight into the perceptions of school pupils about the role of the University of Zululand Science Centre and its activities.

1.7 DELIMITATION OF THE STUDY

This study will involve secondary schools in KwaZulu-Natal that were situated in the area stretching from the Tugela River in the south to Kosi Bay in the north, and inland as far as Nongoma at the time of the study. Furthermore, the study only concentrated on learners in secondary schools which offer science and only those schools which visited the University of Zululand Science Centre. Four schools participated in this study with a total of eighty eight students, from grade ten to grade eleven.

1.8 CONCLUSION

In the above discussion the researcher has outlined the problem this study sought to investigage, what it is that has prompted the study, aims of the study, significance and delimitation of the study. The next chapter focused on literature review.

CHAPTER TWO

THE UNIVERSITY OF ZULULAND SCIENCE CENTRE

2.1 INTRODUCTION

The University of Zululand Science Centre was established in 1983, the University of Zululand Physics Department applied to the University authorities for permission to open a Science Centre in the Faculty of Science, at the end of 1982, (Fish, 1997:1). Permission was granted and work began early in 1983 with a donation from Old Mutual. The centre was housed in an old laboratory on the top floor of the Zoology building. Prof Johan van der Merwe of the Physics Department with the assistance of other staff, ordered equipment for the centre and constructed 100 interactive exhibits. The Centre was opened on the 6th of November 1986. Since then (1986) other staff members have added to the exhibits, and today it houses more than 150 exhibits. The Centre is visited by thousands of students annually (see figures 2.1, 2.2).

Figure 2.1

SCIENCE DEVELOPMENT CENTRE
ACTUAL ACTIVITIES - 1997

DATE	ACTIVITY	ATTENDED BY
ALL YEAR	**SCIENCE CENTRE VISITS**	**16 300 PUPILS**
27 February	Science Teachers' Symposium(+new Science Centre Opening)	170 teachers
28 February	Official opening of Resource Park and new Science Centre	200 V.I.P.'s
14-18 February	Matric practical workshop (mechanics)	4508 pupils

6-8 May	CASME Teachers workshop	36 teachers
26-30 May	Matric practical workshop (electricity)	4760 pupils
29-30 May	Telmast workshop	12 teachers
12-13 June	Telmast workshop	6 teachers
26-29 June	Richards Bay Trade Fair	2500 visitors
14-18 July	Science in Industry Teachers' Programme	34 teachers
6 August	Local Science Expo	20 entrants
14-15 August	Telmast workshop	25 teachers
18-22 August	Exam preparation workshop	155 teachers
11-12 September	Telmast workshop	25 teachers
29 September- 3 October	Matric practical workshop (chemistry)	3674 pupils

Figure 2.2

SCIENCE DEVELOPMENT CENTRE
ACTUAL ACTIVITIES - 1998

DATE	ACTIVITY	ATTENDED BY
ALL YEAR	**SCIENCE CENTRE VISITS**	**20 280 PUPILS**
11 February	Science Teachers' Symposium	134 teachers
12 February	Science Teachers' Symposium (Nongoma) Opening of Nongoma Resource Centre	34 teachers
16-20 March	Matric practical workshop (mechanics)	5112 pupils
24-26 March	Careers Expo	8159 pupils
22-24 April	CASME Teachers' workshop (Science)	45 teachers
6-8 May	CASME Teachers' workshop(Biology)	40 teachers
19-29 May	Matric practical workshop (Electricity)	4245 pupils
24 June	RBM Science Expo: Judging	30 entrants
25-28 June	Richards Bay Trade Fair	5000 visitors
29 June - 3 July	Year of Science & Technology week -Focus week of activities -Science in Industry Teachers' Programme	 400 pupils 38 teachers
5-7 August	CASME Teachers' workshop	52 teachers
17-21 August	Exam preparation workshop	3916 pupils
27-28 August	CASME Teachers' workshop(Biology)	40 teachers
5-9 October	Matric practical workshop(chemistry)	3000 pupils

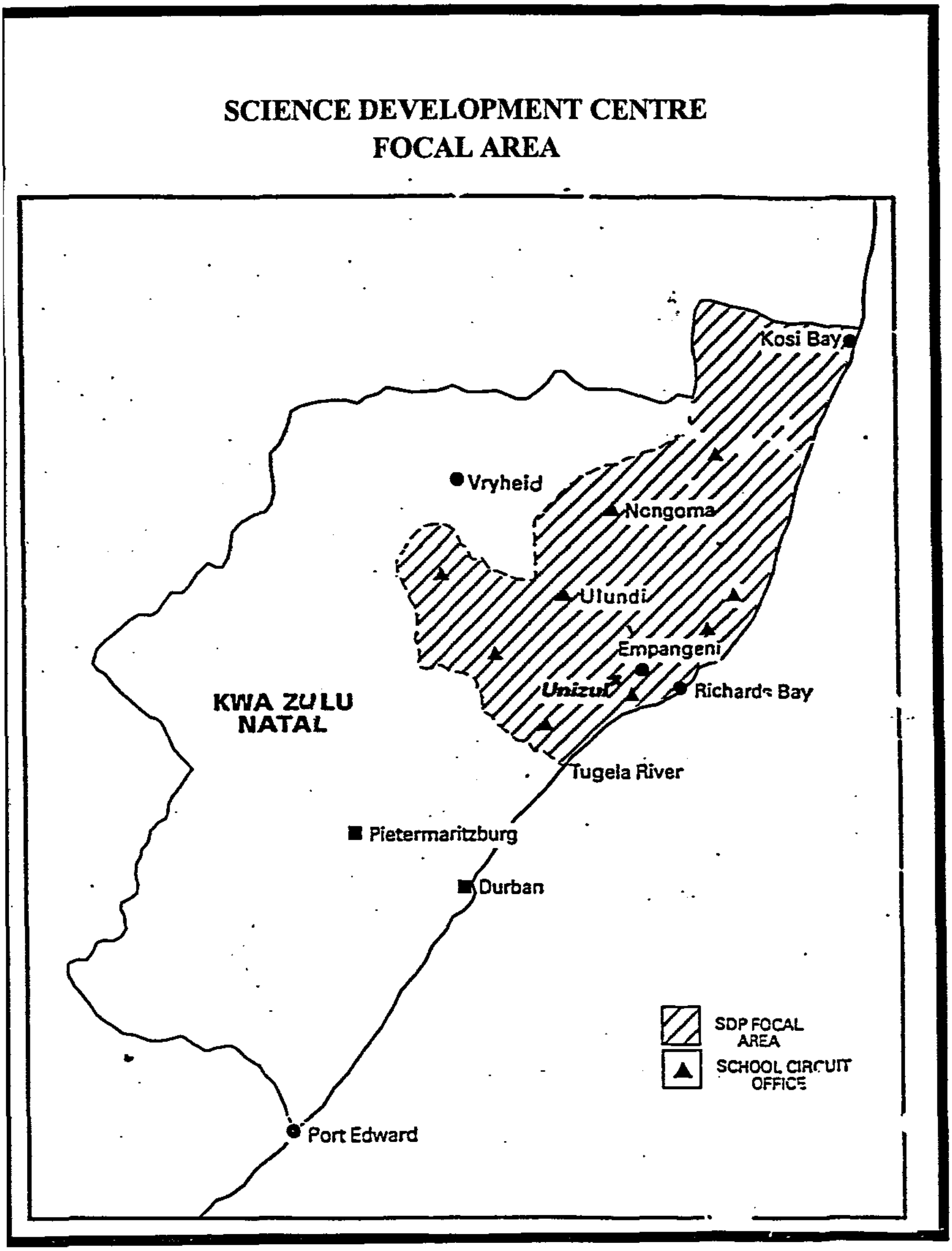
At the end of 1991, Prof B. Spoelstra, the Head of the Physics Department applied to the Foundation for Research Development (FRD) for a staff member for the centre. With the grant from FRD, two full time staff members, a manager and a co-ordinator were then appointed to manage school visits and to assist and respond to questions asked by both pupils and teachers as they view the science exhibit. In addition two part-time assistants were also appointed.

A number of other sponsors have made donations to the centre as well, in particular many of the local (Richards Bay) industries. Due to the extension of activities and support from Richards Bay industries the Science Centre relocated to Richards Bay at the end of 1996. The major reasons for the move were that the building that they were occupying at the University was too small ($200m^2$) compared to the $1000m^2$ building in Alton, Richards Bay. This move was of advantage in that the floor space at Richards Bay could accommodate a large number of pupils. Another advantage was that this building is nearby a number of industries which makes it easier for pupils visiting the Science Centre to also visit some of the industries like Alusaf, RBM, Indian Ocean Fertilizers, and others. In February 1997, the Science Centre opened its new premises in Richards Bay (Alton).

2.2 THE FOCAL AREA AND GROUPS FOR THE SCIENCE DEVELOPMENT CENTRE

The University of Zululand Science Centre originally aimed at promoting science knowledge and skills of Physical Science pupils and teachers in schools surrounding the University of Zululand. Conditions in black schools in Northern KwaZulu-Natal are critical. Science education in particular, has a number of under-qualified teachers, little or no equipment and many schools are not even electrified, do not have water supply. The University of Zululand Science Centre services schools covering a wide area from the Tugela River in the South to Kosi Bay in the north, and inland as far Nongoma. It includes two (of the 8) school regions in the Province which contain about 400 secondary schools (see figures 2.4, 2.5 maps). In addition, schools from as far afield as Gauteng Province visit the Centre (Fish, 1998).

Figure 2.3


SCIENCE DEVELOPMENT CENTRE
FOCAL AREA
Kosi Bay
Vryheid
Nongoma
Ulundi
Empangeni
Unizul
Richards Bay
KWA ZULU
NATAL
Tugela River
Pietermaritzburg
Durban
SDP FOCAL AREA
SCHOOL CIRCUIT OFFICE
Port Edward

MAP : AREAS REQUIRING URGENT EDUCATION INTERVENTION

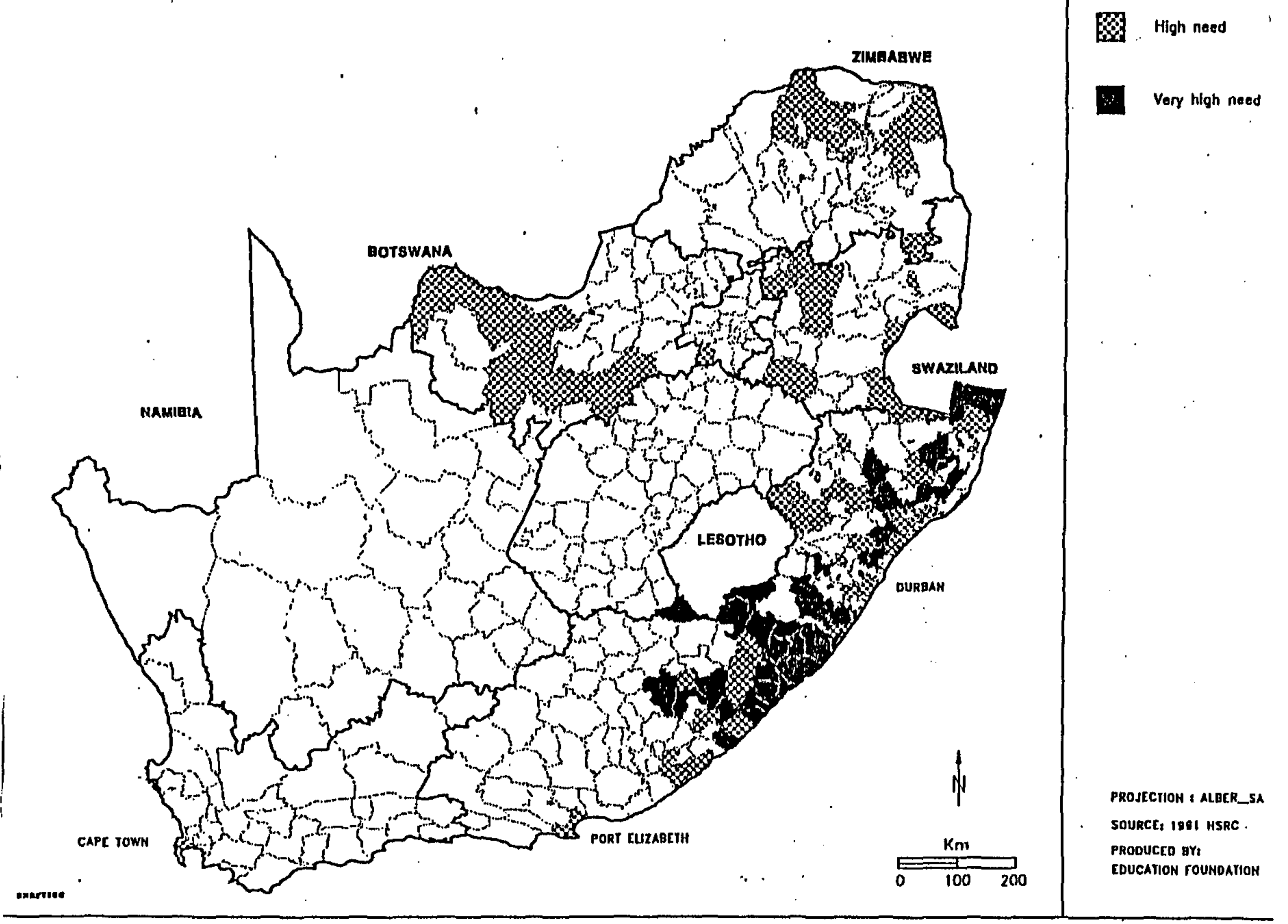


Figure 2.4

2.3 AIMS AND OBJECTIVES OF THE UZSDC

The Centre seeks to address science education problems by stimulating an interest in and awareness of science and technology amongst secondary school pupils; assisting pupils (especially matriculants) and teachers with science content perceived to be difficult in the science syllabus.

2.4 ACTIVITIES OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE

The Centre has several activities for learners and teachers. These activities can be grouped under two categories as discussed below.

2.4.1 INTERACTIVE EXPERIMENTS

The University of Zululand Science Development Centre contains about 150 interactive experiments on display for visiting school pupils. These interactive experiments are used to generate interest in science in that pupils are encouraged to observe any exhibition on their own without the help of the science staff. By so doing they gain experience which encourages them to learn more about wonders of science. This opportunity of observing or viewing interactive experiments helps learners to understand physics concepts better and to see how these concepts are applied in machines and other devices found in their homes or industry. See figure 2.5 below is an example of an interactive exhibition at the Science Centre.

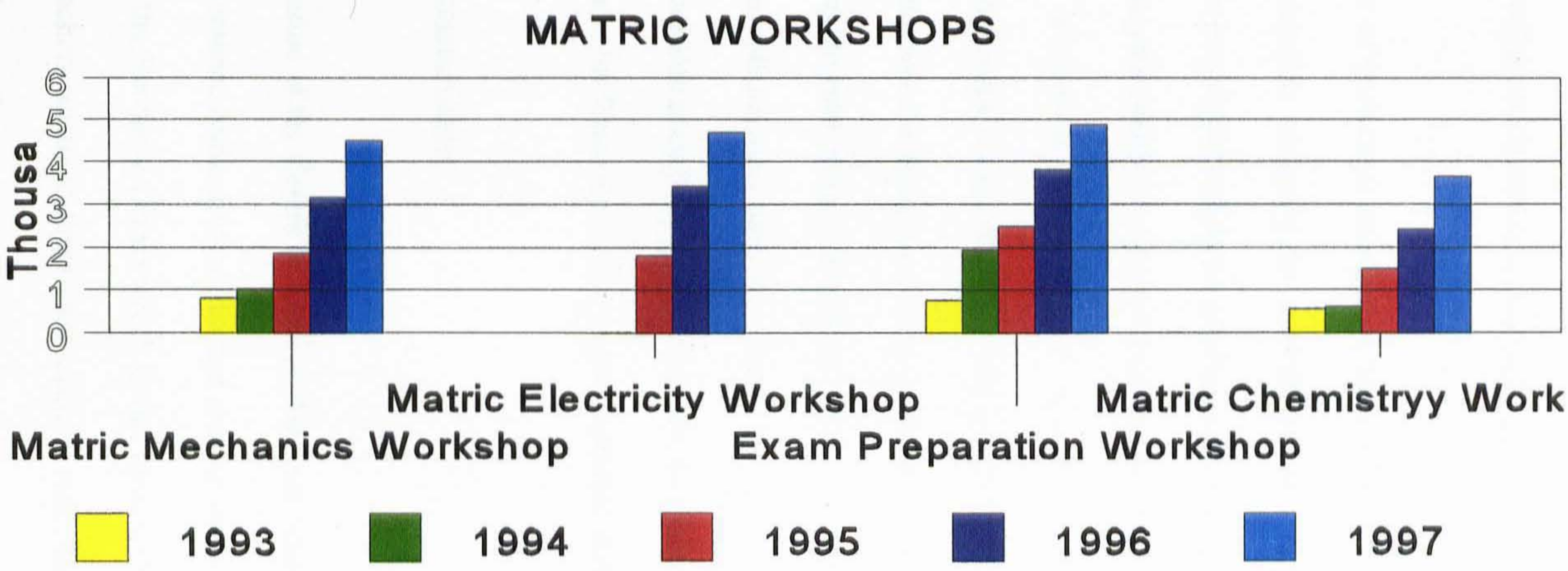
Figure 2.5

2.4.2 SCIENCE DEVELOPMENT PROGRAMMES

A. Matric workshops

Quarterly matric workshops are held to demonstrate practical work for students in the final year of matric (Grade 12). The following areas: mechanics, electricity, chemistry are some of the content addressed in the workshops. An examination preparation workshop is also conducted (see figure 2.6). These workshops are repeated at different locations (Esikhawini, Ulundi, Mtubatuba, Nongoma, Eshowe) in order to minimise cost of travelling by students. What exactly takes place at these workshops is that students observe practical work demonstrated to them by the facilitators.

UZSDC : PUPIL ATTENDANCE



1993	0.8	0	0.75	0.55
1994	1.032	0	1.942	0.603
1995	1.87	1.813	2.504	1.513
1996	3.177	3.436	3.82	2.44
1997	4.508	4.708	4.877	3.674

B. <u>Teacher enrichment courses/workshops</u>

A number of workshops on matric syllabus (Grade 11 and 12) are conducted for science teachers annually to consolidate and broaden their skills. These workshops/courses are mainly for professional development of teachers and aimed at improving the quality of teachers' knowledge of science. A workshops aimed at assisting teachers in the preparation of their pupils for the final year matric examinations is also conducted. According to Coppard(1998:2) a recent innovation in the Centre was a workshop to encourage teachers and pupils to undertake science projects and to enter them in the regional science expo. These workshops/courses are run in collaboration with the Centre for the Advancement of Science and Mathematics Education (CASME). The connection of this centre with the UZSDC is that it runs the Resource Centre which is located within the Science Centre.

C. <u>Resource Centre</u>

The relocation of the Centre to Richards Bay has opened a space for a Resource Centre equipment. Audiovisual media and reading materials for teachers have been set up in the Resource Centre which is run by CASME. This Resource Centre allows teachers access to these vital teaching aids. These audiovisual media are either on loan or for use in the centre. School contribute to the maintenance costs of equipment, as they subscribe to use the centre. The subscription fee is R100.00 a school annually, and any teacher from a subscribed school can come and borrow equipment for a period of two weeks or can come and use the centre freely. The Resource Centre offers the following resources on loan, science kits which contain practical equipment for respiration, photosynthesis, plant water relations and food testing, audiovisual aids, overhead projectors, models and previous examination papers. Other benefits are photocopying facilities, computer, 150 CD-Roms and a library with 300 reference books (Coppard, 1998:3).

D. Science in industry teachers' programme

This programme affords an opportunity to take 40 science teachers each year through 6 of the large Richards Bay industries during a week of their July holidays. The purpose of this programme is to familiarise teachers with the technology used by the industries.

E. Competitions

Competitions are run for pupils from time to time, aiming at generating enthusiasm for the subject. These have included a science expo, bridge-building competitions, steam-car competitions and others.

2.4.3 PROCEDURE FOLLOWED BY SCHOOLS VISITING THE CENTRE

Throughout the year secondary schools within the focal area are allowed to visit the science centre. The following procedure is followed by the school which visit the Science Centre: a)prior to the visit the school has to book first either telephonically or personally, b)on the day of the visit student and their teachers spend the first hour in the science auditorium where the centre's staff give them a briefing about the science centre and also demonstrations on interactive experiments which are intended to arouse the pupils' interests, c) the second hour is spent in the Centre's audio-visual room where pupils are shown some video shows about the Centre and its activities which are also intended to generate more interest on science, d) pupils spend their last hour in the exhibition area itself where they are allowed to gain experience on any of the 150 exhibits which are within the centre. In the exhibition area itself they are given an opportunity to explore and follow directions printed near each exhibit by themselves. At this stage students are not assisted by the Centre's staff, they are allowed to discover things on their own. Pupils spend about 3 hours within the Science Centre

2.6 CONCLUSION

In conclusion, it must be reiterated that the current South African Science, Engineering and Technology system is in crisis. The University of Zululand Science Development Centre in the northern Natal region has attempted to address this crisis by establishing a Science Development Centre which aims at improving the condition of science, engineering and technology in this area. It attempts to promote interest and increase pass rate in science of secondary school pupils.

CHAPTER THREE

LITERATURE REVIEW

3.1 INTRODUCTION

The basic concern of education institutions and the essential part of the educators is to arouse and maintain interest to learn amongst learners. A motivated learner learns more readily than one who is not motivated. That is why motivation is one of the general teaching principles. Another general teaching principle is perception, a principle concerned with the observation of concrete objects as well as representation thereof in the consciousness or the imagination. In other words, the external observation of objects by means of all or some of the senses together with the inner experiences and assimilation of these observations is called perception. It is, therefore, the task of the school to meet the demands for learners' perceptual experiences and capacity for abstract reasoning as well as creating lasting interest for learning.

It is believed that the way pupils perceive a particular subject or topic will have a positive or negative impact on his or her future performance concerning that subject or topic. It is this belief which has motivated the researcher to investigate whether visits to the University of Zululand Science Centre has influenced learners' perception of science and their choice of careers.

This chapter will review literature and discuss research studies pertinent to the topic on perception of science in the following areas: the principles of motivation and learning, learner's classroom experiences, learner's interest in science, previous experiences, gender roles and the value of science. The researcher reviewed the above stated areas of literature with an aim of finding out whether motivation, classroom and previous experiences by learners and gender roles do have a role to play on the pupils' future performance in school science.

3.2 PRINCIPLES OF MOTIVATION AND LEARNING

One assumption made about science curriculum materials and teaching techniques is that they should motivate individuals to learn. According to Trowbridge and Bybee (1986:51), motivation is usually thought of in one of two ways: as influenced by external objects, events or organisms; or as originating from within the individual. Learners can be motivated by their family members, peers, previous experience in a science classroom or other experiences. The external dimensions include many factors in the environment over which science teachers have control. It is believed that the following external elements can increase student motivation to learn:

3.2.1 **Level of concern** - has to do with the level of concern science teachers have for their learners. Effective science teachers are those who motivate student learning through their concern about how well students learn.

3.2.2 **Feeling tone** - how students feel in a situation affects learning. For example, pleasant feelings can result in good attitudes toward science, the science class and the science teacher.

3.2.3 **Success** - success is an excellent motivator. Success is felt when one has a challenging goal and achieves it, whilst a task which is beyond achievement becomes frustrating and demotivates learners.

3.2.4 **Interest** - interest in the learning task increases students' intention to learn. Magi (1993:67) maintains that science teaching which relates to some facet of the students' lives increases interest in learning science.

3.2.5 **Knowledge of results or feedback** - the amount, specificity and immediacy of feedback are critical in improving learners' motivation.

The above discussion shows that incentives and reinforcement from outside the student are important sources of motivation. It is assumed that the University of

Zululand Science Centre is a source of motivation which provides a unique opportunity for leaners to reinforce science interest and learning. It is, therefore, important to investigate whether the Centre does indeed influence learner's atitudes towards science.

Motivation can also be seen from the learner' behavior. According to Abraham Maslow's theory the behavior of individuals is influenced by a hierarchy of motivational needs (Trowbridge and Bybee 1986:53). This hierarchy include the physiological, physical and psychological needs. At the lowest physiological level needs such as food, water, sleep have the greatest motivational force. At the higher levels motivation needs are towards self-actualisation and the full development of an individual's potential. Basic needs, growth needs and personal development originate from within the individual. This intrinsic motivation is what should push every learner toward further growth and the development of individual capacities.

3.3 LEARNER'S EXPERIENCES

When teachers are asked what determines how well students learn science, they usually mention the quality of the teaching and characteristics of the students, such as their abilities, how much they know about the subject to start with, their willingness to learn, their beliefs and attitudes about science (White 1988:14). Most people, I think, will agree that the learner's attitude to a topic, for instance, affects attention given to instruction about it consequently the amount of knowledge that is acquired. Students' mind are not blank slates able to receive instruction in a neutral way; on the contrary, students approach experiences presented in science classes with previously acquired notions and these influence what is learnt from new experiences in a number of ways. The child even when very young, has ideas about things and these ideas play a role in the learning experience. Many different authors such as Ausubel, Piaget and Wallon, have incorporated this notion as an integral part of their theory (Magi, 1993). What children are capable of learning depends at least in part on what they need, as well as on the learning context in which they find themselves.

Depending on the nature of experiences by learners that will have a positive or negative impact toward the perceptions of science. This will mean that if the learner had negative experiences, he or she will have negative perceptions toward science, whereas if his or her experiences were positive he or she will have positive perceptions toward science. Thus a learner with positive experiences will be encouraged to go on furthering his or her science studies.

Curriculum development, especially the development of learning programmes and materials should put learners first, recognising and building on their knowledge and experience, and responding to their needs. Curriculum development processes and delivery of learning content (knowledge, skills, attitudes and values) should take account of the general characteristics, learning styles and rates of learning need to be acknowledged and accommodated both in the learning situation and in the attainment of qualifications. The ways in which different cultural values and lifestyles affects the construction of knowledge should also be acknowledged and incorporated in the development and implementation of learning programmes.

Motivating learners by providing them with positive learning experiences, by affirming their worth and demonstrating respect for their various languages, cultures and personal circumstances is a prerequisite for all forms of learning and development. This should be combined with the regular acknowledgement of learners' achievement at all levels of education and training, and the development of their ability and will to work both co-operatively and independently. Learners should be encouraged to reflect on their own learning progress and to develop the skills and strategies needed to study through open learning, distance education and multi-media programmes (Curriculum Framework for general and Further Education and Training: 1996). This suggests that motivation is another factor which determined how well students can learn.

This has the following implications for teachers; teachers will need to: connect to what the student already knows, feels and understands. Adjust methods to provide for students' learning styles. Students' ability to learn increases when the tasks/environment are compatible with their natural, innate style.

3.4 LEARNER'S INTEREST IN SCIENCE

White (1988:102) further maintains that propositions can be acquired through experience or through social transmission. A child could study mathematics and find it difficult, and so form the proposition 'maths is hard' or he could be surrounded by peers who say 'maths is hard', and come to accept that. If a student finds that she enjoys working with chemicals, and is surrounded by others who enjoy it too, she is likely to acquire a belief that chemistry is fun.

Yager & Yager (1985:347-358) used data from the 1977 to 1982 collections of National Assessment of Educational Progress (NAEP), as well as, additional data collected using the same instruments to study how students of different ages perceived school science. Their finding showed that school science becomes less fun, less interesting, and more boring as student age increased. The more the years our students enrol in science classes, the less they like it. Obviously if one of our goals is for students to enjoy science and feel successful at it, we should quit teaching science in third grade, or perhaps we should try teaching it differently. When we begin teaching science dynamically, as it exists in the real world, and not as a static subject in texts and the minds of many teachers, we may see different perceptions by students. We must offer real-world science, useful now and in the future. Useful means fulfilling a need, whether real or perceived. As we begin to concentrate on meeting the needs of our students, we will increase enrolments, more positive viewpoints and enhanced literacy.

From the above discussion it is indicated that the interest the student have on science can determine how successful he/she can be in learning science.

3.5 PREVIOUS EXPERIENCES OF LEARNERS

Misiti (1991:525) maintains that during the middle school years attitudes are formed that influence science course selections in the high school and tertiary institutions. He states that "Without radical shifts into science and engineering today, the next generation of Americans could well find themselves in a less developed country".

This is true of our context in South Africa, since we are a developing country there should be a radical shift of talent into science and engineering for us to be a developed country. Misiti (1991:525) further maintains that, assuming that previous experiences monitor the number of students who take science seriously, it is hardly cavalier to suggest that a positive student attitude toward science not only superintends scientific literacy, it could also have a bearing on our country's global competitiveness. If a positive attitude is a reasonable expectation for young South Africans, science educators must research on the attitudes of adolescents.

Learning and skills which people have acquired through experience and on-site training or self-education could be formally assessed and credited towards certificated, in order to enable them to qualify for entry to additional education or training.

To emphasise the importance of people's past experiences or prior learning, the Ministry of Education has established the principle of recognition of prior learning. This principle combines the principles of learner centredness, lifelong learning, flexibility of learning provision, the removal of barriers to access learning, the recognition for credit of prior learning experience, the provision of learner support, the construction of learning programmes in the expectation that learners can succeed, and the maintenance of rigorous quality assurance over the design of learning materials and support system (Department of National Education, 1995:28). It must therefore be considered a priority to set up mechanisms and provide access to a formal system of recognition of prior learning (RPL) leading to credits and qualifications registered on the NQF. This will be much easier when interim standards have been agreed in most areas, for RPL candidates to be assessed against. The concept of prior learning should be recognised in the schooling context. Another area where prior learning applies more forcefully is in relation to languages. Although children bring with them to school whole range of levels of expertise in oral and written languages, the learning of a language is usually organised in school as if all learners of a certain age group were uniformly competent. Thus some are expected to cope with languages which may be entirely new to them, whilst others are bored by being treated as beginners when they may possess a high degree of communicative or even formal linguistic and literacy competence. In a learner-paced assessment system these learners could be given differentiated programmes to suit their needs, and could expect to leave school with a range of levels of formal credits in a number of languages (Department of National Education 1995:26).

The above discussions suggest that what the student knows or has acquired contribute a lot to his/her formal learning.

3.6 GENDER ROLES

There are substantial variations among countries and cultures regarding most aspects of gender and science, engineering and technology (SET). One dimension common to all countries is the absence of women from top decision-making positions. This is particularly serious in view of the gender-specific nature of development, as needs and aspirations of women rarely get fully represented. By establishing appropriate enabling SET policies in South Africa we could move towards gender equity. This expectation is rooted in our belief in human rights and the belief that sustainable human development will occur faster if equity existed (Department of Arts, Culutre, Science and Technology, 1996:82).

Data on post-graduate enrolments (Universities and Technikons combined) show a static and disproportionate trend in female enrolments in the sciences and engineering between 1988(25.2%) and 1992 (25.7%). Women are absent in many links of decision-making, from the science and technology institutions that generate the technology, to the mediating institutions that use it. The missing link in this chain are women scientists, engineers and technologists, entrepreneurs, and community leaders, who can best reflect the needs and aspirations of women. The sooner these deficiencies are addressed, the sooner science and technology will serve all of South Africa. (Department of Arts, Culture, Science and Technology, 1996:82).

Even in developed countries, participation rates for women in science are relatively low. In Sweden, which has a long history of promoting equality between sexes, women accounted for only 11% of employed non-academic scientists and engineers in 1985. In Japan, fewer than 8% of scientists and engineers were female in 1992, most of them employed in less prestigious scientific institutions (Department of Arts, Culture, Science and Technology, 1996:82).

There are many factors that contribute to the under-representation of women in scientific careers. The challenge of combining family responsibilities with professional careers where household responsibilities are not equitably shared; the pace at which science advances makes it difficult to re-enter a scientific career once it is interrupted to raise a family; the difficulty of breaking into formal and informal scientific networks that characterize the scientific community, which have been largely white-male dominated; and the reluctance of some employers to invest in training women due to the perceived likelihood that they will leave the organisation to raise a family. These glaring shortcomings are compelling reasons for South Africa to create a policy and institutional mechanisms and environments that will promote gender equity in education, careers and decision making in SET (Department of Arts, Culture, Science and Technology, 1996:83).

The constitution recognises the specific nature of this gender inequality hence the establishment of a commission on gender equality. The Ministry of Education has proposed the appointment of a gender equity task team led by a full-time gender equity commissioner who shall report to the Director General. The terms of reference of the task team will be to investigate and advise the Department of Education on the establishment of a permanent gender equity unit. The gender equity unit will study and advice the Director General on all aspects of gender equity in the education system, and in particular:

i. Identify means of correcting gender imbalances in enrolments, subject choice, dropout, career paths, and performance.

ii. Propose guidelines to address sexism in curricular, textbooks, teaching and guidance.

Indeed the representation of women in sciences either in South Africa or abroad is not up to the required standard. However the above discussion suggest that a lot is done more especially by the South African government in addressing this.

3.7 VALUE OF SCIENCE

Science, Engineering, and Technology (SET) have time and again demonstrated their capacity to generate new and better ways of doing things, thereby contributing to higher standards of living and a better quality of life. The distribution of the benefits of SET in South Africa has been the subject of much controversy in the past. We now need to promote and mobilise the remarkable power of SET to generate democracy into the future (Department of Arts, Culture, Science and Technology, 1996). The above introductory remarks were made by the previous Minister of : Minister of Arts, Culture, Science and Technology, Dr B.S. Ngubane in the South Africa's Green Paper on Science and Technology.

To show how important science is, the Ministry of Education in its White Paper seeks to embark on a student recovery programme in science and mathematics. Such interventions would be part of a comprehensive programme of special measures which are needed to enable many more students to follow science-based careers. Co-ordinated and certificated "second chance to learn" and recovery programmes for students in science and mathematics would offer alternative entry to higher education and employment, but should be part of a comprehensive package of measures, including new science and mathematics curricula linked to accredited in-service programmes at all levels of schooling.

For a country to develop economically it must be technologically advanced and science is the knowledge base for technology. Society's problems which are practical in nature increasingly thrust their way into study and laboratory, insistently narrowing the distance between theory and application, demanding that academic intelligence come into the market place, indeed, offering the tempting, obvious returns for such action. Defence contracts, foundation awards, and ever broadening use of the professor as advisor, witness or consultant indicate what other instruments of judgement have long measured the destruction of university isolation and the rising involvement of its activities with those of society at large. The sciences have led to this development, with their promise of immediate gain, but more importantly, because of their capacities to gather, to order and to retrieve for utilitarian or philosophical decision the varied facts that populate the many world of modern existence (Harry Woolf, 1964:1-2).

Technological activities - research and development are among the nation's fastest growing enterprises and public funds provide much of the support for them. It is important to understand that modern technology has become highly independent upon basic scientific knowledge for much of its progress. In turn scientific research in many fields is only possible because of the elaborate and sensitive tools that technology has made possible. It is clear that life without science could be boring or difficult. The facts stated above are a few to prove that science is of value to us as human beings. It seems quite impossible to lead a life without having used a number of scientific tools.

3.8 CONCLUSION

From the above discussion one can notice that there are a number of factors that are contributory to the perception of science by secondary school pupils. It is not that there is only one factor that determines how pupils perceive science. In the next chapter the researcher will be discussing the following issues, subjects for the study, the survey instruments, and its validation and lastly data analysis procedures.

CHAPTER FOUR
RESEARCH METHODOLOGY

4.1 INTRODUCTION

Man's compelling need to know is dominant drive. The search for truth is a characteristic of human beings. Man wants to understand the nature of phenomena in his surroundings. We are often confronted with problems too extensive and complicated to solve by means of simple logic. Therefore sound research methods should be used when we are searching for the truth. There are various approaches used to select and accumulate knowledge. In this section of the study the researcher described the following, research method, research design, sampling design and instruments that he used in order to collect data.

4.2 EVALUATION RESEARCH

There are several types or methods of research. In this study the researcher has made use of evaluation research, which is a research method that can be used to assess the design, implementation and usefulness of a social intervention. Actually any attempt used to change the conditions under which people live can be thought of as a social intervention (Bless & Hisson-Smith, 1995:46). In this study evaluation research is used to assess the usefulness of the science development programme which is a social intervention which was established so as to improve the learning of science by secondary school pupils. Evaluation research aims to test interventions to see how effective they are and therefore represents an important means of linking action and research in a constructive manner. Interventions may benefit from evaluation research in a number of ways. Three of the most important are listed below:

* Evaluation research used as a diagnostic tool may help people implementing an intervention to identify neglected areas of need, neglected target groups, and problems within organisations and programmes.
* A comparison of a programme's progress with its original aims is another of the functions of evaluation research. This may serve to adjust the programme to the particular needs and resources of the community within which it is situated.
* Further, evaluation research can furnish evidence of the usefulness of a programme. In this way a programme may gain credibility with funding organisations, as well as the community within which it is operating (Bless & Hisson-Smith, 1995:47-48).

There are a number of evaluation research methods, five of the most important are listed below:

4.2.1 DIAGNOSTIC EVALUATION RESEARCH

Diagnostic evaluations are designed to inform researchers and project managers about the present situations within communities, highlighting current problems, trends, forces and resources, as well as the possible consequences of various types of interventions (Bless & Hisson-Smith, 1995:48).

4.2.2 FORMATIVE EVALUATION RESEARCH

It focuses on diagnosing areas of the programme that are weak and making recommendations for improvement. The question of formative research is not whether the programme should be cancelled or kept, but what should be done differently. Its aim is to shape the programme so that it will have the greatest beneficial impact upon the target community (Reaves, 1992:12).

4.2.3 SUMMATIVE EVALUATION RESEARCH

Summative evaluations set out to determine the extent to which programmes meet their specified aims and objectives. This information is used to gain credibility with various groups of people particularly potential funders and target communities. Summative evaluation ought always to happen at the end of the programme (Reaves, 1992:12).

4.2.4 IMPACT EVALUATION RESEARCH

It uses primarily information about the actual effect or impact, that a programme has had for example, an impact evaluation of a programme to give sterile needles to drug addicts to slow the spread of aids would focus on whether the programme had any measurable effect on the number of new aids cases among drug addicts. (Reaves, 1992:13).

4.2.5 PROCESS EVALUATION RESEARCH

Focuses on the details of how the program functions in an attempt to determine what parts of it are successful and what parts of it are not.

4.3 SPECIAL DIFFICULTIES OF EVALUATION RESEARCH (APPLIED RESEARCH)

There are other factors that can make any applied research more difficult to carry out than other forms of research. They stem from the fact that applied research deals with real-world problems, and the real world is seldom as neat and orderly as the research laboratory. The problems fall generally into three categories: those dealing with the reactions of the people involved, and those dealing with the lack of control over situation, and those dealing with measurement and interpretation. While all these problems can apply to any type of research, they are more often important in applied/evaluation research. Lack of control means that the researcher may not be able to make decisions about how a program is to be implemented or how people will be chosen to become involved in the programme and without such control the results of the research will generally not be completely definitive. This is especially likely to happen when a programme is implemented without thought of how its effectiveness will be evaluated, so that research to determine how well the programme works must be designed after the programme is in place. Suppose you want to know whether a certain programme makes a difference. Compared to the situation before the programme began. But perhaps other factors that have changed could account for the difference, not the programme itself. This is true of this study in the sense that the researcher is comparing the situation before the University of

Zululand Science Development Centre(UZSDC) began and the situation after. The problem of control is a critical one in any research that attempts to discover why something happened (Reaves, 1992:14-15).

Whatever the results of an evaluation research study, it will usually affect someone in some way. This means that the people involved in the research programme will often have a definite preference of how the research comes out and may attempt to bias the results. The reactions of the people involved may range from making suggestions about what sorts of things your research could consider, through reporting only the information that fits their biases, to actively distorting records and reports. It is important to be alert for this problem when conducting evaluation research. It is even more important to be sensitive to the feelings of the people who are involved in your research. It must be remembered that they might be affected in important ways by your report. This problem is true for this study because the people conducting the University of Zululand Science Development Centre(UZSDC) will be directly affected by the findings of this research in that they may have to cancel, add, and change certain programmes.

The final problem is actually true of any sort of research, but it is exaggerated in evaluation research because more people have a stake in what the research means.

Measurement problems deal with applying numbers to situations that are very complex, interpretation problems deal with deciding what a particular measurement is saying to us. Almost no matter how you conduct your research, some people are likely to say that you did not measure the important factors at all or that your measurements are faulty or that you misinterpreted your results (Reaves, 1992:15).

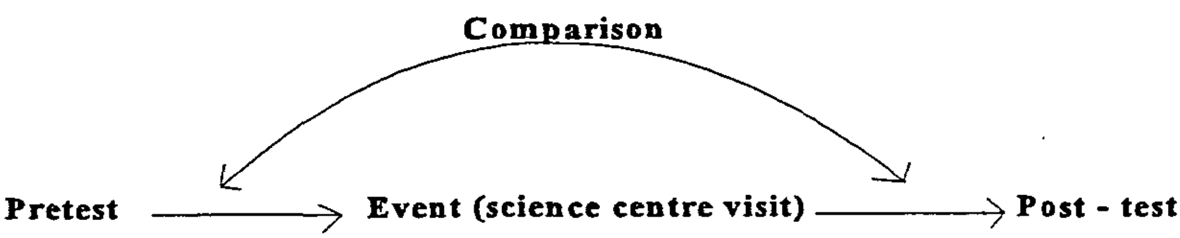
4.4 RESEARCH METHODOLOGY USED IN THIS STUDY

In the light of the above discussion the researcher in this study used both formative and summative evaluation research methods. It is formative in the sense that the aim of the study is to look at how effective the University of Zululand Science Development Centre(UZSDC) is in carrying out its aims, of which the findings will help shape the UZSDC so that it will have the greatest beneficial impact upon the secondary school pupils. It is summative in that the information obtained will be used to gain credibility with various groups of people particularly potential funders of the University of Zululand Science Development Centre such as Foundation for Research and Development (FRD), Alusaf, RBM, and others.

4.4.1 RESEARCH DESIGN

A number of research designs are available for collecting information from the target group, but for the purpose of this study the researcher used the pretest/post-test design. This type of research design is used so as to measure the dependent variable before (pretest) the students visit the science centre and after (post-test) their visit to the science centre. Their visit to the science centre is expected to bring about some change. As a result, the scores on the dependent variable can be compared over two points in time and the difference between the before and after scores may be due to the science centre visit that occured between them.

The design is represented diagramatically below as follows:



However, even this approach to the problem is not without weaknesses. It is quite possible that other experiences occured at the same time as the science centre visit and that these experiences (and not the science centre visit) were responsible for the change in the dependent variable. This is particularly true when a long period of time has elapsed between the pre- and post-tests. To counteract this problem the researcher administered the post-test a month after the visit to the science centre.

4.4.2 THE SAMPLE

A major aim of research is to provide sound propositions about people in general or about specific groups of people. Rarely however, does a researcher actually study or observe all people/things, objects/events he or she is interested in.

A population can be looked upon as all possible observations of a certain kind. The researcher tries to understand a segment of the population on the basis of observing a smaller segment, a sample. Samples can be of any size and can be selected in a number of different ways. From a number of sampling designs available the researcher has made use of random sampling. A stratified sample was selected from the secondary schools in Northern KwaZulu Natal that visited the science centre between March and June 1998 and was selected from rural, peri-urban and urban schools.

This study involved secondary schools in KwaZulu-Natal that are situated in the area stretching from the Tugela River in the south to Kosi Bay in the north, and inland as far as Nongoma. However, four schools were selected from this area which were within travel reach of the researcher. These four schools were selected using stratified random sampling from only those schools which visited the Science Centre between the months of MARCH and JUNE 1998. Three of these schools were from Empangeni district and one school from Babanango district. A list of schools sampled is shown in Table 4.1 below:-

TABLE 4.1 LIST OF SCHOOLS SAMPLED

NAME OF SCHOOL	GRADES	NUMBER OF STUDENTS
Qhamuka High School	10	14
Elangeni High School	10	19
Khombindlela High School	10& 11	38
Malandela High School	10	17

4.4.3 RESEARCH INSTRUMENT

A number of methods can be used to collect data for example, observation, interviewing, standard tests, documentary sources and questionnaires. In collecting data for this study the researcher used the questionnaire as an instrument for collecting data.

In particular the person-to-person variety, was seen as the core of all the methods that could be used in collecting data in this study. The questionnaire consisted of both closed-ended and open-ended questions. The open-ended questions were designed to permit a free response from the subject, that is the respondent is given the opportunity to answer in his own terms and in his own frame of reference. Open-ended questions are advantageous in that they put very few words in the mouth of the respondent, as such, it is more effective in revealing his own definition of the situation; secondly if the respondent does not understand the question, this will be revealed in his answer to open questions. The open-ended questions are however not without draw-backs. One major fallacy is that many answers are not too useful in testing specific hypothesis, because they constitute responses along many different dimensions. Another problem is that the analysis of open-ended answers is complex and difficult.

The close-ended questions were used to limit the responses of the subjects to stated alternatives. The close-ended questions have the advantage of being standardisable, they are simple to administer, quick and relatively inexpensive to analyse. In addition, the information given by the respondent is always relevant to the purpose of the inquiry. Closed-ended questions are however not without disadvantages. One is that it may force a statement of opinion on an issue about which the respondents do not have any opinion.

From this discussion of the relative advantages and disadvantages of open and closed questions, it is apparent that the two differ in the purposes for which they are appropriate. Closed questions are more efficient where the possible alternatives replies are known, limited in number and clearcut. Thus they are appropriate for securing factual information and for facilitating expressions of opinions about issues on which people hold clear opinions. Like in this study closed questions were used for soliciting information or opinions about the perceptions held by secondary school pupils on science. Open-ended questions are called for when the issue is complex, when the relevant dimensions are not known. In this study the researcher used open-ended questions for securing factual information and opinions about the role of the University of Zululand Science Development Centre.

Students' perceptions of science were measured by using an instrument constructed by the researcher, which was adapted from the Likert type scale of measurement. The questionnaire consisted of 31 items and was designed to measure the following six components.

a. Personal background of the student

b. Role of the University of Zululand Science Development Centre

c. Pupil's attitudes or feelings towards science

d. Pupil's perceptions of the learning of science

e. Pupil's perceptions of the value of science, and

f. Pupil's perceptions of science careers

4.5 DATA COLLECTION

The collection of data in the field was achieved through the circulation of questionnaires with closed-ended and open-ended questions to secondary schools. The data were personally collected by the researcher using the questionnaire technique. This made it possible for the researcher to have informal and personalised talks with secondary school pupils, thereby putting them at ease before asking them to respond to the questionnaire. The collection of data by the researcher also eliminated possible errors or inconsistencies that might have occurred if assistant researchers were employed, such as incorrect/irrelevant information supplied in personal particulars of the respondents.

4.6 DATA ANALYSIS

Upon completion of the survey, each questionnaire item was recorded and scanned for any recording errors. All questionnaires related data were statistically analysed.

4.7 CONCLUSION

In this section of the study the researcher has attempted to outline the research method used when conducting his research. Brief view was also done on the difficulties which are specific to this research method. All in all this chapter concerns the methodology which was used by the researcher. The next section of the study will concentrate on the presentation of acquired data.

CHAPTER FIVE
PRESENTATION OF DATA

5.1 INTRODUCTION

The presentation of data in this chapter will be discussed in the following sections:

a. The first section considers the personal characteristics of respondents, that is, the secondary school pupils. Data on their sex, educational background, age grouping is presented.

b. The second area looks at the aim and the general role of the University of Zululand Science Development Centre.

c. The third section presents data on the pupils' attitudes or feelings toward science.

d. The fourth section presents data concerning the pupils' perceptions of the learning of science.

e. The fifth section looks at the pupils' perceptions of the value of science.

f. The last section considers the pupils' perception of science careers.

Since the schools were selected randomly, the schools in this study were those which visited the University of Zululand Science Development Centre during the data gathering period, that is March to June 1998.

Data presented in this section was gathered on pre- and post-test basis. Pretest data was gathered before each school visited the Science Centre. Post-test data was gathered a month after each school visit to the centre. The aim behind this was to make a comparison between pre- and post-test data.

5.2 RESPONDENT CHARACTERISTICS

The respondents for this study came from three types of schools: rural schools, peri-urban and urban schools. Percentages of respondents indicate that 37.5% of the respondents were from rural schools, 19.3% were from peri-urban schools and 43.2% were from urban schools. Of the total number of eighty-eight pupils participating in the study, 54.4 percent were males and 45.5 percent were females. So, although the majority of respondents participating in this study were males, a substantial number of females (over 40%) participated in the study. Table 4.1 shows the data on schools and respondents which participated in this study.

Table 5.1 DATA ON SCHOOLS AND RESPONDENTS

Location schools	number of schools	Name of the School	number of school pupils	percentage
Rural	02	Qhamuka and Elangeni H.S.	33	37.5
Peri-urban	01	Malandela H.S.	17	19.3
Urban	01	Khombindlela H.S.	38	43.2
TOTAL	04		88	100

Data from Table 5.1 indicates that schools were somehow evenly represented, that is, two schools were from rural areas, one school from a peri-urban background and the last one from an urban area.

Table 5.2 AGE RANGE OF SECONDARY SCHOOL PUPILS

Age Range	Frequency/No. Of Pupils	Percentage (%)
15-17 years	58	65.9
18-21 years	30	34.1
22-25 years	00	00
26 years +	00	00
TOTAL	88	100

Data from table 5.2 suggests that a substantial number of secondary school pupils who participated in this study were young (over 65%), that is, were less than 18 years of age. It further indicates that no pupils were over the age of 21 years.

Respondents who participated in this study were from two grades, that is, grades 10 and 11. Fourteen respondents were from grade 11 and out of the 14 respondents 4 were males and 10 were females. Seventy four respondents were from grade 10 and out of the 74 respondents 30 were females and 44 were males.

5.3 THE AIM AND GENERAL ROLE OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE

Data presented in this section was obtained by asking pupils some questions to which they were required to respond. In this section the first question concerned the perception of respondents about the aim of the University of Zululand Science Development Centre. Pretest and post-test data from this question indicated that the majority of students (75% of the pupils on pretest and 84% of the pupils on post-test) felt the main aim of the UZ Science Development Centre is to supply them with relevant knowledge and practical skills, some (17% of pupils on pretest and 9% of the pupils on post-test) students felt that it plays a role in offering guidance related to careers. A minority of students (6% of the pupils on pretest and 7% of pupils on post-test) perceived that this centre aims at increasing the number of students doing science and also improve their pass rate.

Table 5.3 INDICATION OF PUPILS' PERCEPTION OF UZSDC's AIM

PERCEPTIONS OF PUPILS TOWARD THE AIM OF UZSDC	KNOWLEDGE AND PRACTICAL SKILLS		CAREER GUIDANCE		INCREASING THE NUMBER OF PUPILS DOING SCIENCE AND IMPROVE THEIR PASS RATE	
	%		%		%	
	PRETEST	POST-TEST	PRETEST	POST-TEST	PRETEST	POST-TEST
	75	84	17	9	6	7

The second question of this section addressed what students hoped to gain or learn by visiting the science centre. Pretest information suggest that the majority of students i.e. 84% hoped to gain more knowledge and practical skills (e.g proper use of apparatus) and the minority i.e. 12% hoped to gain career guidance information. Post-test data reveals that the majority (88%) of students still perceived that a visit to University of Zululand Science Development Centre helped them to gain knowledge and practical skills. For example, "I learned how to make experiments and how the iron melt, and where it comes from and how to operate the machines", and the minority (8%)of the students gained career guidance information.

Table 5.4 INDICATION OF WHAT PUPILS' HOPED TO GAIN OR LEARN BY VISITING THE SCIENCE CENTRE

WHAT PUPILS HOPED TO GAIN OR LEARN BY VISITING THE SCIENCE CENTRE	KNOWLEDGE AND PRACTICAL SKILLS		CAREER GUIDANCE	
	%		%	
	PRETEST	POST-TEST	PRETEST	POST-TEST
	84	88	12	8

-The third question of this section concerned what else would the students like to learn about in the University of Zululand Science Development Centre. Both pretest and post-test data indicate that the majority of students (52% pre- and 56% post-test) would like to learn a lot about practical skills which will improve their existing knowledge, for example, "I would like to learn more experiments, how to control machines and electricity is formed. Some (30% pre- and 28% post-test) also feel that they require more information concerning career guidance and the minority (9% on pre- and 15% on post-test) suggest that other subjects should be catered for in this science development centre for example Biology, Mathematics, Agriculture and Geography.

Table 5.5 INDICATION OF PUPILS' PERCEPTION OF UZSDC's AIM

WHAT ELSE WOULD PUPILS LIKE TO LEARN ABOUT IN THE UZSDC?	KNOWLEDGE AND PRACTICAL SKILLS		CAREER GUIDANCE		OTHER SCIENCE SUBJECTS	
	%		%		%	
	PRETEST	POST-TEST	PRETES T	POST-TEST	PRETEST	POST-TEST
	52	56	30	28	9	15

The last section looks at whether is it important or necessary to construct more centres like this or not. Both pretest(65%) and post-test(78%) information revealed respondents felt that centres like this should be built in numbers because of its importance.

Table 5.6 INDICATION OF PUPILS' PERCEPTION OF WHETHER SHOULD THERE BE MORE OR LESS CENTRES LIKE THIS

SHOULD THERE BE MORE OR LESS CENTRES LIKE THIS	MORE CENTRES		LESS CENTRES	
	%		%	
	PRETEST	POST-TEST	PRETEST	POST-TEST
	65	78	8	5

The above presented data show that pupils perceived science knowledge and practical skills as of major importance followed by career guidance information.

5.4 PUPILS' ATTITUDES OR FEELINGS TOWARD SCIENCE

Data presented in this section and the other following sections was obtained in one way. Pupils were asked to indicate whether they strongly agree, agree, are neutral, disagree or strongly disagree to a given statement.

Table 4.3 displays data which indicate the attitude or feelings of pupils toward given statements. A point worth mentioning here is that one of the given statements "I have bad feelings toward science" was used in this context so as to ascertain that the pupils were sure or not of their responses to the other statements. In general both pretest and post-test information from this table show that pupils have positive attitudes or feelings toward science.

Table 5.7 INDICATION OF PUPILS' ATTITUDES OR FEELINGS TOWARD SCIENCE (N=88)

Pupils' Attitudes Toward Science	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	%		%		%		%		%	
	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test
Science is enjoyable	48.9	60.2	34.1	33.0	14.8	5.7	1.1	1.1	1.1	-
Science is fun	26.1	23.9	17.0	40.9	20.5	13.6	27.3	8.0	9.1	13.6
Science makes me feel curious	28.4	27.3	33.0	43.1	15.9	15.9	13.6	5.7	9.1	8.0
I have bad feelings toward Science	2.3	2.3	5.7	3.4	14.8	11.4	34.1	22.7	43.1	60.2
I listen or read news about science	28.4	35.0	43.1	48.0	14.8	11.4	5.7	4.5	8.0	1.1

Pretest data from the statement "science is enjoyable" indicate that over 80% of pupils strongly agree or agree that science is indeed enjoyable while approximately 15% of pupils were on the border-line in the pre-test and only 2.2% of pupils felt that sciences was not enjoyable at all. Post-test data from this statement show an improvement concerning pupils attitudes toward science when compared to the pretest data, that is 93.2% of pupils then felt that science is enjoyable, and 5.7% were on the border line and only 1.1% felt that science was not enjoyable.

Pretest data suggest that more than half of the pupils did not feel that science is fun. Since 20.5% of pupils were neutral i.e.did not know whether there is fun or not in science, 27.3% of pupils were in the disagree category and 9.1% of pupils strongly felt that there is no fun in science. A point worth mentioning is that post-test data revealed that the majority of the pupils after the science centre visit did feel that there is fun in science, over 60% of pupils felt fun in science, 13.5% were on the borderline and only 21% of pupils did not feel any fun in dong science even after the science centre visit.

This indicated that post-test percentages were higher in the agree category i.e. more respondents felt that science is fun after the visit to the University of Zululand Science Development Centre.

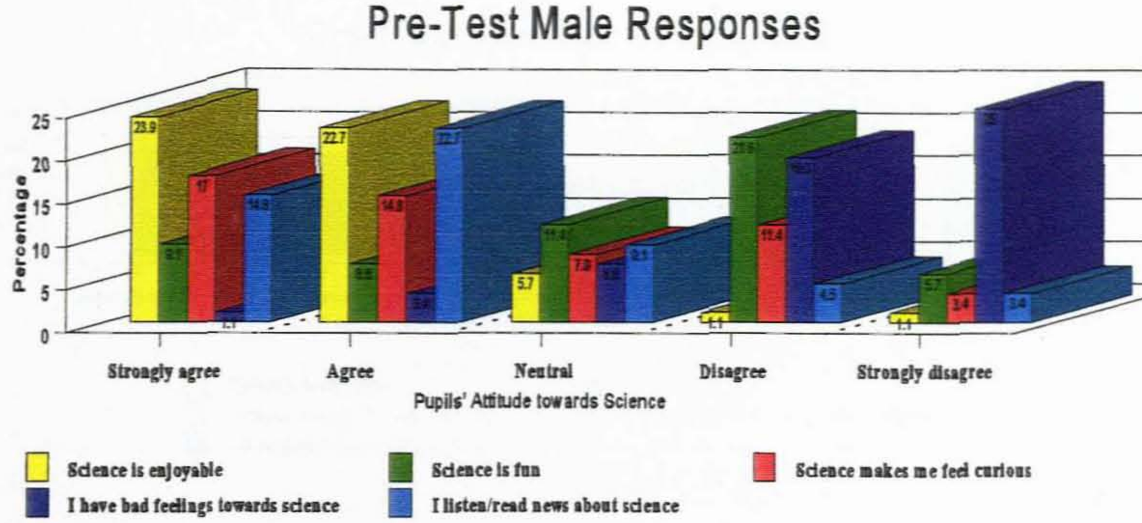
Pretest and post-test data from the statement "science makes me feel curious" suggested the following: on pretest 61.4% of the pupils felt that science promote curiosity. On post-test 70.4% of the pupils felt that science makes them feel curious. 15.9% of the pupils both on pretest and post-test were in the neutral category. Still in this question, on pretest data revealed that 22.7% of the pupils felt that science did not make them feel curious. And on post-test 13.7% of the respondents felt that science did not promote their curiosity.

Data from the statement "I listen or read news about science" indicated that 71.5% of the pupils on pretest listen or read news about science and on post-test 83% of the pupils listen or read news about science. Pretest data also revealed that 13.7% fo the pupils do not listen or read news about science whereas post-test data suggested that only 5.6% of the pupils never listen or read news about science.

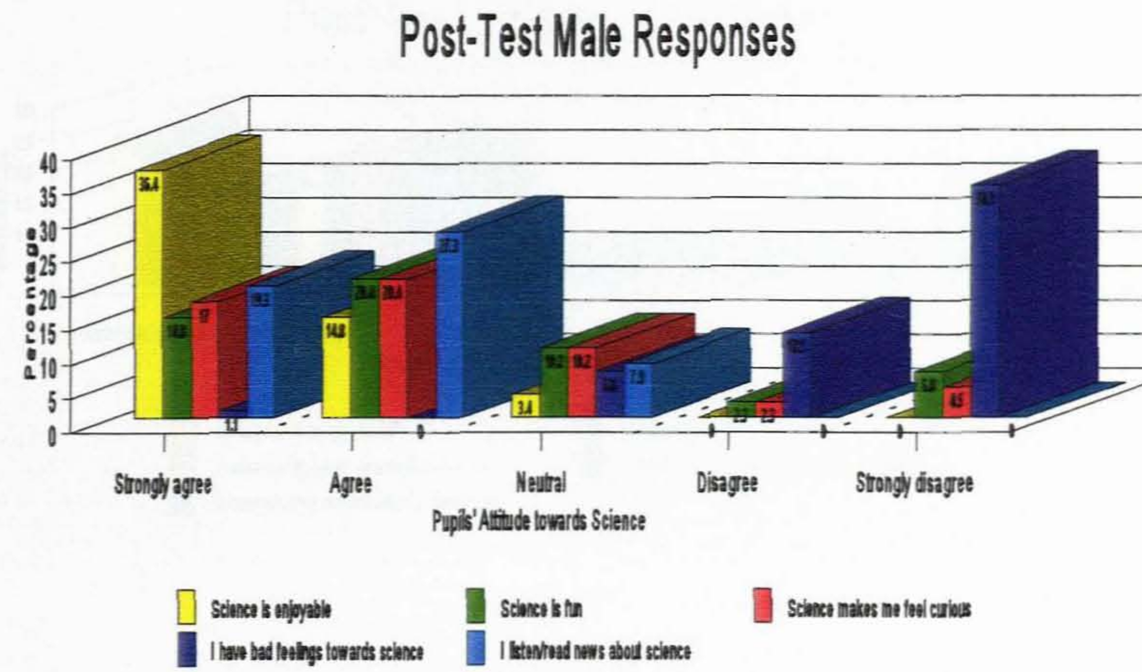
Data concerning the negative statement indicate that the majority of students have good feelings toward science. Pre-test data reveal that 8% of pupils have bad feelings toward science and 14.8% were on the border line and 77.2% of the pupils have good feelings toward science. In line with pre-test data although with some improvement, post-test data suggest that less than 5.7% of the pupils have bad feelings toward science, 11.4% of pupils were on the border line and over 82.9% of pupils have good or positive feelings toward science.

Comparison on male and female responses concerning their attitudes or feelings toward science suggested that in general male pupils have good feelings toward science as compared to their female counterparts. For more details on this part refer to the graphics below.

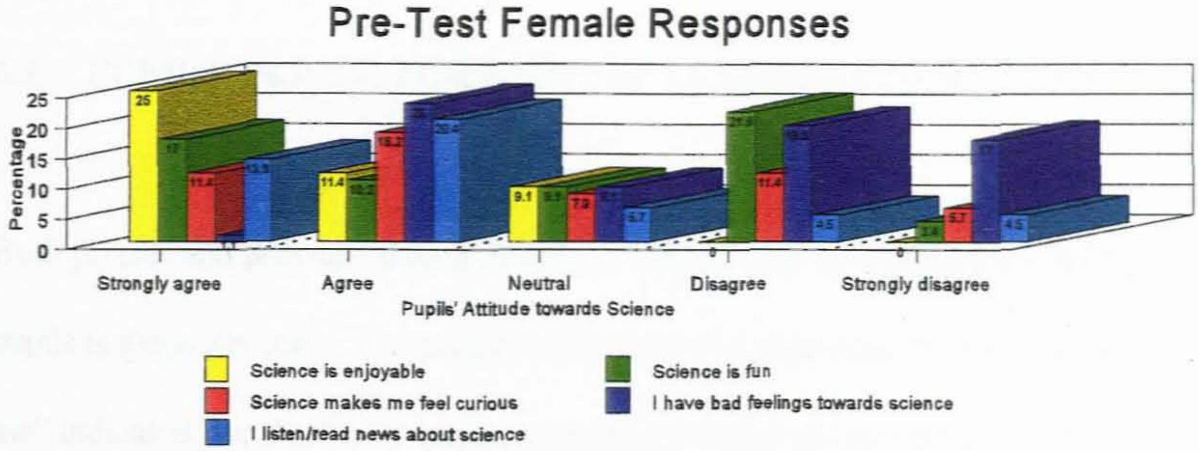
GRAPH 5.1 (a) INDICATION OF PUPILS' ATTITUDES TOWARDS SCIENCE : N = 88



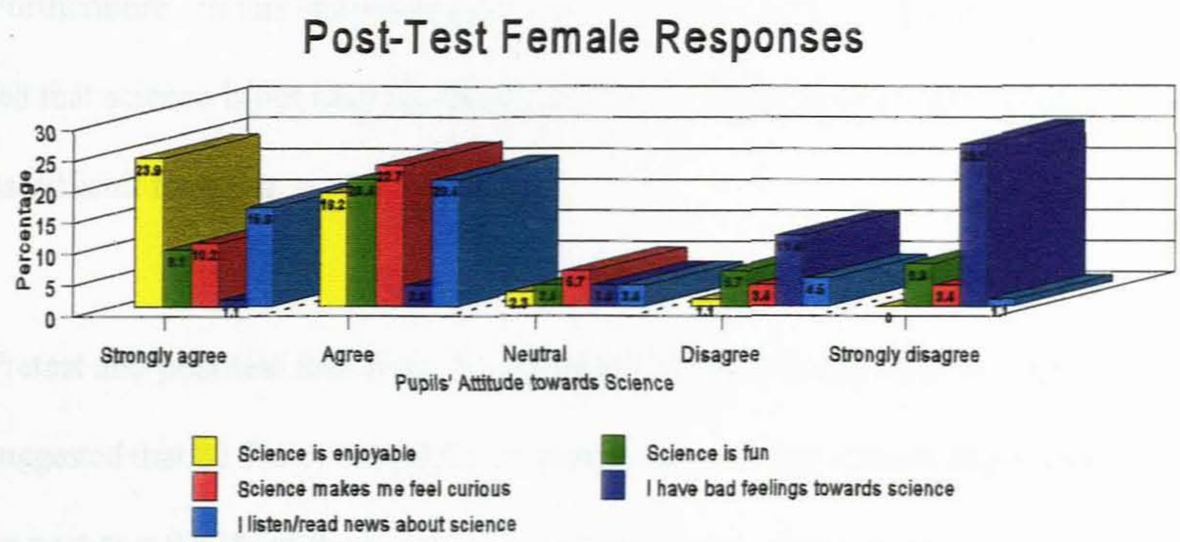
GRAPH 5.1 (b) INDICATION OF PUPILS' ATTITUDES TOWARDS SCIENCE : N = 88



GRAPH 5.1(c) INDICATION OF PUPILS' ATTITUDES TOWARDS SCIENCE : N = 88



GRAPH 5.1 (d) INDICATION OF PUPILS' ATTITUDES TOWARDS SCIENCE : N = 88



For example, data from the statement "science is enjoyable" indicated the following: on pretest 46.6% males and 36.4% females felt that science is enjoyable. On post-test data revealed that 51.2% males and 42.1% females were on the strongly agree and agree categories.

5.5 PUPILS' PERCEPTIONS OF THE LEARNING OF SCIENCE

Both pretest and post-test data in table 4.4 suggest that the learning of science by pupils is generally good. For example data from the statement "science is easy for me" indicated that 63.6% of pupils on pretest felt that science was easy for them. On post-test 71.4% of pupils perceived science as easy for them. Data from this statement also revealed that 25% of the pupils on pretest were in the neutral category and 20.4% of the pupils on post-test were on the neutral category. Furthermore, on this statement data suggested that 11.4% of the pupils on pretest felt that science is not easy for them and only 8.1% on post-test perceived science as difficult for them.

Pretest and post-test data from the statement "I enjoy doing science experiments" suggested that 82.9% of the pupils on pretest enjoy doing science experiments and on post-test 93.2% of the pupils feel that they enjoy doing science experiments.

Data from the statement "everyone should learn about science" indicated that on pretest 51.2% of the pupils felt that everyone should learn about science. On post-test 54.6% of the pupils felt everyone should learn about science. Furthermore, on this statement data revealed that 31.8% of the pupils on pretest felt that not all the pupils should do science. On post-test 29.5% of the pupils felt that science is not for everyone.

Pretest and post-test data from the statement "asking questions helps me understand science" suggest that 80.6% of the pupils on pretest felt that asking questions help them to understand science. On post-test 89.7% of the pupils felt that asking questions promote their better understanding of science. Furthermore, in this statement pretest data suggested that 10.3% of pupils of pupils felt that asking questions does not play a role in the understanding of science. On post-test data revealed that only 4.6% of the pupils felt that asking questions has no role to play in the understanding of science.

Data from the statement "things we learn in science can be used at home or in the community" suggested that on pretest a significant number of pupils (64.7%) felt that things they learn in science can be applied at home or in the community. On post-test 78.4% of the pupils were for the idea that things that they learn in science can be used at home or in the community. Furthermore, in this statement on pretest 23.9% of the pupils felt that things they learn in science is not useful neither at home or in the community. On post-test 10.2% of the pupils felt that there is no integration between what they learn in science and what they do at home or in the community.

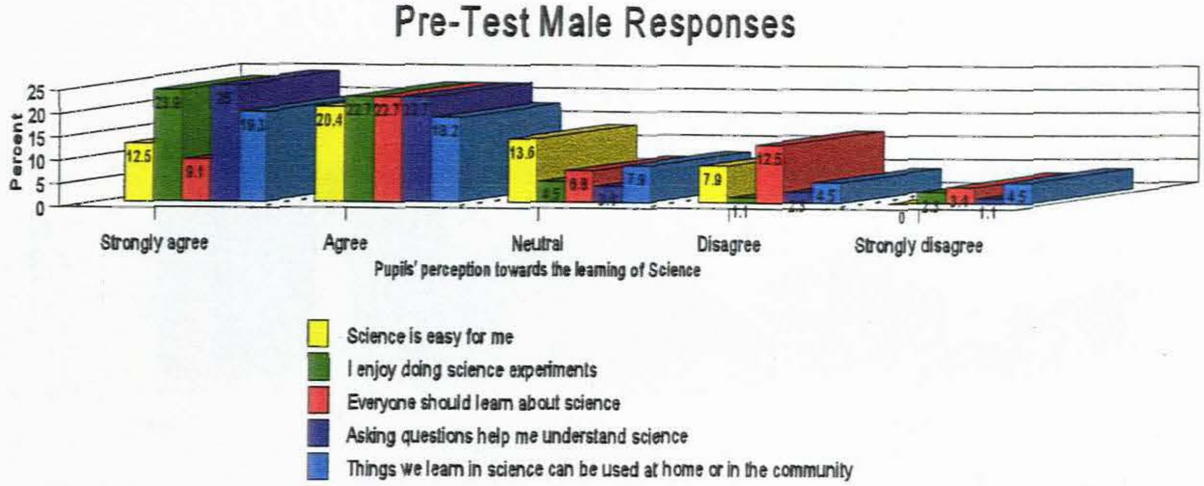
Table 5.8 INDICATION OF PUPILS' PERCEPTIONS OF THE LEARNING OF SCIENCE (N=88)

Pupils' perceptions of the learning of Science	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	%		%		%		%		%	
	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test
Science is easy for me	21.6	17.0	42.0	54.4	25.0	20.4	11.4	7.0	-	1.1
I enjoy doing science experiments	51.1	61.4	31.8	31.8	10.2	2.3	3.4	4.5	3.4	-
Everyone should learn about science	20.5	21.6	30.7	33.0	17.0	15.9	25.0	15.9	6.8	13.6
Asking questions help me understand science	45.4	53.4	35.2	36.3	9.1	5.7	8.0	2.3	2.3	2.3
Things we learn in science can be used at home or in the community	37.5	50.0	27.2	28.4	11.4	11.4	11.4	5.7	12.5	4.5

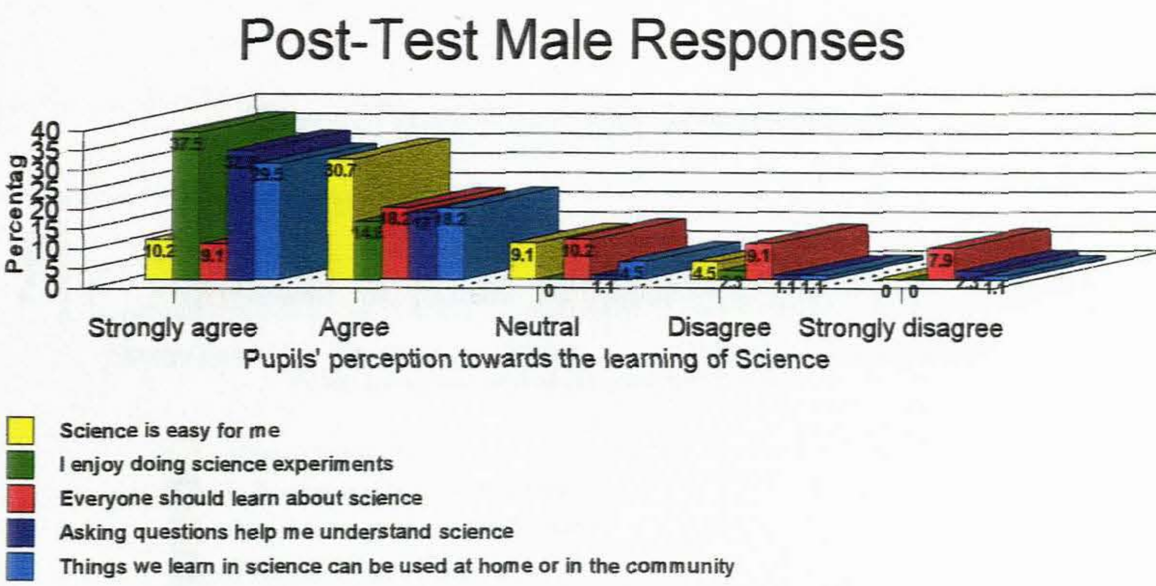
When comparing male and female responses, data indicated that pupils have good feelings of the learning of science. For example data generally indicate that males perceive the learning of science as good when they were compared to their female counterparts. Data from the statement "science is easy for me" revealed that on pretest 32.9% males and 30.7% females felt that science was easy for them.

On post-test 40.9% males and still 30.7% females felt there was no difficult in doing science. For further/more information refer to the graphics below.

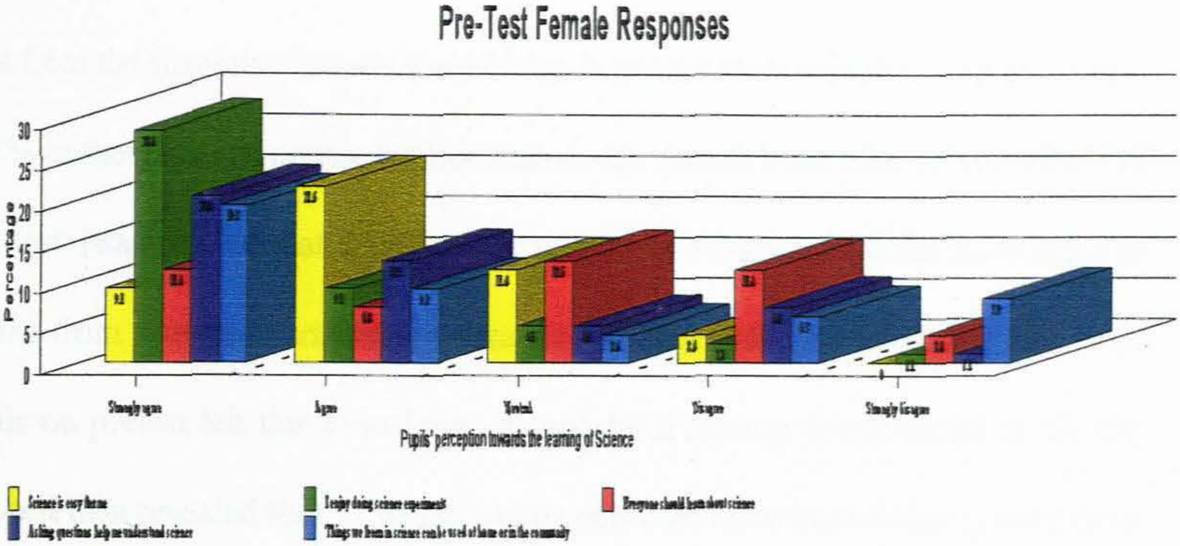
GRAPH 5.2(a) **INDICATION OF PUPILS' PERCEPTION OF THE LEARNING OF SCIENCE : N = 88**



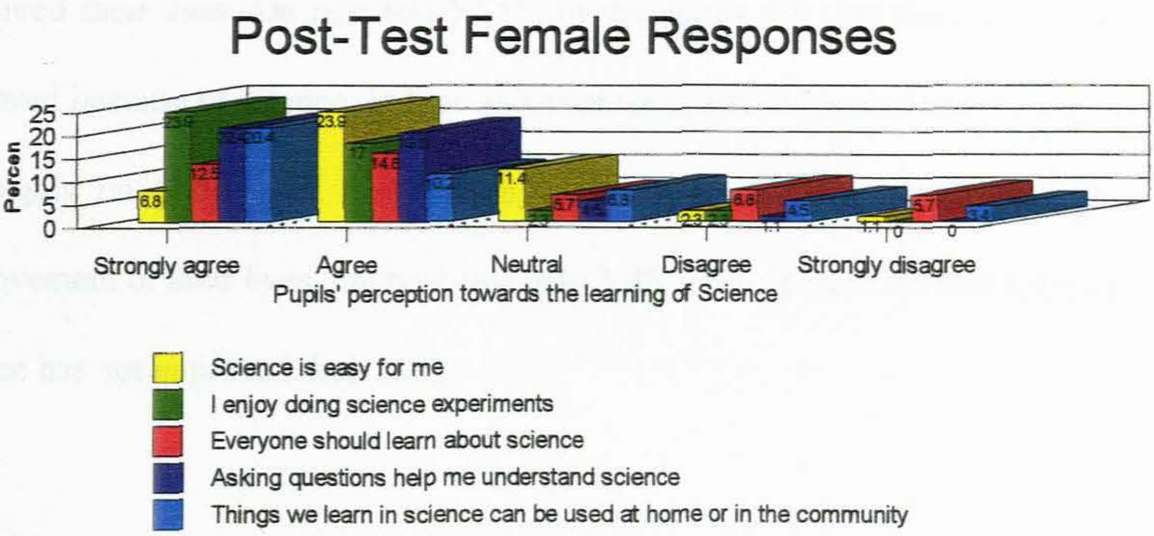
GRAPH 5.2(b) **INDICATION OF PUPILS' PERCEPTION OF THE LEARNING OF SCIENCE : N = 88**



GRAPH 5.2(c) **INDICATION OF PUPILS' PERCEPTION OF THE LEARNING OF SCIENCE : N = 88**



GRAPH 5.2(d) **INDICATION OF PUPILS' PERCEPTION OF THE LEARNING OF SCIENCE : N = 88**



5.6 PUPILS' PERCEPTIONS OF THE VALUE OF SCIENCE

Data from the statement "useful knowledge is gained from science" suggested that 69.2% of the pupils on pretest felt that knowledge gained from science is useful. On post-test data revealed that 84.1% of the pupils perceived that useful knowledge is gained from science. Furthermore data on this statement indicated that 21.7% of pupils on pretest felt that knowledge gained from science is not useful at all. On post-test data revealed that 11.4% of pupils perceived that knowledge gained from science is not useful.

Pretest and post-test data from the statement "learning science has improved my life" indicated that 77.5% of the pupils on pretest perceived that learning science has improved their lives. On post-test 87.5% of the pupils felt that their lives have improved because of science. Still on this statement data suggested that 10.2% of the pupils on pretest felt that learning science has nothing to do with the improvement of their lives. On post-test only 3.4% of the pupils felt that learning science has not improved their lives.

Data from the statement "most of what is learned will be useful in the future" indicated that 65.9% of the pupils on pretest felt that the majority of the information they have learned will be utilized in the future. On post-test 78.3% of pupils perceived that most of what they learned will be useful in the future. Data on this statement also revealed that 19.3% of pupils on pretest felt that not all what they learned will be useful in the future. On post-test data suggested that 8.1% of the pupils perceived that most of what they learned will not be useful in the future.

Information from the statement “knowledge gained from science helps in solving daily life problems” suggested the following: on pretest 52.2% of the pupils felt that knowledge gained from science plays a useful role in solving daily life problems. On post-test data indicated that 67% of pupils perceived that knowledge gained from science as useful in solving daily life problems. Furthermore on this statement data revealed the following, on pretest 27.3% of the pupils did not feel that knowledge gained from science helps in solving daily life problems. On post-test 9.1% of the pupils did not perceive that knowledge gained from science helps in solving daily life problems.

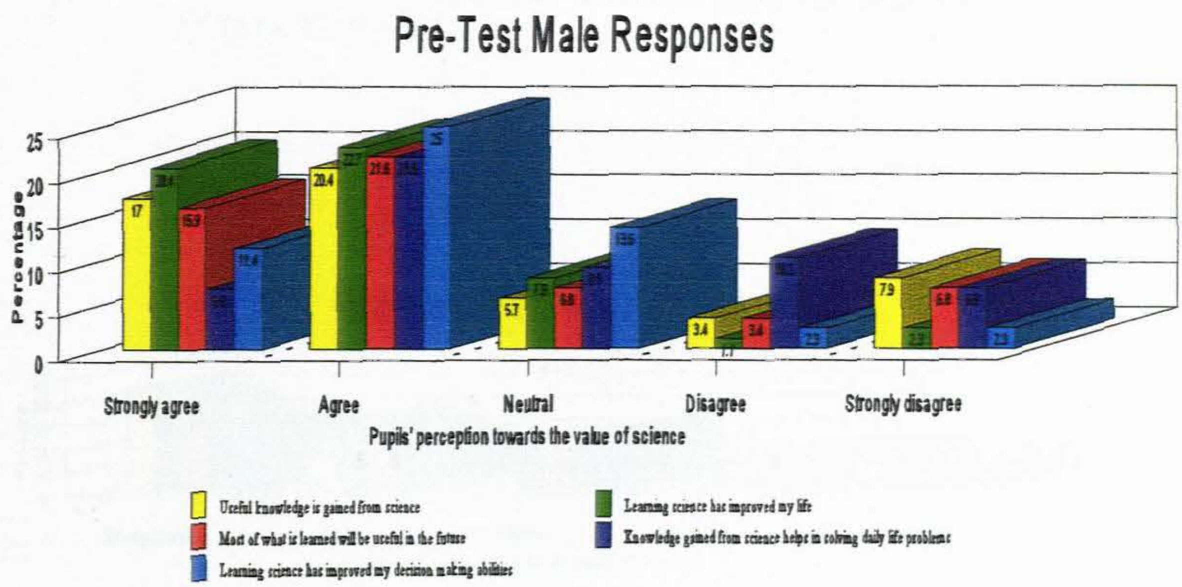
Pretest and post-test data from the statement “learning science has improved my decision making abilities” revealed that on pretest 56.8% of the pupils perceived that learning science improved their decision making abilities. On post-test 78.4% of the pupils felt that learning science improves their decision making abilities. Still on this statement data further suggested that 17.1% of the pupils on pretest felt that learning science does not improve their decision making abilities. Post-test data revealed that only 5.7% of the pupils did not perceive that learning science improve decision making abilities.

Table 5.9 INDICATION OF PUPILS' PERCEPTION OF THE VALUE OF SCIENCE (N=88)

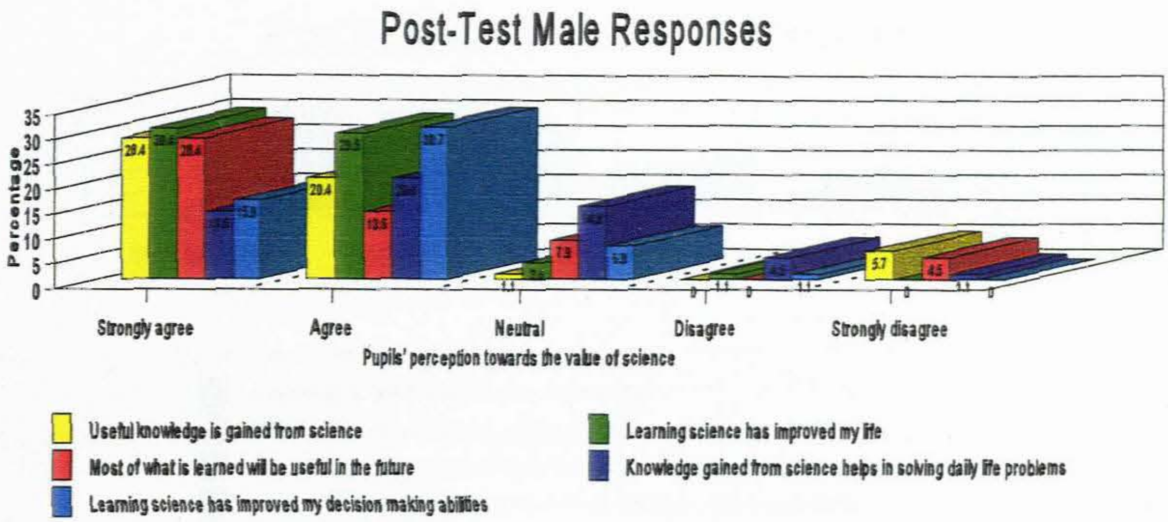
Pupils' perceptions toward the value of Science	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	%		%		%		%		%	
	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test
Useful knowledge is gained from science	38.6	47.7	30.6	36.4	9.1	4.5	5.7	2.3	16.0	9.1
Learning science has improved my life	39.8	35.2	37.5	52.3	12.5	9.1	5.7	2.3	4.5	1.1
Most of what is learned will be useful in the future	31.8	51.1	34.1	27.2	14.8	13.6	9.1	1.1	10.2	7.0
Knowledge gained from science helps in solving daily life problems	19.3	28.4	32.9	38.6	20.5	23.9	14.8	8.0	12.5	1.1
Learning science has improved my decision making abilities	23.9	31.8	32.9	46.6	26.1	15.9	9.1	5.7	8.0	-

Male and female responses of the pupils toward the value of science revealed the following: in general male pupils felt that science is more of value when compared to their female counterparts. For example, pretest and post-test data from the statement "useful knowledge is gained from science" revealed the following, on pretest 37.4% males and 31.8% females felt that knowledge gained from science is useful. On post-test 48.8% males and 35.2% females perceived that science knowledge is useful. For more information on male and female responses refer to the graphics below.

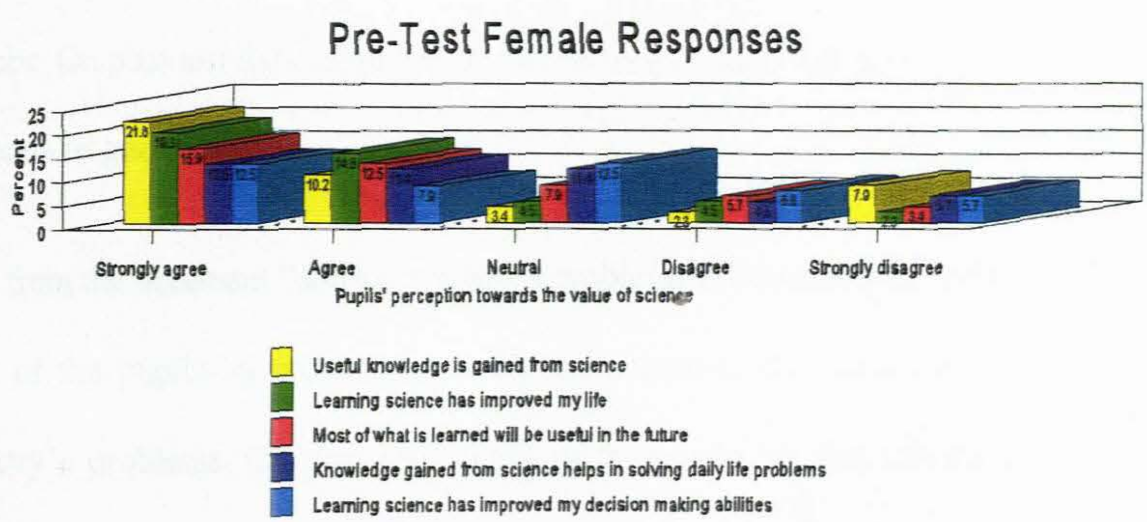
GRAPH 5.3 (a) INDICATION OF PUPILS' PERCEPTION OF THE VALUE OF SCIENCE : N = 88



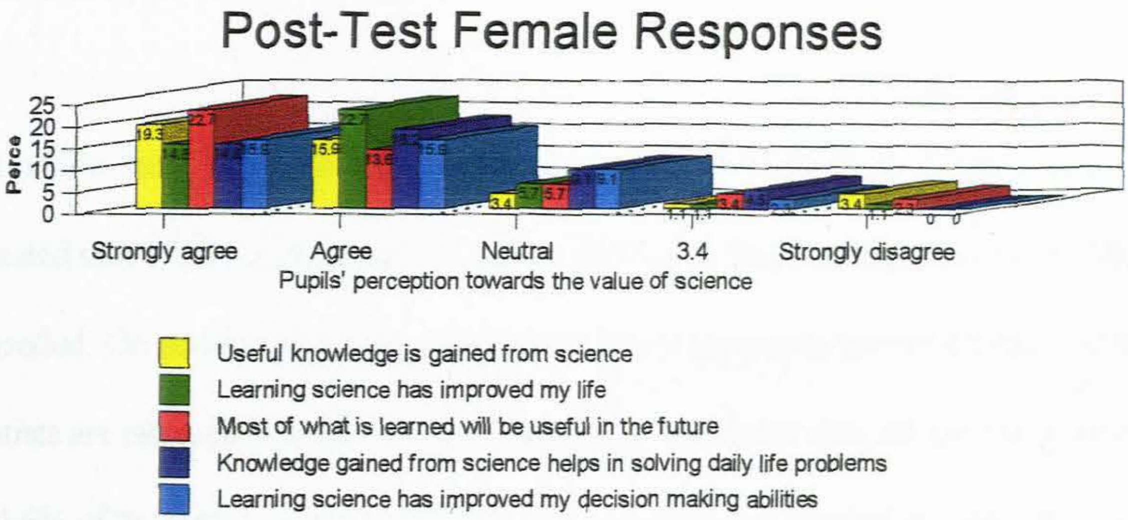
GRAPH 5.3 (b) INDICATION OF PUPILS' PERCEPTION OF THE VALUE OF SCIENCE : N = 88



GRAPH 5.3 (c) INDICATION OF PUPILS' PERCEPTION OF THE VALUE OF SCIENCE : N = 88



GRAPH 5.3 (d) INDICATION OF PUPILS' PERCEPTION OF THE VALUE OF SCIENCE : N = 88



5.7 PUPILS' PERCEPTIONS TOWARD SCIENCE CAREERS

Pretest and post-test data from the statement "success in science leads to good jobs" revealed that on pretest 95.4% of the pupils felt that success in science leads to good jobs. On post-test data suggested that all the respondents felt that success in science leads to good jobs.

Data from the statement "solving country's problems need scientists" indicated that 66% of the pupils on pretest perceived that scientists are needed in solving the country's problems. On post-test 79.6% of the pupils felt that solving country's problems need scientists. Furthermore on this statement data revealed that 17% of the pupils on pretest felt that country's problems do not need scientists. On post-test 5.6% of the pupils perceived that solving country's problems do not require scientists.

Information from the statement "more scientists are needed in South Africa" suggested that 87.5% of the pupils on pretest felt that in South Africa more scientists are needed. On post-test data indicated that 93.2% of the pupils perceived that more scientists are required in South Africa. Still on this statement data further suggested that 4.6% of the pupils on pretest felt that less scientists are needed in South Africa. And on post-test 3.4% of the pupils perceived that less scientists are required in South Africa.

Data from the statement "I would like a career which involves science" revealed that 72.8% of the pupils on pretest felt that they would like a career which is science oriented. On post-test 85.2% of the pupils perceived that a science oriented career was better for them. Data further indicated that 6.8% of the pupils on pretest did not like a career which involved science. On post-test 3.4% of the pupils perceived that they did not like a science oriented career.

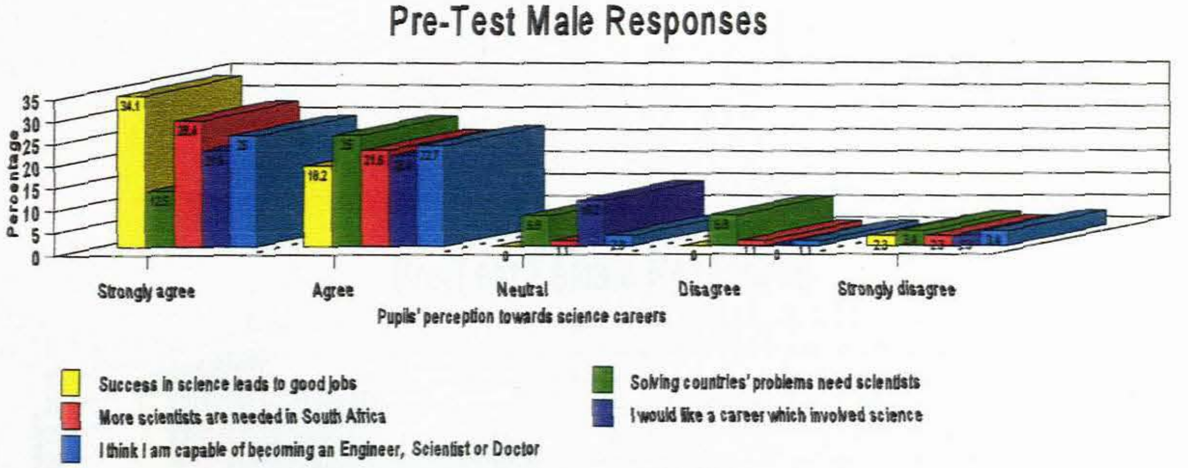
Pretest and post-test data from the statement "I think I am capable of becoming an engineer, scientist or doctor", revealed the following: on pretest 83% of the pupils felt that they were capable of becoming either engineers, scientists or doctors. 95.4% of the pupils on post-test perceived that they could become either engineers, scientists or doctors. Furthermore on this statement data suggested that 7.9% of the pupils on pretest felt that they were not capable of becoming either engineers, scientists nor doctors. On post-test data revealed that only 2.3% of the pupils perceived that they were not capable of becoming either engineers, scientists or doctors.

Table 5.10 INDICATION OF PUPILS' PERCEPTIONS OF SCIENCE CAREERS (N=88)

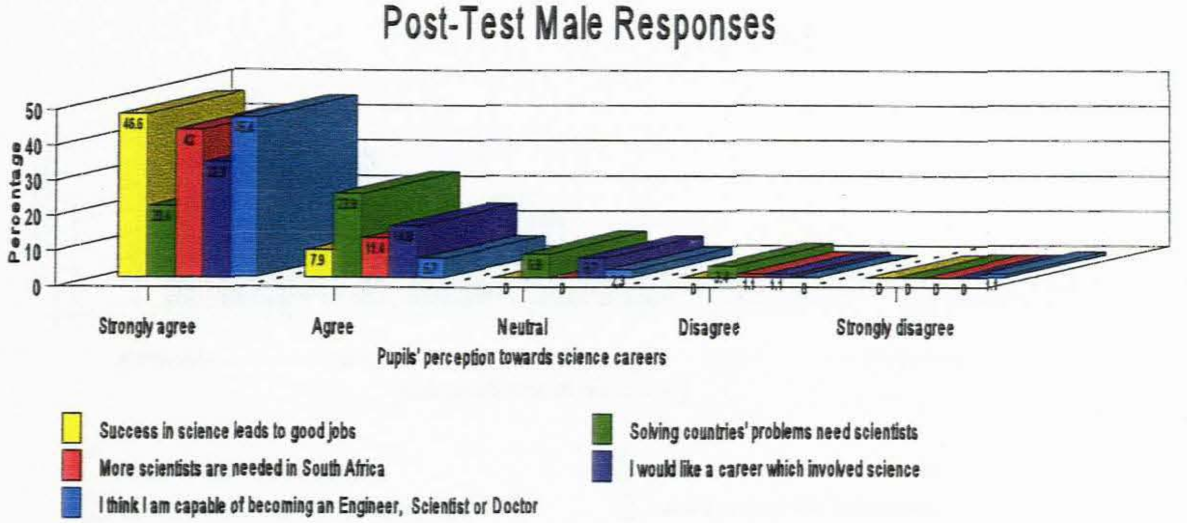
Pupils' perception toward Science careers	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	%		%		%		%		%	
	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test	pretest	post-test
Success in science leads to good jobs	67.0	86.4	28.4	13.6	2.3	-	-	-	2.3	-
solving country's problems need scientists	25.0	39.8	41.0	39.8	17.0	14.8	12.5	4.5	4.5	1.1
more scientists are needed in South Africa	55.7	71.6	31.8	21.6	7.9	3.4	2.3	2.3	2.3	1.1
I would like a career which involves science	36.4	51.1	36.4	34.1	20.4	11.4	3.4	3.4	3.4	-
I think I am capable of becoming an engineer, scientist or doctor	50.0	73.8	33.0	21.6	9.1	2.3	3.4	-	4.5	2.3

When male and female responses were compared on pupils' perceptions toward science careers data revealed the following: for example, on the statement "success in science leads to good jobs", on pretest 52.3% males and 43.1% females felt that success in science leads to good jobs. On post-test data suggested that 54.2% males and 45.5% females perceived that success in science leads to good jobs. For additional information on male and female responses refer to the graphics below.

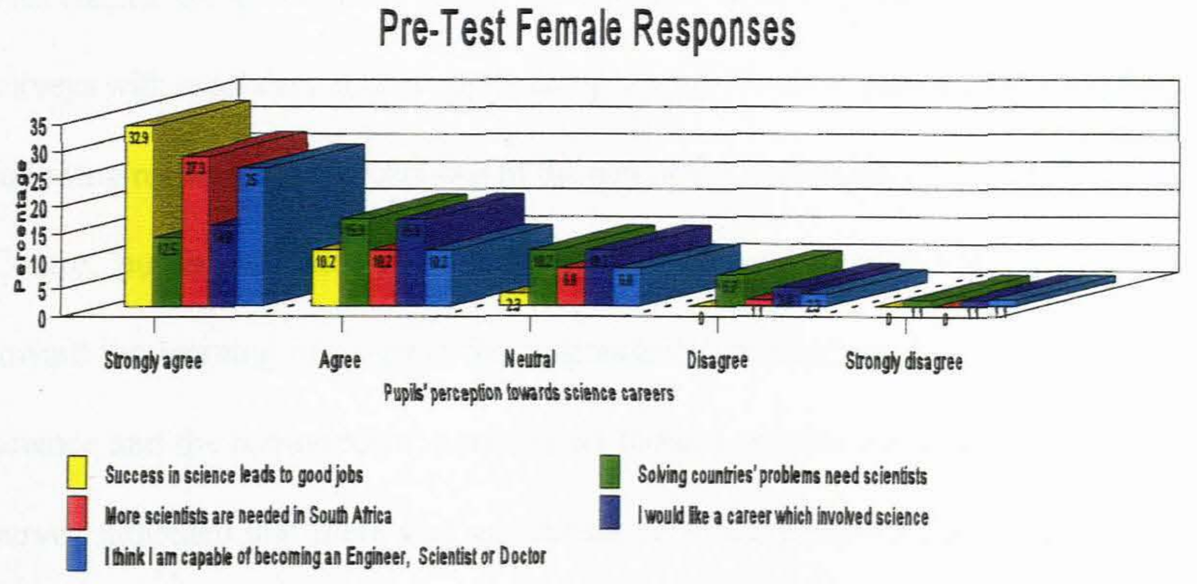
GRAPH 5.4 (a) **INDICATION OF PUPILS' PERCEPTION OF SCIENCE CAREERS : N = 88**



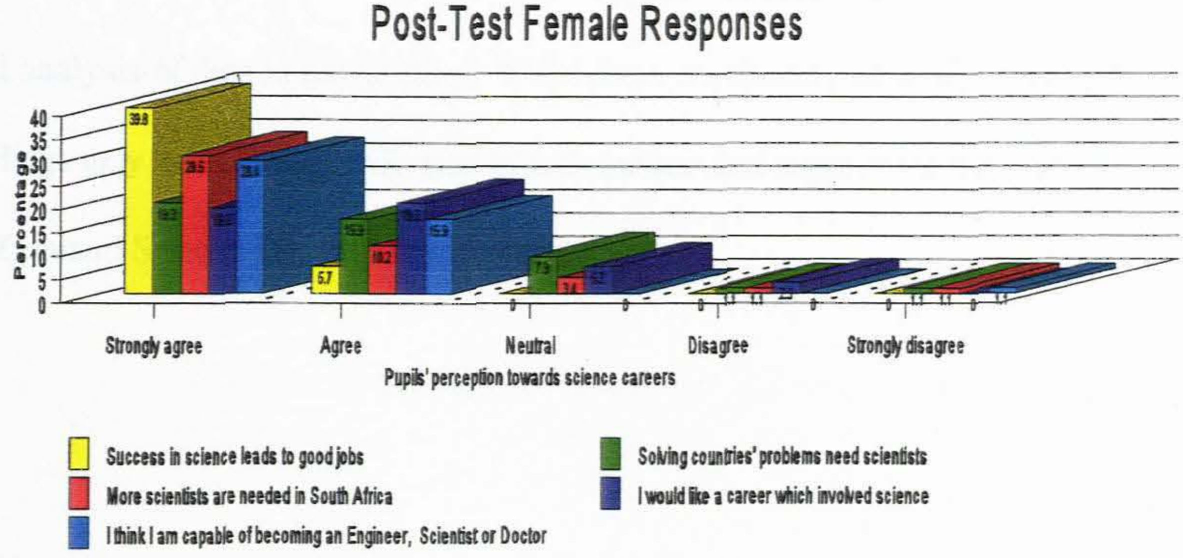
GRAPH 5.4 (b) **INDICATION OF PUPILS' PERCEPTION OF SCIENCE CAREERS : N = 88**



GRAPH 5.4 (c) **INDICATION OF PUPILS' PERCEPTION OF SCIENCE CAREERS : N = 88**



GRAPH 5.4 (d) INDICATION OF PUPILS' PERCEPTION OF SCIENCE CAREERS : N = 88



5.8 CONCLUSION

This chapter has attempted to give a presentation of data which were collected via surveys with secondary school pupils doing science. Several questions examined the following respondents' perceptions of the aim of the University of Zululand Science Centre; pupils' attitudes or feelings toward science; respondents' perceptions toward the learning of science; the respondents' perceptions toward the value of science and the respondents' perceptions toward science careers. Data from this survey indicated that there was agreement on most questions investigated in this study, both pretest and post-test questions. Results indicate that the majority of pupils have positive attitude toward science.

The interpretational explanations in the next chapter will help place the presentation and analysis of data in perspective. While there are limitations in this survey, the findings may provide an initial fund of information and support for the University of Zululand Science Development Centre.

CHAPTER SIX

ANALYSIS AND INTERPRETATION OF DATA

6.1 INTRODUCTION

The data presentation and the discussion in the previous chapter provide a framework for analysis and interpretation about the impact of the University of Zululand Science Development Centre on pupils' perception of science. The discussion in this chapter is closely related to the research objectives and the pertinent question this investigations set out to answer.

This study examined the impact of the University of Zululand Science Development Centre in the area which stretches from the Tugela River in the south to Kosi Bay in the north, and in-land as far as Nongoma. The study further attempted to determine pupils' knowledge about the Science Development Centre and its activities.

For purpose of clearer understanding of the issues to be interpreted the researcher has grouped them into five sections for discussions. The sections are as follows:-

A. The first section sought to find out the following: how knowledgeable the pupils were about the University of Zululand Science Development Centre i.e. Its role and general activities.

B. The second section discusses the pupil's attitudes or feelings toward science.

C. The third section deals with the pupil's perception toward the learning of science.

D. The fourth section discusses the pupil's perception toward the value of science.

E. The fifth and the last section deals with pupil's perception toward science careers.

6.2 THE RESPONDENT CHARACTERISTICS

Out of the three types of sampled schools, 37.5% of the respondents were from rural background, 19.3% were from peri-urban and 43.2% were from urban background. When the schools were visited after a month of their visit to the science centre the following was observed, the schools from rural background were lacking facilities such as apparatus, laboratories and electricity. What was also noticed from such schools was that during class sessions no pupils were seen loitering up and down or found making noise in class neither in the presence no absence of a teacher. Peri-urban schools had electricity and laboratories but without adequate apparatus, it was also noticed that some of the school buildings were neglected and ruined. Urban schools had electricity and with enough apparatus in their laboratories, but what was noticed was that when classes were in session you would see students moving to and from, making noise in classes in the presence of teachers.

6.3 THE ROLE OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE

Pretest and post-test results from the question which concerns the aim of the University of Zululand Science Development Centre indicated the following: 75% of the pupils on pretest feel that the aim of the University of Zululand Science Development Centre is to equip them with relevant knowledge and skills, whereas on post-test 84% of the pupils were for this idea. These percentages indicate a 9% increase from the pre-test data and this may be due to the following: students may have acquired information from their teachers before going to the science centre because the science centre usually run workshops on the science syllabus for secondary school teachers, or they got the information on their visit to the Science Centre.

Still on this question of the aim of the University of Zululand Science Development

Centre, 17% of pupils on pretest felt that the science centre offers guidance related to careers whereas on post-test 9% of the pupils feel that there is career related guidance offered by the science centre. Post-test data indicate 8% decrease from the pretest data and this decrease may be due to the fact that: before going to the science centre students may have come across information that there is career guidance in the science centre. This information could have been obtained from the science centre either from their teachers or other pupils who have gone to the science centre. They realised that career guidance information was inadequate.

Another point worth mentioning on the first question of this section is that 6% of the pupils on pretest were for the idea that the science centre aims at increasing the number of pupils in science and their pass rate, on post-test 7% of the pupils felt that the aim of the science centre is to increase the number of pupils in science and their pass rate. This indicates a 1% increase on post-test from the pretest data this may be related to the following reasons: their teachers on motivating them to go to the Science Centre kept on saying "if you want to pass science you have to go to the Science Centre", and another reason may be the science centre itself that is the information they received from the science centre facilitators. However, this one percent increase is too low and it might indicate that learners do not perceive this as the aim of the Science Centre.

Results from the second question of this section which addresses what the students hope to gain or learn by visiting the centre indicated that 84% on pretest hoped to gain or learn more knowledge and practical skills, on post-test 88% were for this idea this indicate a 4% increase on post-test from the pretest data which may be due to the reason mentioned in the first paragraph. On the second question of this section; on pretest 12% of the pupils hoped to gain career related guidance, however on post-test 8% of the pupils gained career related guidance or information. It is noticed that there is 4% decrease on post-test from pretest data and this may be due to the reasons outline in paragraphed three.

Pretest and post-test data showed that on the question of "What else would you like to learn about in this centre?" Respondents had the following responses; i) 52% of the respondents on pretest wished to learn more about practical skills and knowledge while on post-test 56% of the pupils perceived that practical skills and knowledge were also accommodated. This suggested a 4% increase on post-test from the pretest data, of which the reason for it is similar to those outlined on paragraph one of this section. ii) attending to the second response to the question "what else would you like to learn about in this centre?" 9% of the pupils on pretest perceived there is a need to learn about the other science oriented subjects in the centre (such as Biology, Maths, Agriculture and Geography). On post-test 15% of the pupils felt that other subjects too should be catered for in the centre. This 6% increase from the pre-test to post-test data suggested that students encounter a lot of difficulty when doing these subjects at school, however when they visited the science centre nothing is done concerning these subjects. iii) when addressing the third response to this question, 30% on pretest felt like learning about career guidance. On post-test 28% of the pupils felt that learning about career guidance was essential.

Pretest and post-test results from the question "should there be more or less centres like this one?" Responses were as follows:- on pretest 65% of the pupils felt more centres like this should be constructed, on post-test 78% of the pupils were for the idea that more centres are necessary. This indicate a 13% increase from pretest to post-test data which may be due to the following reasons:- an increase in the pass rate and practical skills of the students who have previously visited the science centre, or due to the information transmitted to them by their teachers who have visited the centre which puts it clearly how essential this centre is or it may be due to the experience that they have gained from their science centre visit. Attending to the second response of this question 8% of the pupils on pretest felt that there is no need to construct more centres, however on post-test 5% of the pupils felt less centres should be constructed and that indicate a 3% decrease from pretest to post-test results. This can be due to the following:- their visit to the Science Centre, whereby they were shown some video materials which played a role in alerting them the importance of a centre like this.

6.4 PUPILS ATTITUDES OR FEELINGS TOWARD SCIENCE

The analysis of pretest and post-test data on the statement "science is enjoyable" indicated that more than 80% of the pupils agreed to this statement and only 2.2% of the pupils disagreed to this statement on pretest. On post-test over 90% of the pupils felt science is enjoyable and only 1.1% felt that science was not enjoyable. The above mentioned results suggested that there was a 10% increase from pretest to post-test data for the students who agreed to this statement. A possible motivating factor for that might be that upon their visit to the science centre they then felt that science was more enjoyable than they have perceived it to be before visiting the science centre. This was due to the fact that upon their visit to the science centre they were shown video materials which were to improve their interest or arouse their interest on science. On top of that they were also allowed to play with any exhibit which is found within the Science Centre.

Pretest and post-test results from the statement "science is fun" suggested the following:- on pretest 43.1% of the pupils felt there is fun in science this figure indicated that 46.9% of the pupils felt there is no fun in science. This may be due to the fact that most of the schools sampled lacked laboratory facilities which may provide a hands on experience in science more especially the rural and peri-urban schools, urban schools being an exception to this. The post-test data showed that over 60% of the pupils felt there is fun in science possible motivating factor for this may be their visit to the science centre whereby they were allowed to play with whatever exhibit that they come across within the Centre.

Pretest and post-test data from the statement "science make me feel curious" suggested the following:- on pretest 61.4% of the students felt that science does promote their curiosity this may be due to their past experience. On post-test 70.4% of the pupils felt that science makes them feel curious this may also be due to the pupils experiences before going to the centre or due to the experiences from their visit to the Centre.

Data regarding the negative statement "I have bad feelings toward science" indicated that on pretest 8% of the students had bad feelings toward science and on post-test only 5.7% of the pupils had bad feelings toward science, furthermore on this statement pretest data indicate that 77.2% of the pupils had good feelings toward science and on post-test 82.9% of the pupils had good feelings toward science. The above mentioned results indicated a 3% decrease from pretest to post-test on the students who had bad feelings toward science and 6% increase from pretest to post-test of the pupils who had good feelings toward science. This 3% decrease on students who had bad feelings toward science (on post-test) and a 6% increase on the students who had good feelings (on post-test) may be associated to the following:- their visit to the Science Centre may have changed the bad feelings that they had toward science.

The analysis of data from the statement "I listen or read news about science" indicated that more than 70% of the pupils on pretest do listen or read news about science and on post-test over 80% of the pupils listen or read news about science and the possible reasons for this may be that almost every household even on rural background does have a radio from which they can receive information about science (education programmes) or it may be from television broadcast on educational issues mainly for those pupils from urban background. Another point worth mentioning from this statement is that on pretest 13.7% of the pupils never bothered themselves to listen or read news about science, however on post-test only 5.6% of the pupils never worried themselves about listening or reading news about science and this indicate 8% decrease from pretest to post-test which may be attributed to the fact that after their visit to the Science Centre they may have been stimulated to acquire more information concerning science either from radios, televisions and newspapers.

6.5 PUPILS' PERCEPTION OF THE LEARNING OF SCIENCE

Another objective in this section attempted to establish the feeling of pupils toward the learning of science. Results showed that for the statement "science is easy for me" over 60% of the pupils on pretest felt science was easy for them. On post-test results suggested that over 70% of the pupils felt science was easy for them. This might be attributed to teachers who may have changed their methods of teaching which may cause science to be seen by pupils to be difficult and they were now using methods which promote learners involvement and full participation in discovering things on their own. This change on the methods of teaching may be associated with the Science Centre which conducts a number of workshops to science teachers, thus helping them to teach effectively and easily. Another motivating factor for this might be due to their visit to the Science Centre. After which they then perceived science as an easy subject for them.

Pretest and post-test results from the statement "I enjoy doing science experiments" suggested that 82.9% of the pupils on the pretest enjoyed doing science experiments. On post-test 93.2% of the pupils enjoyed doing science experiments. Although schools from rural background had limited experimental resources, a fundamental interpretation emerging from the above results is that pupils do enjoy doing science experiments.

Analysis of the results from the statement "everyone should learn about science" indicated that on pretest 51.2% of the pupils perceived that everyone should learn about science, and on post-test 54.6% of the pupils felt everyone should learn about science furthermore on this statement a significant number on both pretest (31.8%) and post-test (29.5%) indicated that science is not for everyone. This might be due to their experiences they have encountered when doing science. A fundamental point arising from the above results is that not everyone can afford to do science.

Analysis of data from the statement "asking questions helps me understand science" suggested that 80.6% of the pupils on pretest felt that asking questions help them to understand science. On post-test 89.7% of the pupils felt asking questions helped them in their understanding of science. Furthermore on this statement pretest results suggest that 10.3% of pupils felt that asking questions did not improve their understanding of science and 4.6% of the pupils on post-test. The overall interpretation of the results reveals that asking question helps students to understand science more easily.

Results from the statement "things we learn in science can be used at home or in the community" suggested that on pretest a significant number of pupils (64.7%) felt that things they learn in science can be used at home or in the community. On post-test 78.4% of the pupils were also for this idea that science can either be applied at home or community situations. Still on the results of this statement on pretest 23.9% of the pupils felt that things they learn in science were not useful neither at home or in the community and on post-test 10.2% of the pupils felt there is no integration between what they learn in the science and what they do at home or in the community. The results in this investigation showed that most of the pupils (64.7%) even before visiting the centre were able to apply knowledge they have gained in science either at home or in the community. After visiting the science centre, their application of knowledge they have gained from science to situations at home or in the community showed an improvement (14%).

6.6 PUPILS PERCEPTION OF THE VALUE OF SCIENCE

The analysis of data on the pupils perception toward the value of science indicated the following:- the results from the statement "useful knowledge is gained from science" suggested that 69.2% of the pupils on pretest felt that knowledge gained from science is useful. This may be due to the pupils past experiences whereby they encountered situation which warranted the application of science knowledge to daily life situation e.g. fixing radios, televisions, electricity etc. Another possible reason maybe that its because we are living in a technological world whereby science knowledge has to inform technology. On post-test results indicated that 84.1% of the pupils felt that useful knowledge is gained from science this indicate 15% increase from pretest (69.2%). This increase might suggest that their visit to the science centre was successful at showing pupils that knowledge gained from science is useful. A fundamental interpretation that emerges from the above results is that knowledge that is gained from science can be used in a number of ways.

Results from the statement "learning science has improved my life" suggested that 77.5% of the pupils on pretest felt that learning science has improved their lives. On post-test 87.5% of the pupils felt that their lives have improved because of science. This suggested a 10% increase from pretest (77.5%) which may be associated to their Science Centre visit whereby they observed a number of exhibits indicating that science knowledge can improve ones life in a number of ways e.g. the use of electricity as a source of light and energy.

Pretest and post-test data from the statement "learning science has improved my decision making ability" showed that 56.8% of the pupils on pretest felt that learning science has improved their decision making abilities. On post-test (78.4%) there was 21.6% increase from pretest and a possible reason may be attributed to the science centre whereby they were encouraged to be fast intuitive and independent on their thinking which may thus influence their decision making abilities. They were encouraged to be fast when doing things through demonstrations which were given to them by the Science Centre staff.

Overall results on this category suggest that pupils have positive perception toward the value of science and the Science Centre played a significant role in this state of affairs.

6.7 PUPILS PERCEPTION OF SCIENCE CAREERS

The results from the statement "sucsess in science leads to good jobs" revealed that on pretest 95.4% of the pupils felt that success in science may lead to good jobs. On post-test the results indicated that all of the subjects(100%) felt that success in science does lead to good jobs. Post-test (100%) results indicated a 4.6% increase from pretest results. Pretest results suggested that pupils did know that if they succeed in science they stand a good chance of occupying good positions and this may be due to something they have observed happening that is, seeing their brothers and sisters who were successful in science occupying better positions in life or they may have read it on newspaper, heard or viewed it either on televisions or radios. The 4.6% increase may be associated to their Science Centre visit because of some video material which were shown to them, that indicated that success in science may lead to good jobs.

Pretest and post-test results from the statement "solving country's problems need scientists" suggested that 66% of the pupils on pretest felt that solving country's problems need scientists and on post-test 79.6% of the pupils agreed to this statement. This 13.6% increase from pretest to post-test may be associated to the following: pupils may have observed that a number of problems in any country requires scientists e.g. health problems like aids required medical practitioners who are scientist.

The analysis of data from the statement "more scientists are needed in South Africa" revealed that 87% of the pupils on pretest did feel that South Africa needed more scientist and on post-test 93% of the pupils agreed to the statement that more scientists are needed in South Africa. A fundamental interpretation resulting from the above results is that South Africa needs more scientists, for example the health ministry was forced to employ Cuban doctors because of the shortage of medical practitioners in Republic of South Africa.

Results from the statement "I would like a career which involves science" suggested that 72.8% of the pupils on pretest felt they would like a career which involves science and on post-test 85.2% of the pupils agreed to the above statement. Interpretation from the above results indicates that the majority of the students would like to pursue science related careers, this may be associated with the fact that science may lead to good jobs and also with the fact that our country requires more scientists to solve our problems.

Analysis of the results from the statement "I think I am capable of becoming an engineer, scientist or doctor" indicated that on pretest 83% of the pupils they are capable of becoming engineers, scientist or doctors and 95.4% of the pupils on post-test agreed to the above statement. These result indicated that pupils feel that if given opportunities they are capable of becoming scientists.

6.8 CONCLUSION

The overall interpretation of the results in this investigation suggest that in general pupils have good feelings toward science. The results further suggest that science is not a subject to be done by everyone. In addition to the above results it is also suggested that pupils feel that science is useful in life in a number of ways. Another point worth mentioning is that science is always related by pupils to good jobs. These results do indicate that The Science Centre plays a role concerning pupils perception of science, however there are some areas where it should pay more attention to, like careers in science.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

The most important question raised in this study was to evaluate the impact of the University of Zululand Science Development Centre in stimulating an interest in and awareness of science and technology amongst secondary school pupils in the area stretching from the Tugela river in the South to Kosi Bay in the north and inland as far as Nongoma. The major aim of the study was to determine the extent to which the University of Zululand Science Development Centre help to change or improve the perceptions held by pupils about science.

The more specific objectives of the study were to:

a. Investigate the perceptions of science held by pupils who visited the University of Zululand Science Development Centre.

b. Determine whether specific difficulties or problems experienced by pupils in studying science were solved after attending the University of Zululand Science Development Centre.

c. Determine whether the University of Zululand Science Development Centre

- helped to create a positive attitude toward science and its related careers.

In the previous chapter these objectives were categorised into groups of five and a comprehensive commentary or interpretation was given. Methodologically, objectives (a) to (c) were addressed through the use of the questionnaire. This chapter considers some of the main findings of this study and the related implications. The findings and implications are presented concurrently. The chapter ends with recommendations.

7.2 MODE OF INQUIRY

The evaluative research methodology was used as the mode of inquiry in this study. This mode of inquiry was valuable in evaluating the impact of the University of Zululand Science Development Centre on stimulating interest in and awareness of science amongst secondary school pupils. The survey instrument used for collecting data regarding pupils' perception toward science created much interest among respondents. Since the researcher visited all sampled secondary schools in order to administer the questionnaire, it was possible to clarify the intentions behind the research, to answer specific and general questions as well as to observe the area in which the school is situated. The respondents regarded their participation as valuable and co-operated fully without fear that their work was being assessed. This relaxed attitude of the respondents has in some way increased the level of reliability of this inquiry.

7.3 SUMMARY OF CONCEPTUAL AND THEORETICAL ISSUES

A summary of the most pertinent issues that emerged from the literature reviewed for this study is presented below. Among the issues emerging from this study is the present crisis in education in South Africa, particularly the crisis in science education, i.e. very limited number of people furthering their studies in science. Part of this crisis in science education concerns the perception of science by individual pupils. Most of the issues that emerge from this study, therefore, are concerned with the factors that may determine attitudes of pupils toward science (CH. 3:14-18).

The literary sources indicate that learner' past experience can largely contribute to the way in which pupils perceive of science. Outcome Based Education suggests that curriculum development, especially the development of learning programmes and materials should put learners first, recognising and building on their knowledge and experience, and responding to their needs (recognition of prior learning). Another major issue that emerges from the review of sources is the relevance of learner's interest in science to how they will perceive science. Literature reveals that if learners have an interest in science that will promote a positive attitude toward science and if the learner has no interest in science he/she will display negative attitudes toward science.

Another issue emerging from the review of sources is that gender roles do play a role toward pupil's perception of science. Literature indicates that boys are more interested in science than girls, that is, girls never show a lot of interest in science thus we find more boys than girls succeeding in science (CH. 3:18-20).

7.4 MAIN FINDINGS AND IMPLICATIONS

The main findings of this inquiry are categorised into six groups. The first category deals with the characteristics of the respondents. The second category deals with the aim and the activities of the University of Zululand Science Development Centre. The third category concerns the pupils' attitudes or feelings toward science. The fourth category concerns the pupils' perception toward the learning of science. The fifth section deals with the pupils' perception toward the value of science. The last category deals with pupils' perception toward the value of science. The last category deals with pupils' perception toward science careers.

7.4.1 THE RESPONDENT CHARACTERISTICS

Findings in this sub-section indicated that secondary school pupils from rural schools were dedicated to their work but were not sufficiently exposed to fully equipped laboratory facilities. On the other hand secondary school pupils from urban school were not dedicated to their work inspite of sufficient exposure to fully equipped laboratories.

The implication of these findings is that poor performance in science by secondary school pupils from rural schools can be directly attributed to the lack of laboratory facilities (apparatus, electricity and laboratories). On the other hand poor achievement by secondary school pupils from urban schools can be directly associated to the lack of discipline on their part, as has been explained in the previous chapter.

7.4.2 THE AIM AND THE ROLE OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE

Findings in this sub-section come from the response of pupils to questions on the aim of the University of Zululand Science Development Centre and its general activities.

7.4.2.1 AIM OF THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE

One of the aims of this study was to investigate whether secondary school pupils knew the aim of the University of Zululand Science Development Centre before and after their visit to the Science Development Centre. The findings showed that pupils (majority) knew the aim of the University of Zululand Science Development Centre and the information they had was improved after their visit to the Science Development Centre. Another finding worth mentioning is that pupils expected some sort of career guidance within the centre but to their surprise it was not adequate.

The implications of the above findings suggested that the Science Development Programme did play a role in letting students aware of its aims, but however there is still room for improvement because some students although in minority were still lost as to what is the aim of the Science Development Centre. Another implication emanating from the above findings is that the Science Development Centre is not doing enough on career guidance, pupils were still not satisfied after their Science Development Centre visit.

7.4.2.2 WHAT STUDENTS HOPE TO GAIN OR LEARN BY VISITING THE SCIENCE CENTRE

The main findings indicated that the majority of students hoped to gain practical knowledge and skills, and on the other hand they expected to gain career guidance information. In general students did gain practical knowledge and skills as they hoped, but did not receive enough information on career guidance. Another finding is that pupils expected to learn other subjects which were not at all attended to on their visit to the Science Centre.

Consequently it can be stated that the Science Centre is giving enough practical knowledge and skills to pupils, but career guidance information is very minimal and that the Science Development Centre concentrate only on Physical Science more especially the Physics part and other subjects are not given attention.

7.4.2.3 SHOULD THERE BE MORE OR LESS SCIENCE CENTRES

The main findings from this section indicated that more than half of the pupils prior to their Science Centre visit felt that more Science Centres should be constructed and after their visit to the Science Centre results show that the majority of the pupils (over 10% increase from pretest) were of the opinion that more science centres must be constructed or established.

This implied that the Science Centre did play a role in making students feel that the Science Development Centre is of importance, however, not all the students did see the need of establishing more centres and this leaves room for improvement by the University of Zululand Science Development Centre.

7.4.3 PUPILS' ATTITUDES OR FEELINGS TOWARD SCIENCE

In general the summary of both pretest and post-test results from the five statements that pupils were to respond to indicated that the majority of the pupils have good/positive attitudes/feelings toward science. An important additional finding is that pupils are not given enough time to play or have fun with the science equipments. Another finding is that pupils at school are not encouraged to read general news about science.

The implications of these findings are that science centre visits by the pupils did play a role in promoting more positive or good attitudes toward science to the secondary school pupils. Another implication is that teachers do not allow pupils free access to science equipment, that is, pupils are not allowed to have fun with science equipments they have available. In case of schools from rural background the reason might be that they do not have science laboratories and even if they have them they are not fully equipped. The findings also showed that at school there is no time given to pupils for collecting general information on science from either newspapers or books in the library or it may be that libraries do not have such information.

7.4.4 PUPILS' PERCEPTIONS OF THE LEARNING OF SCIENCE

The findings showed that in general pupils are comfortable with the way they learn science. Another point worth mentioning is that pupils are somehow struggling to integrate theory into practice, that is, what they learn at school is not readily applied to home or community situations.

The implication of these findings showed that not all what pupils learn at school can be easily applied to home or community situations, i.e. some theoretical materials that they cover within their syllabi is not readily applied to normal life situations.

7.4.5 PUPILS' PERCEPTIONS OF THE VALUE OF SCIENCE

In general it can be concluded from the findings of this study that science centre visits by secondary school pupils played an important role in that the perceptions they had toward the value of science prior to their visit to the science centre were improved. Furthermore, results of this investigation show that although the majority of the pupils had good perceptions toward the value of science, some pupils (minority) do have problems concerning the usefulness of science knowledge in the future and in solving daily problems.

The implications of the above findings suggested that the University of Zululand Science Development Centre is successful in improving positive perceptions pupils have toward the value of science. However, what remains a challenge is that pupils are struggling to apply science knowledge to future and daily life situations or problems.

7.4.6 PUPILS' PERCEPTIONS OF SCIENCE CAREERS

In general, the results indicated that pupils have good perceptions toward science careers even prior to their visit to the Science Development Centre. Furthermore, findings in this section suggest a minimal role played by the Science Development Centre on the improvement of pupils' perceptions toward science careers.

The implications arising from these findings are that little is done by the Science Centre on promoting positive perceptions toward science careers by the pupils. The results further suggested that pupils acquired information from somewhere else which play a role in promoting good feelings toward science careers and this information might be from their past experiences or observations. The previous section in this chapter on the aim and the activities of the Science Development Centre further suggested the minimal role played by the Science Development Centre on providing career guidance information.

7.5 RECOMMENDATIONS

Many recommendations given in this section emanate from the research findings and associated implications discussed in the previous sections of this chapter. For better comprehension the recommendations are subdivided into two categories. The first category relates to those recommendations which serve to assist the University of Zululand Science Development Centre on the following; What to do? What to accentuate more and what to leave out, if any? The second category presents recommendations which make an appeal for further investigation in the field of Science Education and Physical Science Education in particular.

7.5.1 NEWS LETTER BY THE UNIVERSITY OF ZULULAND SCIENCE DEVELOPMENT CENTRE

Emanating from the fore-going discussions, it is recommended that a detailed news letter by the University of Zululand Science Development Centre should be developed so that information on the aim and general activities of the University of Zululand Science Development Centre be easily disseminated to a number of people. This recommendation is important because it has been observed that University of Zululand Science Development Centre tends to lack popularity to its target groups (both teachers and pupils). This was shown by the inconsistency of the schools which were visiting the University of Zululand Science Development Centre during the data gathering period. Some schools booked to visit the Univeristy of Zululand Science Development Centre but they never turned up. On top of that means of disseminating this news letter should be devised such that each and every school offering science which is within the focal area receive such copies.

7.5.2 CAREER GUIDANCE INFORMATION

Findings from this study suggested that there is a lack of career guidance information transmitted by the Centre to the pupils. It is therefore recommended that the Science Centre should accentuate more on career guidance. This may be in the form of video tapes shown to pupils on their visit to the centre, or may be a booklet on science relatedcareers which might require explanatory information from the science centre staff.

7.5.3 PROVISION OF SCIENCE DEVELOPMENT CENTRES TO OTHER AREAS

Considering the impact of this Centre on pupils' perception of science, it is recommended that it should be spread to other areas so that it can readily disseminate information to its target groups. Looking at the fact that this is the only Science Development Centre serving an area which is widely spread (stretching from Tugela River in the South to Kosi Bay in the North and inland as far as Nongoma), thus it makes it imperative for it to be evenly distributed because it might be failing to render services to all of its target groups and this might be due to financial constraints and shortage of manpower.

7.5.4 INCLUSION OF OTHER SCIENCE SUBJECTS WITHIN THE PROGRAMME

Other science subjects in this area such as Maths, Biology and Agriculture are somehow not receiving attention they should be getting from the Science Development Centre. Hence, an inclusion of subjects like Maths, Biology and Agriculture into the Science Development Programme is recommended. This will help to create a platform where specific difficulties encountered by pupils concerning these subjects will be addressed. Pupils will also learn to know that it is not only Physical Science that is of importance as a science subject but other subjects are important too. In the previous sections of this chapter it is indicated that Chemistry part of Physical Science is receiving minimal attention by the Science Development Centre, it is thus recommended that the Science Development Centre pays more attention to the Chemistry portion of Physical Science.

7.5.5 FURTHER RESEARCH ON PHYSICAL SCIENCE CURRICULUM

Outcomes Based Education put a lot of emphasis on outcomes, thus curriculum materials should be structured such that a learner will be in a position to achieve a particular outcome.

In the view of the failure by secondary school pupils (especially black pupils) to integrate some theoretical material they have learnt from class into practicality, mainly on daily life or future situations, the following research effort is recommended for future exploration:

* An investigation need to be conducted into the type of curriculum materials relevant to the Physical Science Programme. This will most likely reveal whether the present curriculum of Physical Science contains material that is easily applied to life situation (i.e. Outcome Based Curriculum).

6.6 CONCLUSION

This research effort has attempted to address the question: What is the impact/role of the University of Zululand Science Development Centre on pupils' perception of Science? The main hypothesis of the study stipulates that the University of Zululand Science Development Centre has an impact on the pupils' perception of science. This hypothesis and other such related suppositions were generally confirmed.

The results of this investigation have indicated that the University of Zululand Science Development Centre (UZSDC) play a major role on pupils' perception of science. Furthermore, this study has also indicated some areas which require further attention from the Science Development Centre. The recommendations put forward in the study are limited to the area that stretches from Tugela River in the South to Kosi Bay in the North and inland as far as Nongoma, but it is possible to have some of them considered for the wider South Africa.

BIBLIOGRAPHY

Adams, W (Ed.) (1935): The new teaching. London. Hodder and Stoughton.

Arnott, A., et al (Edusource). Mathematics and Science Teachers: Utilization, Supply, Demand and Training in South Africa. Johannesburg.

Bless, C. and Hisson-Smith (1995). Fundamentals of social Research Methods: An African perspective Juta & Co, Ltd.

Brown, J.et al, (1986) Science in Schools, Open University Press, Philadelphia.

Coppard, D. (1998). Richards Bay Resource Centre (Document).

Dostal, E. (1989). The long-term future of education in South Africa, occasional paper 15, unit of future research, University of Stellenbosch, cited in C. Colclough & P. Pillay (eds) education in South Africa: Present constraints and future challenges, Ids Bulletin, 25, (1) January 1994, pp.52-58.

Driver, R., Guesne, E. & Tibershien, A eds (1985). Children's ideas in science. Open University Press, Milton Keyness.

Frazer, B. (1978). Environmental factors affecting attitudes toward different sources of scientific information. J. Res. Sci. Teach. 6(3); 274-283.

FRD (Foundation for Research and Development) (1993). SA Science and Technology indicators.FRD, Pretoria.

Gardner, P.L. (1976) Attitudes toward physics: Personal & Environmental influences. J. Res. Sci. Teach 13(2); 111-125.

Hartshorne, K.B. (1985) The state of education in South Africa: Some indicators. South African Journal of Science 81:148-151.

Hasan, O.E. (1985). An investigation into the factors affecting attitudes towards science of secondary school students in Jordan. Science Education, 69(1): 3-18.

Heafford, P.E. (1965): The teaching of science. Glasgow. Peargamon Press Ltd.

Howe, A.C. & Durr, B.L. (1982). Using concrete materials and peer interaction to enhance learning in chemistry. Journal of research in science teaching, 19(3); 225-232.

Isaac, S. and Michael, W.B. (1971): Handbook in Research and Evaluation. Edits Publishers, San Diego.

Kahn, M.J. (1994). Science and Technology Education and Training for Development (Braamfontein, South Africa, Centre For Educational Policy Development).

Keeves, J.P. (1975). The home, the school, and achievement in mathematics and science. Science Education, 59(4); 439-460.

Klopper, L.E. (1983) ed. Science Education Journal in USA.

Lawrenz, F. (1975). The relationship between science teacher characteristics and student achievement and attitude. J. Res. Sci. Teach 12(4); 433-437.

Lawrenz, F. (1976). The prediction of student attitude toward science from student perception of the classroom learning environment. J. Res. Sci. Teach. 13(6); 509-515. John Wiley and Sons, Inc. Pennsylvania.

Lederman, N. G. & O'Maley, M. (1990): Students' perceptions of tentativeness in science: Development, use and sources of change. John Wiley and Sons, Inc. Science Education, 525-54.

Lewin, K.M. (1995). Development Policy and Science Education in South Africa: Reflections on Post-Fordism and Praxis Carfax Publishers Ltd.

Maddock, M.N. (1981). Science Education: An anthropological view point. John Wiley and Sons, Inc. Studies in Science Education.

Magi, N.V. (1993). Biosocial issue as a component of Biology Education. Unpublished D.Ed thesis. Durban: University of Durban-Westville.

Mason, C.L. & Kahle, J.B. (1989). Student attitudes toward science and science related careers: A program designed to promote a stimulating gender-free learning environment. Journal of research in science teaching, 26, 25-39.

Matyas, M.L. (1984) Science career interests, attitudes, abilities, and anxiety among secondary school students: the effects of gender, race/ethnicity, and school type/location paper presented at the annual meetings of the National Association for research in science teaching, New Orleans, LAC Eric Document Reproduction service No. ED 251309.

MacMillan, J. & May, M. (1979). A study of factors influencing attitudes toward science of junior high school students. J. Res. Sci. Teach, 16(3); 217-222.

Misiti, F.L. & Shrigley, R.L. (1991). Science Attitude Scale for Middle School Students. John Wiley & Sons, Inc. Studies in Science Education.

Nachmias, D. and Nachmias, C. (1981).Research in the Social Sciences. St. Martin's Press, New York

National Department of Education (1996).Recommendations for the Development and Implementation of assessment policy, issued by the National Department of Education, (Draft Document).

National Department of Education (1996). Outcomes Based Lifelong Learning Development Framework for South Africa, (Draft Document

National Department of Education (1996).Curriculum Framework for General and Further Education and Training, issued by the National Department of Education, (Draft Document)

NEPI (1992). National Education and Policy Investigation (Cape Town, OUP,NECC).

Ogunniyi, M.B. (1993). Critical issues in Science Education in Africa, in SAARMSE proceedings first annual meeting.

Oliver, J.S. & Simpson, R.D. (1988). Influence of attitude towards science, achievement motivation, and science self concept on achievement in science. A longitudinal study. John Willem & Sons, Inc. Studies in Science Education.

Peil, M. (1982). Social Science Research Methods: An African Handbook, London, Hodder & Stoughton.

Piburn, M.D. & Baker, D.R. (1983): If I were the teacher... Qualitative study of attitude toward science. John Wiley and Sons, Inc. Studies in

Science Education, 393-406.

Reaves, C.C. (1992). Quantitative Research for the Behavioural Sciences. New York, John Wiley & Sons.

Renner, J. & Stafford, D.G. (1972). Teaching Science in the Secondary School. Harper & Row Publishers, New York.

Rennie, L.J. & Dunne, M. (994) Gender, Ethnicity & Students' Perceptions About Science and Science Related Careers in Fiji. John Wiley & Sons, Inc. Science Education, 285-301.

Richards, S. (1983). Philosophy and Sociology of Science in Schools. Open University Press. Philadelphia.

Rolnick, M. & Reddy, V. (1995). Relevance and promotion of equity. A paper submitted to African Science and Technology Education towards the future, Durban, South Africa.

Scott, L. (1986). Girls and Science in ASE Science Teachers' Handbook. Nellist, J. And Nicholl, B. (eds) London: Hutchison.

Simon, J.L. and Burstein, P. (1985). Basic Research Methods in Social Science. New York, McGraw-Hill Publishing Company.

Simpson, R.D. & Oliver, J.S. (1985). Attitude Toward Science and Achievement Motivation Profiles of Male and Female Science Students in Grades Six Through Ten. John Wiley & Sons, Inc. Science Education.

Talton, E.L. & Simpson, R.D. (1986). Relationships of attitudes toward self and school with attitude toward science among adolescents. John Wiley & Sons, Inc. Studies in science education.

The Department of Arts, Culture, Science and Technology (1996). South Africa's Green Paper on Science and Technology: Preparing for the 21st Century. CTP Book Printers, Parow, Cape Town.

The Department of National Education (1995). White Paper on Education and Training. Department of Education, Pretoria.

The University of Zululand Science Development Centre Detailed Overview. A document by Derek Fish (1998).

Trowbridge, L.W. & Bybee, R.W.(1986). Becoming a Secondary School Science Teacher. Columbus, Ohio: Bell & Howell.

Walberg, H.J. & Anderson, G.T.(1968). Classroom climate and individual learning. Journal of Education Psychology, 59; 414-419.

White, R.T. (1988). Learning Science. Basil Blackwell Ltd, Oxford.

White Paper on Education and Training (1995). Government Gazette No. 16312, Cape Town.

Woolf, H. (1964) ed. Technology and Society. The Johns Hopkins Press. Baltimore, Maryland.

Yager, R.E. & Penick, J.E. (1986). Perceptions of Four Age Groups Toward Science Classes, Teachers and the Value of Science. John Wiley & Sons, Inc. Science Education.

Yager, R.E. & Yager, S.O. (1985). Changes in perceptions of science for third, seventh, and eleventh grade students. Journal of research in science teaching, 22(4) 347-358.

APPENDIX A : ABBREVIATIONS USED

Abbreviation	Full meaning of the abbreviation
CASME	Centre for the Advancement of Science & Mathematics Education
FRD	Foundation for Research Development
NAEP	National Assessment of Educational Progress
NOLA	National Open Learning Agency
NQF	National Qualifications Framework
RDP	Reconstruction and Development Programme
RPL	Recognition of Prior Learning
SET	Science, Engineering & Technology
UZSDC	University of Zululand Science Development Centre

APPENDIX B

QUESTIONNAIRE TO STUDENTS
PRE-TEST

DISTRICT:______________________________

PLACE :______________________________

DATE OF INTERVIEW:___________________

A. PERSONAL BACKGROUND

1. Name of student :____________________________
2. Name of school :____________________________
3. Standard :____________________________

NB: Use a cross (x) in spaces provided where applicable.

4. Where is your school located?

Urban	
Peri-urban	
Rural	

5. Sex

Male	
Female	

6. Age

15 - 17 years	
18 - 21 years	
22 - 25 years	
26 years and over	

B. Role of the University of Zululand Science Development Centre

8. In your opinion, what is the aim of the University of Zululand Science Development Centre?

9. What do you hope to gain or learn by visiting this centre?

10. What else would you like to learn about in this centre?

11. In your opinion, should there be more or less centres like this one?

Read the following statements carefully and indicate whether you:

5) Strongly Agree
4) Agree
3) Neutral
2) Disagree
1) Strongly Disagree

Indicate the statement by making the appropriate number with a cross (x).

C. Pupil's attitude or feelings towards Science

12	Science is enjoyable	5	4	3	2	1
13	Science is fun	5	4	3	2	1
14	Science makes me feel curious	5	4	3	2	1
15	I have bad feelings towards Science	5	4	3	2	1
16	I listen/ read news about Science	5	4	3	2	1

D. Pupil's perception of the learning of Science:

17	Science is easy for me	5	4	3	2	1
18	I enjoy doing Science experiments	5	4	3	2	1
19	Everyone should learn about Science	5	4	3	2	1
20	Asking questions helps me understand Science	5	4	3	2	1
21	Things we learn in Science can be used at home or in community	5	4	3	2	1

E. Pupil's perceptions of the value of Science:

22	Useful knowledge is gained from Science	5	4	3	2	1
23	Learning Science has improved my life	5	4	3	2	1
24	Most of what is learned will be useful in the future	5	4	3	2	1
25	Knowledge gained from Science helps in solving daily life problems	5	4	3	2	1
26	Learning Science has improved my decision-making abilities	5	4	3	2	1

F. Pupil's perceptions of Science Careers:

27	Success in Science leads to good jobs	5	4	3	2	1
28	Solving countries' problems needs scientists	5	4	3	2	1
29	More scientists are needed in South Africa	5	4	3	2	1
30	I would like a career which involves Science	5	4	3	2	1
31	I think I am capable of becoming an engineer, scientist or doctor	5	4	3	2	1

APPENDIX C

QUESTIONNAIRE TO STUDENTS

POST-TEST

DISTRICT:______________________________

PLACE :______________________________

DATE OF INTERVIEW:____________________

A. PERSONAL BACKGROUND

1. Name of student :______________________________
2. Name of school :______________________________
3. Standard :______________________________

NB: Use a cross (x) in spaces provided where applicable.

4. Where is your school located?

Urban	
Peri-urban	
Rural	

5. Sex

Male	
Female	

6. Age

15 - 17 years	
18 - 21 years	
22 - 25 years	
26 years and over	

7. Do you take Physical Science at school

Yes	
No	

B. Role of the University of Zululand Science Development Centre

8. In your opinion, what is the aim of the University of Zululand Science Development Centre?

9. What did you gain or learn by visiting this centre?

10. What else would you like to learn about in this centre?

11. In your opinion, should there be more or less centres like this one?

Read the following statements carefully and indicate whether you:

5) Strongly Agree
4) Agree
3) Neutral
2) Disagree
1) Strongly Disagree

Indicate the statement by making the appropriate number with a cross (x).

C. Pupil's attitude or feelings towards Science

12	Science is enjoyable	5	4	3	2	1
13	Science is fun	5	4	3	2	1
14	Science makes me feel curious	5	4	3	2	1
15	I have bad feelings towards Science	5	4	3	2	1
16	I listen/ read news about Science	5	4	3	2	1

D. Pupil's perception of the learning of Science:

17	Science is easy for me	5	4	3	2	1
18	I enjoy doing Science experiments	5	4	3	2	1
19	Everyone should learn about Science	5	4	3	2	1
20	Asking questions helps me understand Science	5	4	3	2	1
21	Things we learn in Science can be used at home or in community	5	4	3	2	1

E. Pupil's perceptions of the value of Science:

22	Useful knowledge is gained from Science	5	4	3	2	1
23	Learning Science has improved my life	5	4	3	2	1
24	Most of what is learned will be useful in the future	5	4	3	2	1
25	Knowledge gained from Science helps in solving daily life problems	5	4	3	2	1
26	Learning Science has improved my decision-making abilities	5	4	3	2	1

F. Pupil's perceptions of Science Careers:

27	Success in Science leads to good jobs	5	4	3	2	1
28	Solving countries' problems needs scientists	5	4	3	2	1
29	More scientists are needed in South Africa	5	4	3	2	1
30	I would like a career which involves Science	5	4	3	2	1
31	I think I am capable of becoming an engineer, scientist or doctor	5	4	3	2	1

APPENDIX D

PROPOSED STRUCTURE FOR AN NQF			
NQF LEVEL	BAND	Types of Qualifications and Certificates	
8	Higher Education and Training Band	Doctorates Further Research Degrees	
7		Higher Degrees professional Qualifications	
6		First Degrees Higher Diplomas	
5		Diplomas Occupational Certificates	
FURTHER EDUCATION AND TRAINING CERTIFICATES			
4	Further Education and Training Band	School/College/Training Certificates Mix of units from all (NGOs)	
3		School/College/Training Certificates Mix of units from all (NGOs)	
2		School/College/Training Certificates Mix of units from all (NGOs)	
1 = General Education and Training Certificates = 4			
	General Education and Training Band	Senior Phase	ABET Level 4
		Intermediate Phase	ABET Level 3
		Foundations Phase	ABET Level 2
		Pre-school	ABET Level 1