Teachers' perceptions of factors influencing learners' choice of Physicals sciences in grade 10

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RESEARCH

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DEDICATION

This study is dedicated to the following people who are very important in my life:

- My beloved wife, Gadibolae (Manana) Elizabeth Segola
- My three children Ketlholang (Papa), Tshepagalang and Masego Segola
- My parents Pule and Nobengazi Segola, who taught me and gave me the right direction in life and education.

ABSTRACT

This study is intended to explore educator's perceptions of the factors influencing learner's choice of Physical Sciences in Grade 10 and is in particular a case study of the Lejweleputswa District. In order to meet the set aim, the researcher conducted an investigation utilising a questionnaire to determine the educators perceived factors that influence learners choice of Physical Sciences in Grade 10.

The study starts with the analysis of literature which focuses on the different factors both internationally and within South Africa that have been noted to influence learners choice of subject in particular sciences and science related subjects. A sample of 74 physical sciences teachers participated by completing the questionnaire which presented questions with answers on the Likert scale. This quantitative study utilise the collected the different responses that participants provided by analysing the using SPSS. The analysis presented descriptive analysis and also factors analysis.

The research found that educators in Lejweleputswa District had different perceptions on the factors that influence learners' choices to take Physical Sciences in Grade 10. The study shows that physical sciences teachers noted their contribution towards the decline in the enrolment of learners in Grade 10 Physical Sciences. They noted that their teaching in previous grades when dealing with Natural Sciences had a major influence on the learners choice of subject. These experiences are all educator-related as the different aspects mentioned are their responsibility, namely the quality of teaching, the teacher-student relationship in class, adoption of teaching approaches and the planning of practical work for class

Furthermore teachers demonstrated that learners' tendency to choose courses believed to have less work has also major impact on their choice of Physical Sciences in grade 10. The study then recommendations a focus dealing with teachers teaching in Physical Science as it is perceived to impact on the learners choice of the Physical Science. The educator's perceptions will help to influence the learners to choose

Physical Sciences in Grade 10. The findings in this study point out the importance of the role played by science teachers at different phases within the South African classroom through their teacher-learner relationship, teaching and learning approaches as well as the general science curriculum. The study therefore indicates that science teachers play a significant role in increasing the number of enrolling for Physical Science in Grade 10.

DECLARATION

I declare that:

The research thesis titled **Educators' perceived factors influencing learners' choice of Physical Sciences in Grade 10: A case study of Lejweleputswa District** is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of reference.

_____ _____

K. B. Segola DATE

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KEYWORDS

Learners Choice

Teaching and learning in Physical Sciences

Teachers' perceptions

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ACRONYMS AND ABBREVIATIONS

- **ASTA**- Australian Science Teacher Association
- **CUT**- Central University of Technology
- **DoE**- Department of Education
- **FET**- Further Education and Training
- **FSDoE**- Free State Department of Education
- **GET**- General Education and Training
- **ICASE**- International Council of Associations for Science Education
- **ICT**- Information and Communication Technology
- **NS**- Natural Science
- **RQ**- Research Question
- **SET**- Science, Engineering and Technology
- **SCRE**- Science Community Representing Education
- **SCT**- Social Cognitive Theory
- **SAASTA**- South African Agency for Science and Technology Advancement
- **SPSS**- Statistics Program for Social Sciences
- **UNESCO**- United Nations Education Science and Culture Organisation

CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

After the introduction of democracy in South Africa in 1994, the system of education was drastically changed. The new curriculum noted and emphasised the importance of the Science subjects but this did not change the continued negative attitude of learners towards the subjects and the notably low enrolments along with poor performance in the national examinations (Adesokan, 2002:337).

Education and training during apartheid was characterised by the under-development of human potential, generally of blacks in particular and the teaching and learning of mathematics, Science and technology were the hardest hit (Department of Education, 2001). The content of the subjects taught had some changes while school curriculums changed from General Education and Training (GET) to Further Education Training (FET) and as a result educators had to be trained to meet the requirements of each phase as per the different policies of the Department (DoE, 2001). The researcher has observed that over the past seven years, the enrolments of the learners in Grade 10 who chosen Physical Science as a subject decreased in the different schools within the District of Lejweleputswa.

The new curriculum that was introduced after 1994 brought in new and different phases for students to follow from Grade R to 12: foundation, intermediate, senior and the further education and training phase (FET). In the senior phase, which consists of

Grades 7, 8 and 9, Natural Sciences is compulsory as a subject for all learners. When they move to the Further Education and Training (FET) phase learners in Grade 10 can choose to do Science subjects such as Physical Sciences or follow other combinations that exclude Physical Sciences.

Table 1.1 presents learners who registered for Sciences in five randomly selected schools, namely A, B, C, D and E, in the Lejweleputswa District between 2010 and 2014 as requested in a survey conducted by Khoboli (2014). The table presents the number of learners that were registered for Natural Sciences, a compulsory subject in Grade 9. It then shows the number of learners who opted for Physical Sciences in Grade 10 in the same schools. The learners who opt for Life Science could also choose to take Physical Sciences if they desired. The main concern in this study, however, is the number of learners who opt for Physical Sciences. In a similar way the learners who choose Life Sciences could choose not to do Physical Sciences. Enrolments for Life Sciences has been increasing.

The same number of learners who took Physical Science in 2011 (in Grade 10) were also doing Natural Science in 2010 in Grade 9. It was difficult to acquire the exact number of learners who were doing both Physical Sciences and Life Sciences versus those that were doing only one of them. The number of learners who register for Sciences in Grade 10 is declining in all the schools. There may be different reasons for this decline.

The schools A, B, D and E show a clear decline from 2011 to 2014, even though school A shows a small decline. In School C it is observed that there was a fluctuation in the

number of learners who opted for Physical Sciences with the percentages ranging between 33.3% and 43.0% over 4 years. Therefore, the table below demonstrates a decline in the numbers of learners who opt for Physical Sciences in Grade 10 in Lejweleputswa District.

Table 1.1: Learners' enrolment in Science subjects in Grade 9 and 10 (Khoboli, 2014).

		No. of learners				
SCHOOL	**Subjects**	**2010**	**2011(%)***	**2012(%)**	**2013(%)**	**2014(%)**
SCHOOL A	Natural Sciences (Grade 9)	348	340	421	465	324
	Physicals Sciences (Grade 10)	110	62(16.8)	58(17.1)	67(15.9)	66(14.2)
SCHOOL B	Natural Sciences (Grade 9)	198	264	212	219	206
	Physical Sciences (Grade 10)	54	47(23.7)	62(23.5)	49(23.1)	48(21.9)
SCHOOL C	Natural Sciences (Grade 9)	238	219	216	221	302
	Physical Sciences (Grade 10)	64	89(37.4)	92(42.0)	72(33.3)	95(43.0)
SCHOOL D	Natural Sciences (Grade 9)	191	206	234	256	247
	Physical Sciences (Grade 10)	76	92(48.2)	89(43.2)	96(41.0)	86(33.6)
SCHOOL E	Natural Sciences (Grade 9)	233	279	308	267	192
	Physical Sciences (Grade 10)	97	104(46.7)	89(31.9)	88(28.6)	74(27.7)

*Represents the percentage of learners in that group with relation to the number of learners that were doing Natural Science the previous year. For School A we have 62 (Grade 10 in 2011) divided by 348 (Grade 9 in 2010) which gives 16.8%.

1.2 Statement of the research problem

The educator in the school is the person who guides learners through teaching, learning and preparation for future professions. In this situation the educator is expected to play a specific role in motivating the learner to both recognise their personal potential as well as to choose the appropriate and suitable subjects for their chosen professions, especially when they reach Grade 10. At this stage learners should be assisted in looking at different factors such as their personal academic performance, their desired career as well as the required subjects for that. It is at this time when they choose to either continue with or drop Science subjects if they feel that their chosen profession would not require it. The majority of learners opt for non-Science subjects when they start Grade 10.

Over the past few years South African schools have demonstrated a significant decline in the number of learners who choose Physical Sciences in the Further Education and Training band (FET). This poses a serious concern as Science in this FET band is intended to "deal with society's need to understand how the physical environment works in order to benefit from it and responsibly care for it" (DOE, 2011:8). The Department of Education document goes further to demonstrate the purpose of this curriculum, as to "… equip learners with investigating skills….knowledge and skills in scientific inquiry and problem solving….". Therefore, the implications of the decline of learners opting for Science subjects in FET impacts on the supply of needed and qualified personnel for Science related course such as engineering. This is implicates a decline in the promotion of future skilled scientists for South Africa. Furthermore, this affects the scientific literacy of South African citizens. Therefore, understanding the factors that influence learners' choices of Science subjects as well as whether or not

to take them could assist the Department of Basic Education (DBE), stakeholders and the country at large.

1.3 Research questions

The study would, therefore, work towards answering the following research questions:

- What do Lejweleputswa District Science educators perceive as the factors contributing towards the decline in Grade 10 Physical Science enrolments?
- Is there any relationship between the educators' views and their different biographical data?
- Which type of advice on Physical Science as a subject do educators perceive will help learners in their deliberations on subject choices?
- What role do educators think they have in the process of increased enrolments in Grade 10 in Physical Science as a subject?

1.4 Significance of the study

The significance of this research project will be to make the educators, learners, stakeholders and the Free State Department of Education in Lejweleputswa District aware of the influences that educators have on learners' choice of Sciences in Grade 10. The study would also present the strategies educators could use to influence learners' choice of subjects in Grade 10. Lastly, and more importantly, the study is intended to inform the DBE on the influence of Science educators on learners` choices of Science subjects in Grade 10.

1.5 Aims and objectives of the research

The aim of this research is to determine the teachers' perceptions of factors influencing learners' choice of Physicals sciences in grade 10 in the Free State's Lejweleputswa District. The study will solicit from the educators the factors they perceive contribute towards the decline in learner enrolments in Grade 10 Physical Sciences.

The study will have the following objectives:

- To determine the perceived factors the educator has that influences learners' choices of Science subjects in Grade 10,
- to determine the relationship between the educators' biographical data and the educators perceived factors,
- to determine the type of advice on Physical Sciences that educators perceive will help learners in their deliberations on subject choices,
- to establish the role that educators think they play in the process of increased enrolments in Grade 10 Physical Sciences, and

  to provide recommendations on how to deal with the declining enrolments in Grade 10 Physical Sciences to the Department of Basic Education

1.6 Purpose of the study

The purpose of this research project is to investigate the perceived factors that influence learners' choice of Physicals sciences in grade 10 by teachers. The educators' views on decreasing Science enrolments in the past years in the South African schools are concern. Several factors are suggested contributing to this decline are suggested by the teachers.

1.7 Research design and methodology

1.7.1 Research approach

The study adapts the questionnaire to produce the numbers necessary for use in the quantitative approach. The questionnaire that was adapted for this use was presented by Lyons and Quinn (2010:126) when they were investigating the reasons for the decline in Science enrolments in Australia. It was, however, adjusted to suit the South African context. The questionnaire focuses on the educators' views on declining enrolments in the Sciences. It helped the researcher to determine the educators' views on the role they play towards the learners' choice of Science subjects in FET in South Africa. Within this questionnaire, different educator factors believed to contribute towards the decline of enrolments are investigated with open and closed questions. The questionnaire goes further to explore the different sources of advice that educators could provide on choosing Science subjects and how these are perceived to influence learners' choices. The first section of the questionnaire provides the quantitative data while the last section, which consists of open-ended questions, provides the quantitative data.

1.7.2 Population and sample

The researcher intends to derive a representative sample from the schools in Lejweleputswa District. The population will be made up of Science as well as non-Science educators in schools in this district. A population is a group of elements or cases, whether individuals, objects or events, that conform to specific criteria and to which we intend to generalise the results of the research (McMillan & Schumacher, 2010: 129). A problem, therefore, relates to a specific population and encompasses the total collection of all the units' analysis of the perceived influence that educators

have on learners` choice of sciences in Grade 10. All the educators in the selected schools will therefore participate.

There are decisive, clear factors that prompt the researcher to select the sample from the population in this way. Corbetta (2003:2010) states that sampling is the process of selecting a number of participants for a study in such a way that the participants represent the group from which they were selected. Therefore, the sample will be 140 educators from 70 secondary schools in the Lejweleputswa District. In this way, the sample group was purposefully chosen.

1.7.3 Data collection and analysis

As mentioned, a questionnaire adopted from Lyons and Quinn (2010:126) was adjusted to suit the South African situation and utilised to collect data for this study. The researcher distributed the questionnaires to the chosen schools along with guidelines for the completion of the questionnaire which was discussed with the participating educators. Furthermore, the data was then analysed using the Statistics Program for Social Sciences (SPSS) version 22 of 2014 in order to determine the perceived views that educators have on their influence on learners' choice on selection of subjects.

1.7.4 Ethical considerations and administration

Permission was obtained from the Free State Department of Education (FSDoE), the Lejweleputswa District Education as well as the principals of the selected schools. The application for approval and a copy of a questionnaire was submitted to the

FSDoE. The researcher gave the Science educators the questionnaire intended for this investigation and their responses were kept anonymous. The identity of participants and their schools are also kept secret and the information obtained from all participants treated with confidentiality. Consent for participation was obtained from the participants (Science educators) and the participants' right to withdraw their participation was also highlighted.

1.8 Limitations of the study

This research project focuses on the Lejweleputswa District in the Free State and the educators that are working in those schools. Most importantly, the project is limited to the perceived role of educators in learners' choice of Physical Sciences in Grade 10. The researcher concentrated on 70 schools as the sample of this research. The data can therefore only be utilised to make conclusions about the schools in the Lejweleputswa District and not generally about other areas of the country.

1.9 Programme of study

The research report will be organised in chapters in the following way:

Chapter 1: Introduction and background to the study

The introduction provides a general background and summary of the study which includes the introduction to the research, research questions and objectives.

Chapter 2: Literature review

This chapter provides an idea as to what other researchers who have dealt with similar topics in other parts of the world have found and reported. It therefore covers the literature on perceptions that the public, educators and others involved in education hold towards the educator and the factors that influence learner choices of science subjects.

Chapter 3: Methodology

In Chapter 3 the methodology adopted to gather information in this research, including the research design, data collection and the research sample is dealt with. This chapter documents the process followed during data collection as well as the profile of the respondents to the questionnaire.

Chapter 4: Data presentation and analysis

Chapter 4 presents the data collected along with the results found from both the closed and open-ended questions. After the data is presented, an analysis is completed and presented in this chapter. The chapter further interprets the results for each section as they come up. The questionnaire findings are then consolidated in order to give a clear and specific conclusion as to what the educators perceive is their influence on learners' choice of Science subjects in Grade 10 and what they think could be done, mainly by educators, to improve their role in the students' process of selecting subjects.

Chapter 5: Discussion and conclusion

This chapter critically discusses the findings of the research along with evaluating the questionnaire in order to make strategic recommendations and conclusions based on these responses. The conclusion puts forward suggestions on what could be done to better understand learners' choices of Physical Science as a subject and ways to improve the process of subject choice in Grade 10. It further gives the significance of the study and its use by all stakeholders in Physical Science teaching at school along with the support needed at district level.

1.10 Summary

The chapter has provided the background to the study as well as the general introduction to this study. The next chapter intends to provide a literature review on the perceived learners' choice of factors influencing their choices of subjects in school.

CHAPTER 2

LITERATURE REVIEW ON LEARNERS' CHOICES

2.1 Introduction

In the previous chapter both the research problem and background to the study were outlined and conceptualised. The chapter also discussed the rationale behind the significance of this particular research study. Chapter 2 intends to provide a detailed review of literature on factors impacting on students' choices of subjects internationally, in Africa and also within South Africa. Learner subject choice has been documented in literature and this demonstrates that there are different reasons why learners make certain subject choice. Different researchers have indicated the importance of science as a subject and further noted the influence that a teacher could have on a student's choice of this subject. The literature also demonstrates the influence of gender differences, the role of parents as well as the students' perceived personal ability on choices of Science subjects.

Many studies presented did not focus specifically on the 'Physical Sciences' but most of them investigate Science generally. In this study, the researcher considered studies that mentioned Science which included Physics, chemistry, and biology. This was based on the fact that there are not many studies done specifically on Physical Sciences alone and therefore the researcher needed to consider all other Science subjects during the literature review.

The main reasons for a learners' decision to opt not to register for certain subjects when given a choice has been presented as a varying aspect (Mabula, 2012). Mabula

has gone further to indicate that these factors could vary between developed and developing countries but their impact is the same.

2.2 Factors influencing learners choice of subjects

A learners subject and career choices are becoming a major challenge for educators, learners and parents in the modern world. This has not been the case in the past as the choices were easily made as the son of a farm worker would become a farm worker and a son of a bricklayer would become a bricklayer. There was less choice available. Today, however, industrialisation, and the subsequent advancement in technology have come with a variety of professions which require different prior knowledge at high school level and hence have changed the way parents and learners look at subject choices.

Kori, *et al*. (2015), based on their study, presented factors that were found to impact on learners choices of information and communication technology as subjects. These factors are:

- Interest: the learners interest in working in a specific field;
- Necessary at work: this has been described as providing more knowledge which is needed in the chosen career;
- Salary: some learners focus on a specific subject based on its relation to a career that has the potential of providing a good salary;
- Labour market: different jobs and career opportunities available to the learners after doing the subject;

- Importance in the future: this covers the view of the specific subject importance in the current time and also in the future;
- Scholarship: the availability of funding when going for further studies has been one of the factors that seems to impact on student's choice. This also goes with the competition for such funding. Some students go for a specific subject which not many others would go for specifically as there is then less competition when applying for university;
- Likeability: learners perception of liking the subject also ensures that they commit to it;
- Prior experience (candidate has prior work experience or practice in ICT), and
- Self-realisation: this involves a learners desire to achieve something important in an area or field that is said to be challenging.

The factor of self-realisation that is presented by Kori, *et al*. (2015) has not been noted by many researchers and hence not many research questionnaires include it. This factor actually demonstrates that despite some researchers having found that learners opt for easier subjects, there is still some who would like to prove the point that they have potential by going for those subjects believed to be difficult. Kori, *et al*. (2015) have gone further to indicate that there other factors such as role models, school reputation, curriculum as well as future prospects which have been noted to impact on a learner's choice of subjects.

The decline of enrolments in Science subjects has been a result of certain learner factors such as gender, the intended career after high school as well as factors

involving the pupil's teachers. Furthermore, educators in this study believe that the decline in enrolments is due to "lack of efforts from Science organisations and university faculties to encourage learners to choose senior Science" (Lyons & Quinn, 2010: 31). When looking at the different factors that learners considered as important when making subject choices, therefore, researchers differed in their list.

The result of the study by Lyons and Quinn (2010) found that in general teachers' views of the factors contributing to the decline in Science subjects as a choice did not vary significantly with the type of school, the state or territory or the type of area in which the school is in. Fullarton and Ainley (2000), however, presented learners home location, gender and their performance in different subjects as the top three factors affecting this decision. These researchers included the type of school where the learner is attending and their personal biographical data as other factors.

Similar to decreasing enrolments, Van Bragta, *et al*. (2011) found three major reasons being related to:

- future anticipated or chosen occupations;
- personal issues; and
- learners' perceptions and experiences with issues related to education, organisation and the learning environment.

2.3 Factors influencing learners choice of Science

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 2010 presented an international review which was conducted by the International

Council of Associations for Science Education (ICASE) in collaboration with the Australian Science Teacher Association (ASTA) and which focused on the views of aged 15 year old learners. This study, supported UNESCO, compared learners' views of Science as well as other school subjects. The conclusion reached demonstrated the reasons for learners' loss of interest in Science, these being:

- The intention of Science teaching being content diffusion: Learners perceive Science learning as a process in which they are expected to absorb all the content presented by the teacher.
- The arbitrary nature of the type of school Science content makes it irrelevant: Learners therefore lack interest in what is taught in Science classes as it does not relate to their daily lives
- Learner's daily encounters with Science related activities is noted in films and in the media: These encounters are often presented as exciting but this is not the type of content they engage with in school Science.
- Both academically performing and non-performing learners find learning Science relatively difficult compared to most other school subjects.

In this study the researcher looks at the teaching and learning which includes the teacher qualifications, teaching and learning environment, and finally the teacher's ability to adopt different teaching approaches would be covered. Furthermore this section covers the discussion of the relevance of a subject with specific reference to career choice, gender differences and learners perceived personal ability in Sciences.

2.3.1 Teaching and learning in science

This factor has a number of sub-factors that are inter-related, such as teacher qualification, teachers' content knowledge, teaching environment and teachers' ability to adopt relevant teaching approaches.

2.3.1.1 Teaching qualification

The general learning of content is properly achieved when a teacher is qualified to teach, mainly in their specific subject. In other words, a teacher qualified in Sciences must teach Sciences. Aaronson, Barrow and Sander (2007) have noted that in most cases poor performance in teaching and learning is the result of a lack of qualified and properly trained teachers. They go further to show that a lack of properly qualified teachers can result in a lack of quality teaching which then impacts on the learner's desire to continue in Science in higher classes and further Science related careers. Similarly, Lyons and Quinn (2010) also find that the quality of teaching in Science classes impacts on a learners' choice of subjects whenever they get the opportunity to make choices. This means, therefore, that the teachers' qualifications are impacting on the learners' choice of subject as the teacher cannot also prepare the necessary learning environment.

2.3.1.2 Teaching and learning environment

Mabula (2012) has presented the school learning environment as one factor that impacts on the decline on learners' enrolment in Science subjects. This learning environment is fully the responsibility of the specific Science teacher and also the school as a whole. Lyons (2006) has further noted that in Tanzania teaching and learning within Science classrooms contributed to the decline in the enrolment of learners in Science subjects.

2.3.1.3 Teachers' ability to adopt relevant teaching approaches

Movahedzadeh (2011) has also demonstrated that the way Science is presented through teaching plays an important role in developing learners' attitudes towards Science. Speering and Rennie (1996) have noted that adoption of a variety of teaching approaches impacts on learning in Science which results in increased enrolments. They further noted the declined learners performance from classes where teachers who presented Science as highly theoretical with very little room for activities that involve observation and practical work. This type of teaching is noted to strongly impact on learners' interest and desire to continue with Science and Science related fields (Speering & Rennie, 1996). Similarly, Akintade (2012) also notes that learners' attitudes towards choice of geography was highly influenced by teachers' poor adoption of relevant teaching methods.

Lavonen, *et al*. (2007:86) demonstrate that most learners consider the Physics content boring hence teachers' appropriate choice of teaching method and classroom activities play an important role in choice of subjects. The authors also indicate that interesting presentation strategies of Science content in class develops the learners' interest.

Ndalichako and Komba (2014) indicate that facilitation of teaching and learning depends highly on the teacher's skills. This has been noted to be a factor that encourages or discourages learners to take part in that particular subject. Hence, in their study, from the responses of the learners that were taking part they found that

teachers play a major role towards the development of interest in a subject. Different characteristics of a teacher, such as quality of teaching, friendliness, being hardworking and punctuality were observed as important to learners' development of interest. This interest and encouragement were therefore noted as key contributors towards learners' choice of Science subjects.

The strategies and methods that teachers utilise to encourage students to take up Science has been noted to be a significant factor towards learners' choice of Science subjects (Woolnough, *et al*., 1997). Adams and Salome (2014:1302) in their study conducted in Nigeria found that availability of qualified teachers who are competent contributes significantly to learners' choice of Science subjects. Sadler, *et al*. (2013) demonstrate that in their study there was statistical relationships between the teachers' content knowledge and their learners' achievement. The qualified teachers possess the necessary subject content knowledge which then plays an important role in their teaching and learning of Science.

In a study conducted in Kenya, Mbithe (2012) also notes that teaching methods influence the choice of Physics, especially in the Kangundo District. Similarly, Mbithe (2012) notes that these teaching method include practical work in the laboratory and demonstrations. Lastly, learners who are taught by competent qualified teachers who are able to us effective Science teaching methods develop a strong and sustained interest in the Science (Sadler, *et al*., 2013). While on the other hand, teachers without qualifications often mislead their learners as they may teach Science concepts in a wrong way. Sadler *et al*. (2013) further notes that the availability of laboratory

equipment along with the teacher's ability to us it in practical science activities influences the learners' choice of Science subjects as it contributes to effective teaching and learning.

Akerman (2012) has noted that teaching approaches adopted by teachers are not based on learners' ability level or the specific content to be taught. The adoption of teaching methods has been habitual. Ndalichako and Komba (2014) note that the subject learning experience gained in the previous classes forms the foundation for learners deciding the subjects to take in their next classes. They further demonstrate that the learning environment contributes significantly to learners' performance in specific subjects which then impacts on their choices.

Mbithe (2012) demonstrates that 75% of science teachers who used demonstration methods in their Physics lesson developed their learners' interest in Physics drastically. Furthermore the learners who were not provided with the opportunities to interact with laboratory instruments in Physics classes demonstrated poor understanding of theory which then lead to poor academic performance. Poor internalisation of theory, therefore, results in a learners' poor performance which contributes significantly towards the decrease in the number of learners who choose science as a subject.

2.3.2 Relevance of a subject or subject choice based on career development

Ndalichako and Komba (2014) note that learners place a certain value on some subjects which they believe to be applicable to their everyday real life. This includes the subjects that provided them with the knowledge and necessary skills needed to deal with their day-to-day activities and challenges.

A subject with content recognised as difficult to understand and which requires students to memorise was therefore further observed to be rejected by most students (Ndalichako & Komba, 2014).

2.3.3 Gender differences

Sadler, *et al*. (2012) note that most of the past studies conducted in high schools showed that the percentage of male learners opting for Sciences were constant and sometimes even increasing in numbers whilst the number of female learners on the same level were observed to decrease drastically. Jin, Muriel and Sibieta (2010) have demonstrated that subject choice for learners can be influenced by the perceived different gender stereotypes. Males and female learners could have different perceptions about their personal ability and competency to perform in certain subjects which could influence their enrolment choices as they would go to those where they believe they would perform well (Nagy, *et al*., 2006).

In the study by Mbithe (2012) that was conducted in the Kangundo District it was observed that the major reason for not choosing Science in high school was gender.

Mbithe (2012) found that there were more male physics teachers than females and this affected the enrolment of girls in Physics. Gilbert and Calvert (2003) found in their study that most girls did not perceive themselves as being capable of studying and succeeding academically in Science, which then reduced their interest in Science.

Omondi (2013) notes that learners' gender has been observed to impact on their enrolment, the values they attach to different subjects as well as their academic performance. Omondi goes further to demonstrate that the gender differences that are observed elsewhere (colleges and universities) are also observable in studies involving high school learners.

Tenenbaum (2008) notes that science and mathematics are less likely to be chosen by female learners compared to male learners. Tenenbaum goes further to demonstrate that female learners are more likely to choose English language and literature as compared to science and mathematics. Furthermore, mathematics achievement was significantly stronger for males than for females in the study by Stevens *et al*. (2007). They also note that the level of personal interest in science and mathematics for females versus males plays a significant role as a predictor of intentions to enrol in those subjects (Stevens *et al*., 2007).

Lyons and Quinn (2010) asked the learners to demonstrate their own academic ability in science classes compared to classes for other subjects. In general, more than half of all participants rated themselves above average in this study. Despite this average

rating, males were found to rate their personal ability significantly higher than that of females. Even though the learners varied, when considering males only, those who were attending single sex schools rated their ability in science significantly higher than males who were from mixed sex schools. When looking at the results for girls from single sex and mixed sex schools there was no difference in their rating of personal ability. Science teachers were considered to have the greatest influence in helping learners choose science subjects (Lyons & Quinn, 2010). Mothers and fathers follow teachers in the order of being influential and then close friends. In this study by Lyons and Quinn (2010) males who opted for science demonstrated a significant influence from their fathers when compared to girls.

Gender, therefore, has an influence on a learners' choice as well as the gender of those who provide them with advice. In the same way, the teachers impact on the learners' choice of subjects which could also be influenced by gender.

2.3.4 Perceived personal ability

> Why should I continue studying Science subjects when there are more interactive, interesting and less difficult ones to study? (Fensham, 2008:21)

Learners were observed to choose certain subjects based on their perceived personal ability to perform well academically in those subjects (Lyons & Quinn, 2010). Furthermore, Lyons and Quinn (2010) also indicate that, due to their perceived academic performance, learners tend to choose the subjects that are less demanding and in which they can performance better. Granström (2006) notes that acceptable

learner performance is achieved by establishing suitable learning contexts in which the teacher guides learners and encourages them to work together. According to Stevens, *et al*. (2007) a learner's perceived personal ability had an influence on their enrolment in mathematics, as an example.

Learners performing higher in their previous science classes are more likely to choose science in the following classes in comparison to those who attain a low academic performance in that subject (Tripney *et al*., 2010). Germeijs, *et al*. (2012) has presented a learners evaluation of their personal academic performance as a formation of their personal identity. Germeijs *et al*. (2012) further indicates that this personal identity involves a personal definition of who they are, their personal goals, their personal academic performance capability and their values. This personal identity impacts on how learners view themselves with relation to their performance in the sciences and hence if they were not performing well in science they would not choose science when they are given the opportunity to choose subjects.

In another study, the perceived level of difficulty of a subject such as physics was observed to influence learners' choices as most who preferred physics were observed to possess a strong perception that physics was difficult (Mbithe, 2012). Mbithe (2012) also shows that those learners who performed poorly in physics indicated that they would not continue further with physics when given the opportunity.

Woolnough, *et al.,* (1997) also demonstrate that learners must be motivated and inspired by their science teachers in order for them to continue doing science beyond the lower levels.

Woolnough, *et al*., (1997) present the different factors that should be dealt with in order to increase the number of learners doing Science beyond primary school. Some of these broad factors presented were:

- The quality of science teachers and their teaching in schools;
- The improved quality of the science curriculum to be implemented in schools;
- The development of science careers to be made more attractive to learners;
- The use of extra-curricular science activities which are challenging and stimulating;

2.4 Teacher's views

Contreras (2011:14) has indicated that "if a teacher expects that a student doesn't need help or will do well, the student is likely to do well; if a teacher expects a student to fail, they will probably fail". This shows that if a teacher believes that a student will not be able to do well in a particular subject then the learner will not do well and perhaps not even go further in that particular subject. This impression on learner performance in particular subjects by teachers is a result of interactions and relationships that the teacher have with their learners. Koomen, *et al*. (2011) have noted that many researchers have noted the importance of the relationship between the teacher and the learner. Ladd, Birch and Buhs (1999) have demonstrated that the

quality of this relationship impacts significantly on the general functioning of the learner which then impacts on their learning and hence influences their subject choices.

Harvey (2013) demonstrates the importance of building effective relationships between teachers and learners as this impacts on the learners' confidence in learning. Furthermore, Harvey demonstrates that a teacher's understanding of the learning process and a teacher's knowledge of the different learners, he believes, plays an important role in improving the motivation of learners. Teachers' views could be problematic as they influence learner's behaviour or beliefs about a specific subject which then directs them towards other subjects different from science and those science related.

Lyons and Quinn (2010) investigated teacher's perceptions of the observed decreasing number of learners taking science and further note that a similar decrease has been found in subjects such as geography, economics and mathematics. They further note that this decrease has a complex impact and is due to multiple factors. Lyons and Quinn (2010) present three factors which were observed to be highly influential in the learner's choice of sciences. These are:

- Learners failure to picture themselves in any science related career;
- The low reward for science compared to worked required to pass; and
- School science has not been able to meet each learner through engagement and learning support.

These three are seen to strongly impact on the learner's choice of sciences whilst on the other hand Lyons and Quinn (2010) present some factors which they found to not influence the learners choice of science. These factor were given as:

- A learner's experience of science in earlier years;
- A learners perception that scientists struggle to get jobs; and
- The low salaries given to individuals in science related careers.

The study went further to ask secondary science teachers questions regarding factors they believe influence a learner's choice of sciences (Lyons & Quinn, 2010).

The top four items that Lyons and Quinn (2010) found were generally showing the decline in an enrolment in science is perceived to be: levels of difficulty of the subject, a learners' lack of intent to take part in sciences and the availability of many other subjects, which are less demanding compared to sciences.

Teachers also perceived that advice from friends, peers, older learners and siblings have a greater impact on the learners' decisions to take science (Lyons & Quinn, 2010). Furthermore, the teachers in Lyons and Quinn (2010) note that parental advice is observed to be more influential than that from any advice that learners received from Science teachers. When asked to suggest strategies that could be utilised to encourage learners to take science up in higher classes, they indicate that teachers should increase the relevance, engagement and interest of science in lower science classes (Lyons & Quinn, 2010).

Having noted the decrease in learners' enrolment in sciences, when asked to suggest strategies, teachers included the establishment of links between every day contexts and the science content with an increased amount of quality practical work (Lyons & Quinn, 2010). This is dependent on the different lesson designs and teaching approaches chosen by the science teacher. Similarly, when learners were asked strategies for encouraging more learners to take science in higher level classes, they emphasised the important role that increased practical work in science lessons could play. Furthermore, they demonstrate the need to ensure relevance and applicability of science with the reduced theoretical presentation of science (Lyons & Quinn, 2010).

2.5 Impact of decreased number of learners in sciences

> In 2006 Sussex University announced to shut down its high-ranking chemistry department, the proud source of three Nobel laureates. Scientists reacted angrily to the announcement but Sussex University's authorities confirmed the plans to concentrate in other areas, including English, history and media studies. It was the latest in a long list of closures indicative of the weakening state of chemistry education… (Elias, 2009:74)

Currently no impact has been recorded at high school level but the major impact is observed beyond high school in colleges, universities, industries and the economy at large. Angell, *et al*. (2004) demonstrate that there is a growing concern presented in some countries about the decreasing of learners' choices of physics or sciences as this impacts on the number of learners who could enrol for science related professions in higher institutions of learning. The impact extends beyond institutions of higher learning as the labour force in science and technology sectors are also affected.

Osborne, Simon and Collins (2003) in their study conducted in the United Kingdom, demonstrate the negative impact that the decrease in the number of learners doing science have on the politics, economy and the general industrial development in a country. They further demonstrate that present economic development is highly dependent on technology and the decrease in the number of professionals joining the sciences and technology fields falls behind this development as fewer capable workers join the work force. Furthermore, the decrease in the numbers of learners who are scientifically literate on its own impacts on the learners opting for careers in science based industries.

Fajonyomi (2007) notes the importance of increasing the number of people who are qualified in technology and engineering as a strategy to increase economic status. In Nigeria, Ogbazi (1987) demonstrates that the lack of qualified citizens to deal with the fast growing industrial development has been observed to be due to a lack of qualified individuals who had science in their lower classes and who even dared to further opt for science related careers.

In the United States of America, the Department of Labour (2007) found that the employment rate of careers which are science related increased by 3.3% per year on average in the years between 2004 and 2008 whilst employment in other non-science related careers on average had an increase of only .3%. Therefore, the low number of learners opting for science impacts on the number of professionals who can occupy the positions becoming available annually in most countries.

2.6 Suggested strategies of increasing learner enrolments in science

Lyons and Quinn (2010) have stated that the starting point for dealing with the decreasing number of learners in sciences is by designing specific policies as the problem is both complex and multi-faceted. The decrease in the number of learners registering for science subjects in schools is a result of a variety of issues such as curriculum, the general society, and school context as well as other factors relating to learners themselves. Therefore, interventions targeting learners only or teachers only cannot be effective. Any approach taken should be the effort all the stakeholders in science including teachers, researchers and parents.

In the study by Lyons and Quinn (2010) it was observed that 55% of the learners who did not choose science indicated that they moved away from it because they did not enjoy science in lower level classes. The South African Agency for Science and Technology Advancement (SAASTA) has also noted the need to encourage more learners to opt for sciences and science related professions (SAASTA, 2007). SAASTA has been working towards science awareness within primary schools through Primary Science Days. These Science Days, which target primary schools, are a science celebration relevant for this level of student. This is an intervention strategy intended to develop learners interest in and content understanding of, mathematics and science as it has been noted that the experiences on this level have an impact on the choices that are made later. Based on the above stated lower level science experience of learners, teachers recommend that the most effective strategy for increasing learner's enrolment in science subjects in senior classes is through providing teaching and learning in the junior classes which is enjoyable and interesting to the learners. The teachers also note the impact of the context in which the learning

of science is taking place whilst the learners were concerned with the experimental work done in science classes. Therefore, the preparation of the school science learning context is seen as another strategy that could increase the number of learners in science classes in universities in the future.

Most of the science teachers in the Lyons and Quinn (2010) study indicate that learners lacked information on the different careers available to them. This lack of knowledge could be countered through the establishing of strong links with industry in order to give the learner information about different science-related careers at the appropriate time. Giving learners information at the stage when they are about to go to university could be too late as the trends of their careers were set when they choose subjects in previous years.

Within the Year 10 group, 80% of learners believed that their recent experience contributed to their choice of sciences in senior classes (Lyons & Quinn, 2010). Even though it is noted that past experiences influence subject choice, few learners demonstrate that their primary school experience influenced their choice of science as a subject. This however, does not mean primary science should not be a focus in the process of dealing with learners choice of science in higher classes.

Even though the teachers considered themselves to have less impact on learners' choice of science in senior classes than others such as parents and peers, the learners view was totally different as they demonstrated teachers as the main contributors

towards the subjects they chose (Lyons & Quinn, 2010). Learners who chose science indicated that they did that based on their teacher's advice. Teachers should therefore be supported in noting the role they play in their student's subject selection whilst also being supported in looking for strategies to develop the different teacher factors that directly or indirectly impact on learner's choices of science subjects.

Teachers generally (67%) believe that the decline in science enrolments in senior classes is due to a learner's tendency to choose those subjects which are considered less demanding academically, as given by the broad curriculum (Lyons & Quinn, 2010). The hidden view is that learners weigh the perceived difficulty of the subject and this impacts on their choice of subjects such as physics and chemistry as they are perceived to be more difficult that other subjects. Lyons and Quinn (2010) recommend that adequate recognition of the difficulty of science in the calculation of university entrance points would ensure that more learners go for science subjects.

2.7 Theoretical framework of the study

This study is intended to determine the factors educators perceive as influencing learners' choices in taking Physical Sciences in Grade 10 as a subject. Hence, there is a need to utilise a specific theoretical framework that would provide the basis for understanding learners' choices. Bottia, *et al*. (2012) show how they adopt a social cognitive theory (SCT) in order for them to understand the role that learners' school experiences play in their decision-making process of pursuing specific science subjects. Hence this study adopts social cognitive theory in order to interpret the

perceived factors educators have on what contributes to the specific choice of subjects made by learners.

Lent, Brown and Hackett (1994) present that SCT considers academic choice as a dynamic process as it involves a variety of factors contributing towards a specific choice by learners. SCT has been utilised to understand the process of motivation, personal evaluation and past experience that influences the choice of learners in taking science subjects during high school. Bandura (1989) notes that these personal encounters impact on individuals differently, with some making a small impact whilst others making a life-changing impact. The selection of which subject to follow in academic situation, therefore, is not a static process but a complex activity that is directly associated with different school and individual characteristics which might influence an individual to choose, or not to choose, a specific subject.

Bandura (1989) indicates that the planned or unplanned acquisition of knowledge on certain issues can change the course of life of an individual. The issues responsible for such changes could include factors such as personal self-belief, self-regulatory and personal confidence. These aspects allow an individual to expand the choices they make based on their interactions with people and the environment around them as explained by the SCT.

For the learners to be able to follow or choose science subjects they require a great deal of social support. Bandura (1989) has demonstrated that this is highly necessary during high school years when specific decisions about self are being made. The

different paths in life that learners follow, therefore, are influenced by societal structures and as well as a student's past course in life. Based on social cognitive theory, the different choices that individuals make are not only due to their inner self but also to the general interaction with the environment around them. Bandura (2001:287) demonstrates that "social cognitive theory analyses social diffusion of new behaviour patterns in terms of three constituent processes and the psychosocial factors that govern them. Bandura (2001) goes further to presents these three process as: i) the acquisition of knowledge about innovative behaviours, ii) the adoption of these behaviours in practice, and iii) the social networks through which individuals exist. Therefore the teachers perceived factors impacting on the learners choices is a result of complex interaction process that is based on a variety of factors utilised by an individual to have that specific perception.

In this study SCT will help the researcher understand the reason for the perceived choices made by the learners as seen by the teachers.

2.8 Summary

This chapter presented the different factors that were observed to influence learner's choice of sciences and how teachers perceived their role in the process. Furthermore, the chapter presented the theoretical framework adopted in the study. The next chapter will focus on the methodology and methods utilised in this study.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The study intends to determine educators' perception of factors influencing learners' choice of Physical Sciences in Grade 10 in the Free State, specifically in the Lejweleputswa District. Therefore, this chapter presents the adopted research design, methodology and the processes followed to collect the data. This has been achieved through a discussion of the quantitative research approach and how it would ensure the collection of data required to answer the set research questions. Furthermore, this chapter discusses the research methods as well as the specific sample and sampling methods utilised.

The methodology that is presented in this chapter was designed in order to answer the following research questions:

- What do Lejweleputswa District science educators perceive as the educator factors contributing towards the decline in Grade 10 Physical Sciences enrolments?
- Is there any relationship between the educators' views and their different biographical data?
- Which type of advice on Physical Sciences do educators perceive to help learners in their deliberations on subject choices?

- What role do educators think they have in the process of increasing enrolments in Grade 10 Physical Sciences?

Therefore, all the processes presented in this chapter were set to facilitate the collection, analysis and interpretation of data to help the researcher answer the above research questions.

3.2 Research design

Creswell (2012: 20) indicates that research design is “specific procedures involved in the research process: data collection, data analysis, and report writing”. Similarly, research design could be defined as the specific plan made to provide answers to the set research questions whilst also covering the strategies adopted to ensure the integrity of the research project (Polit & Beck, 2008:765). De Vos, *et al*. (2009:268) present research design as the researcher’s decisions on the process of the study. McMillan (2012:13) presents the research design as “the plan for carrying out a study”. McMillan then goes further to indicate that research design can be either qualitative, quantitative or through the use of mixed-methods.

McMillan (2012:12) presents qualitative research as an interpretive research that takes place in the natural setting as a strategy of understanding a particular phenomenon. This approach relies on the verbal narratives while in other situations this would include documented observations. Similarly Gay *et al*. (2011:7) present qualitative research as the process of collecting, analysing and interpreting narratives and visual

data. Fraenkel and Wallen (2010:15) indicate that qualitative researchers focus more on the understanding of a particular situation based on the participants' views and description.

McMillan (2012:14) presents the different types of qualitative research design as:

- Phenomenological study: which is the study intended to examine a particular issue and understand it.
- Ethnography: which involves the researcher's description and interpretation of a specific issue.
- Grounded study: focuses on the specific environment in order to produce or discover a theory.
- Case study: which is concerned with the in-depth investigation of events or programs.
- Critical study: is concerned with injustice or inequity with the specific setting.

Quantitative research design is research in which the collection and analysis of numbers are used in order to provide a description or explanation of a specific phenomenon (Gay, Mills & Airasian, 2011:7). McMillan (2012:11) describes quantitative research as an approach which studies a phenomenon objectively through obtaining different statistical measurements needed to answer set research questions. Gay *et al*. (2011:7) indicates that qualitative research goes beyond just the collection of numerical data as it has specific procedures needed to collect data. This research approach will not be utilised in this study.

Furthermore McMillan (2012:13) presents two types of quantitative research design, namely:

- Non-experimental research: the researcher does not have direct influence on the manipulation of certain factors to be investigated.
- Experimental research: in this particular design the researcher identifies a specific factor that will be manipulated in order to observe its impact on the participants.

The methodology is the general approach the researcher takes in carrying out the research project. To some extent this approach dictates the particular tools the researcher selects (Leedy & Ormrod 2013:12). In this study the researcher followed the quantitative research approach. This study, therefore, has been designed to follow quantitative research mainly utilising the non-experimental approach as the researcher will not manipulate any factor during or after data collection.

3.3 Population and sample

MacMillan (2012:96) indicates that the research questions presented by the researcher should provide direction from which the population and the sample will be drawn. The population of a study is described as all the possible units or elements which could be included in the study in order to get answers to the set research questions (Gray, 2009:148). Furthermore, the participants who form a group of those who will take part in the research study is described as a population (Durrheim &

Painter, 2006). MacMillan (2012:96) goes further to define a population as individuals in a specific group of interest meeting the set criteria for the planned research activity. From the population, which is the focus of the researcher, a small group is chosen for intended investigation and this is called a 'sample' for that study (Fraenkel & Wallen 2010:90). The population is therefore the entire set of individuals who have some common characteristics (Polit and Becker 2012:738), which in this study is the Physical Sciences teachers in Lejweleputswa District in the Free State.

Strydom (2011:224) has indicated that for most research studies it is not possible to collect data from the whole population, hence the researcher has to make a decision on a smaller group that is named as the sample group. A sample is also present as a subset of a population made of specific individuals who are selected to participate in the research study (Polit and Beck 2012:742). MacMillan (2012:95) presents a sample as part of the population which the researcher fully utilises to generate data for the intended research (Freankel & Wallen 2010:90). Polit and Beck (2012:742) describe sampling as a process of choosing a sample or a small group of individuals from the population to represent the entire population. Strydom (2011:224) has presented two kinds of sampling, namely probability and non-probability sampling (Creswell, 2012:142). Furthermore, these two kinds can be divided into sub-groups which then ensure that a researcher clarifies the process of picking the specific individuals that are participating in their research.

Probability sampling is a strategy used by the researcher to select specific individuals from the population to be the participants who represent the population (Creswell,

2012:142). Leedy and Ormrod (2013:207) describe probability sampling as a method of choosing a group of participants from a population in which all individuals have the potential to be represented. Strydom (2011:228) present probability sampling as made up of the following:

- Simple random sampling: this is the method used by most researchers (Creswell, 2012:143). In this method the researcher identifies the participants from individuals who are having equal opportunity of being selected. Leedy and Ormrod (2013:207) indicate that this approach is highly suitable when the population is small and the researcher knows all the participants.
- Stratified random sampling: Leedy and Ormrod (2013:211) have presented the definition of this approach by presenting an example in which research is being conducted in a school and the researcher selects Grade 4, 5 and 6 to take part. Therefore, in this approach the researcher divides the population using a specific character which in this example is the Grades of the population group.
- Systematic sampling: Creswell (2012:143) indicates that in this approach the researcher counts the participants and select every nth individual to make the set number. Hence, this approach selects the participants using a specific sequence.
- Cluster sampling: In some situations the population is found within a large area and the researcher cannot make a list of individuals in that area but there is nonetheless specific set demarcations (Leedy & Ormrod, 2013:211).

There are situations in which the researcher cannot predict the individuals that will form the sample (Leedy & Ormrod, 2013:214). Furthermore, some individuals within

the population have no chance in being selected to form part of the sample. Creswell (2012:145) indicates that the researcher in this approach depends on the participants who volunteer to participate. Non-probability sampling has been noted to include (Strydom, 2011:230):

- Convenience Sampling: Gay *et al*. (2011:140) describe convenience sampling as a process of collecting data from individuals who are available to participate at the time when data is being collected.
- Purposive sampling: MacMillan (2012:105) indicates that in this sampling method the researcher makes a selection of individuals based on their perceived knowledge of a particular topic. Gay *et al*. (2012:141) indicate that this method is sometimes called judgement sampling and it is a sample selection process which depends on the researcher's experience and knowledge of the group. Fraenkel and Wallen (2010:99) state that in purposive sampling, a sample is chosen by the researcher based on the researcher's familiarity with the participants and the research aim. The advantage of purposive sampling is that the researcher is guided by the understanding and knowledge of the participants.
- Quota sampling: Gay *et al*. (2012:141) demonstrate that for some research studies the sample is based on a specific number of individuals of different characters.
- Snowball sampling: Gay *et al*. (2012:141) describe this approach as a process in which the researcher selects participants based on the researcher's set requirement and the individuals' personal identification.

The study was set within the non-probability sampling approach with particular use of convenience sampling as a strategy of choosing the participants. Convenience sampling as a method of including all participants who happens to be available (Gay *et al.* 2011:140). In this study, the population was the Lejweleputswa District Physical Science teachers as they were found to be the relevant source of valuable information regarding the learners' choice of Physical Sciences in Grade 10. The population from which the sample was chosen was believed to have the necessary information that the researcher could utilise to answer the set research questions.

A questionnaire adopted from Lyons and Quinn (2010) was adopted and adjusted to suite the South African situation and then utilised to collect the data. The researcher distributed the questionnaires to the teachers in the schools chosen (Appendix 4). The researcher went to the schools to give the teachers the specific copies of the questionnaires. There were 100 questionnaires distributed to Physical Science teachers but only 74 were returned.

The participants were informed of the aim of this study and were also reassured that not taking part in this study would not impact on their employment. Furthermore, the participants were also made aware that taking part in this study was free and they could stop participation at any time. Participants were also informed that their personal information should not be written on any of the pages of the completed questionnaires. This would ensure that the participants freely share their views in the questionnaires without fear of being personally identified.

3.4 Data analysis

Data analysis is a process of bringing order, structure and meaning to the mass of collected data (De Vos *et al.* 2009:334). Creswell (2012:10) indicates that this involves the dismantling of data in order to make conclusions through tables, pictures, figures or providing explanatory words. In quantitative research, data analysis is a process of finding answers to the research questions using different statistical techniques through descriptive and inferential statistics (Fraenkel & Wallen, 2010:10).

In this study, data analysis started with the completed questionnaire being summarised in a Microsoft excel document which was later given to the statistician. Furthermore, the data was analysed using the Statistics Program for Social Sciences (SPSS) version 22 of 2014 to determine the perceived views that educators have on their influence on learners' choice on their selection of subjects.

3.5 Ethical considerations

MacMillan (2012:17) indicates that issues around ethics in research involves considerations of "what is right or wrong, good or bad, proper or improper". Similarly, Polit and Beck (2012:726) indicate that ethics in research is generally about the moral values and the degree of professionalism, legality and social obligations to the participants of the study. This study involves administration of questionnaires to human participants and it was required that the process and questions be ethical. The

questions were therefore checked by the different CUT research committees as well as other critical partners to ensure that they are not in any way unethical.

3.6 Permission to conduct the study

The researcher started with the necessary application and registration of the study within the Central University of Technology, Free State (CUT). The study was registered and approved within CUT which gave the researcher the opportunity to apply for the permission to conduct the study from the Department of Education Free State (See Appendix 1). The letter of permission from CUT was therefore utilised to get the necessary letter from the Lejweleputswa District Department of Education Director who authorised the researcher to gain access to participants, namely Physical Sciences teachers within the Lejweleputswa District high schools. Finally, the letter from the district office was received and presented to all the school Principals and teachers during data collection (Appendix 5).

3.7 Summary

This chapter presented the methodological process of this research study which was quantitative in nature and utilised a specific questionnaire to generate statistical data. The chapter has further presented the sample and the processes utilised to collect and analyse the data, including the ethical considerations. The next chapter will present the results from the questionnaire which will help the researcher to answer the set research questions.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents data from the 74 participants that took part in the study which was intended determine teachers views of the factors contributing towards the declining enrolments of students in Physical Sciences in Grade 10. This chapter further presents the analysis and interpretation of the data. Data analysis is done through descriptive and inferential statistics. Chambliss and Schutt (2013:156) have described descriptive statistics as a way a researcher describes the distribution of variables and further look at the relationship between these variables. Furthermore, Chambliss and Schutt indicate that inferential statistics is "used to estimate how likely it is that the statistics result based on the data from random sample is representative of the population from which the sample is assumed to have been selected". This chapter will therefore focus on statistics generated from the participant's answers to the different questions.

The data collected in this study is intended to answer the following research questions:

- What do Lejweleputswa District science educators perceive as the factors contributing towards the decline in Grade 10 Physical Sciences enrolments?
- Is there any relationship between the educators' views and their different biographical data?
- Which type of advice on Physical Sciences do educators perceive to help learners in their deliberations on subject choices?

- What role do educators think they have in the process of increasing enrolments in Grade 10 Physical Sciences?

Furthermore, this data was intended to help the researcher determine the educators' perceived factors influencing learners' choice of Physical Sciences in Grade 10 in the Free State, specifically the Lejweleputswa District. The study also aims to understand the educators' perceived factors of and their contribution towards the decline in learner enrolments in Grade 10 Physical Sciences as a subject choice.

Based on the data analysis and interpretation, the study will meet the following objectives:

- Determine the perceived factors educators believe influences learners' choices of Physical Sciences in Grade 10;
- Determine the relationship between the educators' biographical data and the factors that are perceived to influence learners choices of Physical Sciences in Grade 10;
- Determine the type of advice on Physical Sciences that educators perceive to help learners in their deliberation on subject choices;
- Establish the role that educators think they play in the process of increasing enrolments in Grade 10 Physical Sciences; and
- Provide recommendations on how to deal with the declining enrolments in Grade 10 Physical Sciences to the Department of Basic Education.

The below sections present the analysis of the responses that the respondents provided in order to answer the presented questions and meet the set objectives.

4.2 Research questions, aim and objectives of the study

Quantitative research requires the questionnaires used to demonstrate the attainment of reliable and valid data. The calculation of Cronbach's alpha presents the reliability of a questionnaire (Tavakol & Dennick, 2011:53). Tavakol and Dennick (2011:53) further note that reliability of a questionnaire determines the consistence of measuring what it has been planned for. The value of Cronbach's alpha ranges between 0 and 1 with the high reliability coefficient being given by the values which are close to 1. The Cronbach's alpha coefficient for this questionnaire is 0.846, which is above 0.7. Field (2009: 675) presents that any value above 0.6 is an acceptable value. Cronbach's alpha coefficient is closer to 1, therefore, which shows the reliability of the different questions presented in the questionnaire administered. These questions and statements, therefore, were testing what they were intended for.

4.3 Biographical data of participants

This section presents the biographical data of the participants who took part in this study. The total number of the individuals that took part is 74 but some questions were not answered by all and therefore the total for each question fluctuates.

Most participants (51.4%) are in the age range of 41 – 50 years with 51 and above following at 31.1%. Very few participants were aged between 20 and 30 years (Table

4.1). From this group, 72.9% were females while males were only 27.1% (Table 4.2). During the statistical analysis there were four categories produced during coding for age with “20-30 years” being “1” and “51 years and above” being “4”. Hence the mean age is 3.08 which is close to “41-50 years” of age with the standard deviation of 0.807 which shows that the age majority of the participants are above 31 years of age.

Table 4.1: Age of participants (Question 1)

	Frequency	Percentage	Cumulative %
20 - 30 years	4	5.4	5.4
31 - 40 years	9	12.2	17.6
41 - 50 years	38	51.4	68.9
51 and above	23	31.1	100.0
Total	74	100.0	

Table 4.2: Gender of participants (Question 2)

	Frequency	Percentage	Cumulative %
Female	51	72.9	72.9
Male	19	27.1	100.0
Total	70	100.0	

Table 4.3 shows that 86.5% of the teachers who took part in this study have a teaching qualification while 13.5% were not qualified teachers, hence they were specialists in other professions but not teaching. The table further presents that 39.2% of participants had certificates and diplomas while 21.6% had a Bachelors in Education and another 21.6% had a Master’s in Education. From this it can clearly be noted that there were by far more females taking part in this study than males.

Table 4.3: Highest qualifications of participants (Question 3)

	Frequency	Percentage	Cumulative %
STC	4	5.4	5.4
DIP	25	33.8	39.2
Bachelor of Education	16	21.6	60.8
Master of Education	16	21.6	82.4
Other Education Qualification	3	4.1	86.5
Other Qualification not in Education	10	13.5	100.0
Total	74	100.0	

Most of the participants (60.8%) had more than 15 years of experience while 16.2% had between 6 and 10 years of experience (Table 4.4). Furthermore, 12.2% of the participants had less than 5 years of experience and 10.8% had experience ranging from 11 to 14 years. Based on these six categories the mean was 3.26 which is just near the “Bachelor of Education” and the standard deviation was 1.453. This means therefore that the majority of the participants were between “diploma” and “other education qualification”.

Table 4.4: Educators’ experience (Question 4)

	Frequency	Percentage	Cumulative %
0 - 5 years	9	12.2	12.2
6 - 10 years	12	16.2	28.4
11 - 14 years	8	10.8	39.2
15 years and above	45	60.8	100.0
Total	74	100.0	

Table 4.5 shows that 81.9% of the educators who took part in this study were teaching Physical Sciences without teaching mathematics whilst 4.2% were teaching both subjects. Those who were also teaching mathematics only constituted 13.9%. Teaching experience was dived into four categories and based on this the average was 3.20 which is the category "11-14 years" and the standard deviation is 1.110. This means that most participants have experience of more than 6 years.

Table 4.5: Subject(s) taught in FET (Question 5)

	Frequency	Percentage	Cumulative %
Physical Sciences	59	81.9	81.9
Mathematics	10	13.9	95.8
Both Maths and Physical Sciences	3	4.2	100.0
Total	72	100.0	

4.3.1 Summary

The majority of the participants were aged between 41-50 years with most of the participants being females. Most participants had the necessary qualifications for teaching and had more than 15 years of teaching experience. Lastly, most of the participants have taught Physical Sciences in FET. Therefore, the majority of the participants had the necessary experience in teaching and specifically in the teaching of science and mathematics.

4.4 Data analysis on educators perceived factors

This section presents the statistics for the different choices that educators made when asked the different questions that relate to factors that would impact on students' choice of Physical Sciences in Grade 10. The questions provided the following option: "not at all influential" = 1, "Not very influential" = 2, "moderately influential" = 3, "very influential" = 4 and "extremely influential" = 5. Their choices, therefore, ranged between "1" and "5" for these questions. This means that the mean will be between "1" and "5".

4.4.1 Data from questions 7 to 11

Table 4.6: The wide range of subjects available to FET learners (Question 7)

	Frequency	Percentage	Cumulative %
Not at all influential	7	10.6	10.6
Not very influential	15	22.7	33.3
Moderately influential	28	42.4	75.8
Very influential	11	16.7	92.4
Extremely influential	5	7.6	100.0
Total	66	100.0	

Table 4.6 shows that 24.8% of the participants perceived that the availability of a wide range of subjects available for students in FET has a great influence on them while 42.4% believe that this has moderate influence and 33.3% think this is not influential. The mean is 2.88 which is close to 3, a "moderate influence" with the standard deviation being 1.060 (Table 4.11). Therefore, most participants ranged between "not very influential" and "very influential".

Table 4.7: The decrease in the number of learners taking mathematics (Question 8)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.9	5.9
Not very influential	13	19.1	25.0
Moderately influential	15	22.1	47.1
Very influential	21	30.9	77.9
Extremely influential	15	22.1	100.0
Total	68	100.0	

Table 4.7 presents the answers that participants gave when asked if the decrease in the number of learners taking mathematics has an impact on the learners opting for Physical Sciences in Grade 10. This shows that 53% of the participants recognised the decrease in mathematics having an influence in students' choice of Physical Sciences and 22.1% think that it has a moderate influence. Furthermore, 25% believe that the decreasing numbers in mathematics classes has no impact on the students' choice of Physical Sciences. When asked if the decrease in the number of learners taking mathematics affects the number of students choosing Physical Sciences, the mean was 3.44 which is between "moderate influence" and "very influential" while the standard deviation is given by 1.202 (Table 4.11). This demonstrates that the majority of the participants chose between "not very influential" and "extremely influential".

Table 4.8: Students choose courses seen as less academically demanding (Question 9)

	Frequency	Percentage	Cumulative %
Not at all influential	5	7.1	7.1
Not very influential	11	15.7	22.9
Moderately influential	29	41.4	64.3
Very influential	16	22.9	87.1
Extremely influential	9	12.9	100.0
Total	70	100.0	

Table 4.8 shows that 35.8% of the participants agreed that students choose courses that they think are less academically demanding as a factor impacting on the decrease in students choosing Physical Sciences in Grade 10. Furthermore, about 41.4% think that student's choice of courses of less academically demanding subjects has a moderate influence on student's choice of Physical Sciences in FET. A small group of participants (22.5%) did not perceive the decrease in students enrolling for Physical Sciences as being influenced by the students' idea of choosing courses seen as less demanding academically. The participants were asked if the decrease in the number of learners choosing Physical Sciences is a result of students deciding to choose the courses that they think are less demanding academically and the mean was 3.19. This mean is close to "moderate influence" and the standard deviation is given by 1.081 (Table 4.11). This standard deviation shows that most participants chose between "not very influential" and "extremely influential".

Table 4.9: The decrease in the number of role models in science, engineering and technology (SET) careers (Question 10)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.7	5.7
Not very influential	12	17.1	22.9
Moderately influential	29	41.4	64.3
Very influential	14	20.0	84.3
Extremely influential	11	15.7	100.0
Total	70	100.0	

About 41.4% perceived the lack of role models in sciences, engineering and technology careers as influencing the learners' choice of Physical Sciences while 35.7% think it had recognisable impact (Table 4.9). Again, 22.9% of the participants showed the belief that a lack of role models in the above-mentioned areas has no influence on a student's choice of Physical Sciences. The mean for this question is 3.23 which is just above 3 which represents "moderate influence" with the standard deviation being 1.092 (Table 4.11). This standard deviation demonstrates that most participants chose between "not very influential", "moderate influence" and "very influential".

Table 4.10: Students choose subjects believed to have less work (Question 11)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.7	5.7
Not very influential	10	14.3	20.0
Moderately influential	16	22.9	42.9
Very influential	22	31.4	74.3
Extremely influential	18	25.7	100.0
Total	70	100.0	

The answers of the participants varied when asked if a learners' decision to choose courses that are perceived to have less work has an impact on the learners' choice of Physical Sciences in Grade 10 (Table 4.10). Slightly more than half of the participants (53%) recognised the decrease in students' choice of Physical Sciences as influenced by the learners' desires to choose subjects that are believed to require less work. Furthermore, 22.9% of the participants believe that this has a moderate influence on learners' choice of Physical Sciences while 20% were clear that they believe that the decreasing numbers of students' choosing Physical Sciences is not influenced by the learners' desire to choose subjects believed to require less work. The mean for this question is 3.57 which could be located between the options of "moderate influence" and "very influential" with the standard deviation calculated as 1.187 (Table 4.11). This demonstrates that the majority of the participants chose between "not very influential" and "extremely influential".

4.4.2 Summary of data from question 7 to question 11

The analysis of questions 7 to 11 demonstrates that there were between 66 and 70 participants who answered the questions with the majority being those who answered questions 9 to 11 (see Table 4.11). These questions had five options ranging from "not very influential" to "extremely influential". Question 7 had the lowest mean of 2.88 while question 11 had the highest mean of 3.57. The distribution of the choices of the participants has been observed to be the least in question 7 with standard deviation being 1.069 while it was the highest for question 8 with the standard deviation of 1.202.

Table 4.11: Summary of five questions (Question 7 to 11)

	N	Minimum	Maximum	Mean	Std. Deviation
The wide range of subjects available to FET learners	66	1	5	2.88	1.060
A decrease in the number of learners taking mathematics affects numbers in Physical Sciences	68	1	5	3.44	1.202
A tendency for students to choose courses seen as less academically demanding	70	1	5	3.19	1.081
A decrease in the number of role models in science, engineering and technology (SET) careers	70	1	5	3.23	1.092
A tendency for students to choose courses believed to have less work	70	1	5	3.57	1.187

4.4.3 Data from questions 12 to 17

There were about 44.2% of participants who perceived students' tendency to choose courses seen as more interesting or engaging than science as influencing the learners' choice of Physical Sciences while 33.8% think it has a recognisable impact (Table 4.12). Again 22.1% of the participants think that a student's tendency to choose courses seen as more interesting or engaging than science has no influence on the student choice of Physical Sciences. The mean for this question has been shown as 3.26. This is just above "moderate influence" with the standard deviation being 1.087 (Table 4.18). This standard deviation demonstrates that most participants chose between "not very influential", "moderately influential" and "very influential".

Table 4.12: Students' tendency to choose courses seen as more interesting or engaging than science (Question 12)

	Frequency	Percentage	Cumulative %
Not at all influential	5	7.4	7.4
Not very influential	10	14.7	22.1
Moderately influential	23	33.8	55.9
Very influential	22	32.4	88.2
Extremely influential	8	11.8	100.0
Total	68	100.0	

The participants had varied answers when asked if they believed a learners' decision not to do Physical Sciences in Grade 10 is influenced by students' reluctance to persevere with repetitive tasks, as required in experimental work. This is presented in Table 4.13. The data shows that 38.3 % of the participants recognised the students' reluctance to persevere with repetitive tasks, as required in experimental work, as influencing their decision to choose Physical Sciences.

Table 4.13: Reluctance of students to persevere with repetitive tasks, as required in experimental work (Question 13)

	Frequency	Percentage	Cumulative %
Not at all influential	4	6.0	6.0
Not very influential	12	17.9	23.9
Moderately influential	26	38.8	62.7
Very influential	23	34.3	97.0
Extremely influential	2	3.0	100.0
Total	67	100.0	

Furthermore 38.8% of the participants are of the idea that students' reluctance to persevere with repetitive tasks, as required in experimental work, has a moderate influence on a learners' choice of Physical Sciences in Grade 10 while 23.9% showed

their belief that this has no influence at all. The mean for the analysis of this question is 3.26 and this is between the options of “moderate influence” and “very influential”. The standard deviation that was calculated is 1.087 (Table 4.18). This demonstrates that the majority of the participants chose between “not very influential” and “extremely influential”.

Table 4.14 presents the answers that participants gave when asked if learners’ negative experiences in science classes during lower phases had an impact on the learners not opting for Physical Sciences in Grade 10. The data shows that 39.1% of the participants recognised that learners’ negative experiences in science classes during lower phases has an influence in students’ choice of Physical Sciences whilst 36.2% think that it has a moderate influence. Furthermore, 24.6% think that the decreasing in the numbers of students who choose Physical Sciences is being influenced by learners’ negative experiences in science classes during lower phases. The mean for this analysis is 3.10 which is between “moderate influence” and “very influential” and the standard deviation is given by 0.940 (Table 4.18). The majority of the participants chose their answers between “not very influential” and “extremely influential”.

Table 4.14: Students' negative experiences in lower phases science classes (Question 14)

	Frequency	Percentage	Cumulative %
Not at all influential	6	8.7	8.7
Not very influential	11	15.9	24.6
Moderately influential	25	36.2	60.9
Very influential	17	24.6	85.5
Extremely influential	10	14.5	100.0
Total	69	100.0	

When asked if the content in Natural Sciences syllabus or curriculum which is done in Grades 8 and 9 has an influence on the learners' choice of Physical Sciences in Grade 10, the majority of the participants (43.3%) chose moderate in influence (Table 4.15). About 35.9% think that the content done by learners in Natural Sciences influence their choice of Physical Sciences, while 19.4% think that it is not influential and only 1.5% said it is not at all influential. Furthermore, Table 4.18 shows that the mean for this question is 3.22 which is slightly above "moderately influential" and the standard deviation is 0.918. This shows that the majority of the participant's choices ranged between "not very influential" and "very influential".

Table 4.15: The content in Natural Sciences syllabus or curriculum (Question 15)

	Frequency	Percentage	Cumulative %
Not at all influential	1	1.5	1.5
Not very influential	13	19.4	20.9
Moderately influential	29	43.3	64.2
Very influential	18	26.9	91.0
Extremely influential	6	9.0	100.0
Total	67	100.0	

Participants were asked if the quality of teaching in Natural Sciences classes had an influence on the learners' choice of Physical Sciences in Grade 10. The majority (43.5%) think that it has a moderate influence (Table 4.16). This is followed by 40.6% who think that the quality of teaching in Natural Sciences has an influence and 13.0% who think it is not very influential along with 2.9% who think it had not influence at all. The statistical analysis for this question presents the mean as 3.33 which is just above the option of "moderately influential" and with the standard deviation being 0.950 (Table 4.18). This demonstrates that the majority of the participants chose between "not very influential" and "very influential" for this question.

Table 4.16: The quality of teaching in Natural Sciences classes (Question 16)

	Frequency	Percentage	Cumulative %
Not at all influential	2	2.9	2.9
Not very influential	9	13.0	15.9
Moderately influential	30	43.5	59.4
Very influential	20	29.0	88.4
Extremely influential	8	11.6	100.0
Total	69	100.0	

The answers of the participants varied when asked if teacher-learner relationships in Natural Sciences classes has an influence on the learners' choice Physical Sciences in Grade 10 (Table 4.17). Around 45.6% of the participants recognised the decrease in learners' choice of Physical Sciences as moderately influenced by the teacher-learner relationships in Natural Sciences classes. Again 36.7% of the participants think that this has an influence on learners' choice of Physical Sciences while 16.2% were clear that they believe that the teacher-learner relationship in Natural Sciences classes is not very influential on learners choosing Physical Sciences in Grade 10.

The mean for this question is 3.26 which is close to the option of "moderately influential" and the standard deviation is calculated as 0.891 (Table 4.18). This demonstrates that the majority of the participants chose between "not very influential" and "very influential".

Table 4.17: The teacher-learner relationship in Natural Sciences classes (Question 17)

	Frequency	Percentage	Cumulative %
Not at all influential	1	1.5	1.5
Not very influential	11	16.2	17.6
Moderately influential	31	45.6	63.2
Very influential	19	27.9	91.2
Extremely influential	6	8.8	100.0
Total	68	100.0	

4.4.4: Summary of data from question 12 to question 17

Table 4.18: Summary of responses for questions 12 to 17

	N	Minimum	Maximum	Mean	Std. Deviation
A tendency to choose courses seen as more interesting or engaging than science	68	1	5	3.26	1.087
A greater reluctance among today's students to persevere with repetitive tasks, as required in experimental work	67	1	5	3.10	0.940
Students' negative experiences in lower phases science classes	69	1	5	3.20	1.145
The content in Natural Sciences syllabus or curriculum	67	1	5	3.22	0.918
The quality of teaching in Natural Sciences classes	69	1	5	3.33	0.950
The teacher-learner relationship in Natural Sciences classes	68	1	5	3.26	0.891

Table 4.18 presents the analysis of questions 12 to 17 where there were between 67 and 69 participants who answered these questions. As in the previous set of questions, these questions had five options ranging from “not very influential” to “extremely influential”. All the questions had their means above 3 and their means ranged between 3.10 and 3.33. The question which asked the participants about the “greater reluctance among today’s students to persevere with repetitive tasks, as required in experimental work” had the lowest mean of 3.10 while the question which asked them about “The quality of teaching in Natural Sciences classes” had the highest mean of 3.33. The distribution of the choices of the participants has been observed to range between 0.891 and 1.145. The question on the influence of “The teacher-learner relationship in Natural Sciences classes” seemed to have the least standard deviation, being 0.891, while the question which asked the participants about the influence of “Students’ negative experiences in lower phases Science classes” in their choice of Physical Sciences was the highest, with the standard deviation of 1.145.

4.4.5 Data from question 18 to question 27

The participants had varied answers when asked if a learners’ decision not to do Physical Sciences in Grade 10 is influenced by the teaching approaches utilised in Natural Sciences classes. This is presented in Table 4.19. The data shows that the majority of the participants (39.1%) recognise the teaching approaches utilised in Natural Sciences classes as moderately influencing the learners’ decisions to choose Physical Sciences. Furthermore, 42.0% of the participants are of the idea that the teaching approaches utilised in Natural Sciences classes have a great influence on a learners’ choice of Physical Sciences in Grade 10 while 14.5% believe that this is not very influence and 4.3% saying it is not influential at all. The mean for the analysis of

this question is 3.28 which is between the options of “moderately influential” and “very influential”. The standard deviation that was calculated is 0.968 (Table 4.29). This demonstrates that the majority of the participants chose between “not very influential” and “very influential”.

Table 4.19: The teaching approaches utilised in Natural Sciences classes (Question 18)

	Frequency	Percentage	Cumulative %
Not at all influential	3	4.3	4.3
Not very influential	10	14.5	18.8
Moderately influential	27	39.1	58.0
Very influential	23	33.3	91.3
Extremely influential	6	8.7	100.0
Total	69	100.0	

The participants had varied answers when asked if a learners’ decision not to do Physical Sciences in Grade 10 is influenced by the decline in the amount of practical and experimental work undertaken in Natural Sciences classes. This is presented in Table 4.20. The data shows that 40.6% of the participants recognised the decline in the amount of practical and experimental work undertaken in Natural Sciences classes as having a moderate influence on the learners’ decisions to choose Physical Sciences. Furthermore, 40.5% of the participants are of the idea that the decline in the amount of practical and experimental work undertaken in Natural Sciences classes is influential on learners’ choices of Physical Sciences in Grade 10 whilst 15.9% declared this as not very influential and 2.9% say it is not at all an influencing factor. The mean for the analysis of this question is 3.35, just above the option of “moderately influential” and the standard deviation that was calculated is 1.027 (Table 4.29). This

demonstrates that the majority of the participants chose between “not very influential” and “very influential”.

Table 4.20: A decline in the amount of practical and experimental work undertaken in Natural Sciences classes (Question 19)

	Frequency	Percentage	Cumulative %
Not at all influential	2	2.9	2.9
Not very influential	11	15.9	18.8
Moderately influential	28	40.6	59.4
Very influential	17	24.6	84.1
Extremely influential	11	15.9	100.0
Total	69	100.0	

Participants were asked if the content in Physical Sciences syllabus or curriculum had an influence on the learners’ choice of Physical Sciences in Grade 10 with the result that 46.4% think that it has a moderate influence (Table 4.21). This is followed by 33.3% who think that the content in Physical Sciences syllabus or curriculum has an influence and 13.0% think it is not very influential with a further 7.2% who think it has no influence at all. The statistical analysis for this question presents the mean as 3.33 which is just above the options of “moderately influential” and with the standard deviation being 0.950 (Table 4.18). This demonstrates that the majority of the participants chose between “not very influential” and “very influential”.

Table 4.21: The content in Physical Sciences syllabus or curriculum (Question 20)

	Frequency	Percentage	Cumulative %
Not at all influential	5	7.2	7.2
Not very influential	9	13.0	20.3
Moderately influential	32	46.4	66.7
Very influential	19	27.5	94.2
Extremely influential	4	5.8	100.0
Total	69	100.0	

Table 4.22 shows that 36.8% of the participants agreed that the quality of teaching in Physical Sciences classes is a factor impacting on the decrease in students choosing Physical Sciences in Grade 10. Furthermore, about 41.2% think that the quality of teaching in Physical Sciences classes has just a moderate influence on a learner's choice of Physical Sciences in Grade 10. A small group of 16.2% of participants perceive the quality of teaching in Physical Sciences classes as not very influential in the numbers of learners enrolling for Physical Sciences in Grade 10 whilst 5.9% think that it has no influence at all. The mean was 3.12 which is close to "moderately influential" and the standard deviation is given by 1.045 (Table 4.29). This standard deviation shows that most participants chose between "not very influential" and "very influential".

Table 4.22: The quality of teaching in Physical Sciences classes (Question 21)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.9	5.9
Not very influential	11	16.2	22.1
Moderately influential	28	41.2	63.2
Very influential	17	25.0	88.2
Extremely influential	8	11.8	100.0
Total	68	100.0	

There were about 47.1% of participants who perceived the teaching approaches utilised in Physical Sciences classes as moderately influencing the learners' choice of Physical Sciences while 32.3% think it is very influential (Table 4.23). Once again 14.7% of the participants think that the teaching approaches utilised in Physical Sciences classes are very influential on the student's choice of Physical Sciences and 5.9% are clear that they believe it is not influential at all. The mean for this question has been shown as 3.15, just above "moderately influential" with the standard deviation being 0.981 (Table 4.29). The value of standard deviation demonstrates that most participants chose between "not very influential", "moderately influential" and "very influential".

Table 4.23: The teaching approaches utilised in Physical Sciences classes (Question 22)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.9	5.9
Not very influential	10	14.7	20.6
Moderately influential	32	47.1	67.6
Very influential	16	23.5	91.2
Extremely influential	6	8.8	100.0
Total	68	100.0	

The participant's answers varied when asked if the teacher-learner relationship in Physical Sciences classes has an influence on a learner's decision not to do Physical Sciences in Grade 10 (Table 4.24). The data shows that the majority of the participants (49.3%) recognised the teacher-learner relationship in Physical Sciences classes as moderately influencing the learner's decisions to choose Physical Sciences. Furthermore, 31.8% of the participants are of the idea that the teacher-learner relationship in Physical Sciences classes has a great influence on a learner's

choice of Physical Sciences in Grade 10 while 13.0% declared that this is not very influential and 5.8% said it is not influential at all. The mean for the analysis of this question has been 3.17 and this is close to the option of "moderately influential". The standard deviation that was calculated is 0.985 (Table 4.29). This demonstrates that the majority of the participants chose between "not very influential" and "very influential".

Table 4.24: The teacher-learner relationship in Physical Sciences classes (Question 23)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.8	5.8
Not very influential	9	13.0	18.8
Moderately influential	34	49.3	68.1
Very influential	15	21.7	89.9
Extremely influential	7	10.1	100.0
Total	69	100.0	

When asked if the learners' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points and the effect this has on influencing the learners' choice of Physical Sciences in Grade 10, the majority of participants (41.2%) chose "moderately influential" (Table 4.25). About 27.9% think that learners' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points influence their choice of Physical Sciences, while 20.6% think that it is not very influential and only 16.3% said it is not at all influential. Furthermore, Table 4.29 shows that the statistical mean for this question is 2.91 which is slightly close to "moderately influential" and the standard deviation which is 1.018. The value of the

standard deviation shows that the majority of participant's choices ranged between "not very influential" and "very influential".

Table 4.25: Students' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points (Question 24)

	Frequency	Percentage	Cumulative %
Not at all influential	7	10.3	10.3
Not very influential	14	20.6	30.9
Moderately influential	28	41.2	72.1
Very influential	16	23.5	95.6
Extremely influential	3	4.4	100.0
Total	68	100.0	

Participants were asked if the increased competition in university entrance had an influence on the learners' choice of Physical Sciences in Grade 10 and it shows that the majority (44.9%) think that it is very influential (Table 4.26). This is followed by 27.5% who think that the increased competition in university entrance has a moderate influence and 23.2% who think it is not very influential along with 4.3% who think it had no influence at all. The statistical mean for this question is 3.22 which is just above the options of "moderately influential" and the standard deviation has been presented as 1.041 in Table 4.29. This demonstrates that the majority of the participants chose between "not very influential" and "very influential".

Table 4.26: The increased competition in university entrance (Question 25)

	Frequency	Percentage	Cumulative %
Not at all influential	3	4.3	4.3
Not very influential	16	23.2	27.5
Moderately influential	19	27.5	55.1
Very influential	25	36.2	91.3
Extremely influential	6	8.7	100.0
Total	69	100.0	

Table 4.27: Students' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid (Question 26)

	Frequency	Percentage	Cumulative %
Not at all influential	7	10.1	10.1
Not very influential	15	21.7	31.9
Moderately influential	27	39.1	71.0
Very influential	12	17.4	88.4
Extremely influential	8	11.6	100.0
Total	69	100.0	

Table 4.27 shows that 39.1% of the participants agreed that learners' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid is moderately influencing learners choice of Physical Sciences in Grade 10. Furthermore, 29.0% think that learners choice of Physical Sciences in Grade 10 is seen as influenced by learners' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid. A small group of the participants (21.7%) perceived learners' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid as not very influential towards learners choosing Physical Sciences. The participants were asked if the decrease in the number of learners taking Physical Sciences is a result of learners' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid and the mean was 2.99. This mean is close to "moderately influential" and the standard deviation is

given as 1.131 (Table 4.29). This standard deviation shows that most participants chose between “not very influential” and “very influential”.

Participants were asked if learners’ lack of knowledge about the wide range of SET careers available had an influence on the learners’ choice of Physical Sciences in Grade 10 and the majority (44.9%) think that it is moderately influential (Table 4.28). This is followed by 36.2% who think that learners’ lack of knowledge about the wide range of SET careers available has a great influence and 14.5% who think it is not very influential with 4.3% who don’t believe it has any influence at all. The statistical mean for this question is 3.26 which is just above the option of “moderately influential” and the standard deviation has been presented as 1.010 in Table 4.29. This demonstrates that the majority of the participants chose between “not very influential” and “very influential” for this statement.

Table 4.28: Students’ lack of knowledge about the wide range of SET careers available (Question 27)

	Frequency	Percentage	Cumulative %
Not at all influential	3	4.3	4.3
Not very influential	10	14.5	18.8
Moderately influential	31	44.9	63.8
Very influential	16	23.2	87.0
Extremely influential	9	13.0	100.0
Total	69	100.0	

4.4.6: Summary of data from question 18 to question 27

The analysis of questions 18 to 27 shows that there were between 68 and 69 participants who answered these questions with very few questions being answered

by 68 of the participants (Table 4.29). These questions had five options ranging from "not very influential" to "extremely influential". Questions about the influence of "students' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points" had the lowest mean of 2.91 while the question which asked the about the influence of the "decline in the amount of practical and experimental work undertaken in Natural Sciences classes" had the highest mean of 3.35.

Table 4.29: Summary of responses for questions 18 to 27

	N	Minimum	Maximum	Mean	Std. Deviation
The teaching approaches utilised in Natural Sciences classes	69	1	5	3.28	0.968
A decline in the amount of practical and experimental work undertaken in Natural Sciences classes	69	1	5	3.35	1.027
The content in Physical Sciences syllabus or curriculum	69	1	5	3.12	0.963
The quality of teaching in Physical Sciences classes	68	1	5	3.21	1.045
The teaching approaches utilised in Physical Sciences classes	68	1	5	3.15	0.981
The teacher-learner relationship in Physical Sciences classes	69	1	5	3.17	0.985
Students' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points	68	1	5	2.91	1.018
The increased competition in university entrance	69	1	5	3.22	1.041
Students' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid	69	1	5	2.99	1.131
Students' lack of knowledge about the wide range of SET careers available	69	1	5	3.26	1.010

The choices of participants did not vary much (SD=0.963) when asked if "the content in Physical Sciences syllabus or curriculum" had an influence in the student choice of Physical Science" and was the lowest in this group. The highest standard deviation for this group was for the statement "students' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid" with a value of 1.131 which shows that the participants view of this factor varied.

4.4.7 Data from question 28 to question 34

Table 4.30 shows that 34.7% of the participants agreed that the perception among students that there is a low demand for SET jobs is a factor which is very influential on the learners' choice of Physical Sciences in Grade 10. Furthermore, about 39.1% think that the perception among students that there is a low demand for SET jobs has a moderate influence on student's choosing Physical Sciences. A small group of participants (20.3%) did not perceive the decrease in students enrolling for Physical Sciences as being influenced by the perception among students that there is a low demand for SET jobs. The mean for this question is 3.10. This mean is close to "moderately influential" and the standard deviation is given by 1.002 (Table 4.37). This standard deviation shows that most participants chose between "not very influential" and "very influential" for this question.

Table 4.30: A perception among students that there is a low demand for SET jobs (Question 28)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.8	5.8
Not very influential	14	20.3	26.1
Moderately influential	27	39.1	65.2
Very influential	19	27.5	92.8
Extremely influential	5	7.2	100.0
Total	69	100.0	

The participant's answers when asked if a learners' decision not to do Physical Sciences in Grade 10 is influenced by a teacher's comments about Physical Sciences are presented in Table 4.31. The data shows that the majority of the participants (34.8%) recognise that a teachers comments about Physical Sciences as moderately influencing the learners decisions to choose Physical Sciences. A further 31.8% of the participants believe that the teachers comments about Physical Sciences has a great influence on learners' choice of Physical Sciences in Grade 10 while 27.5% noted that they don't think this is very influential and 5.8% say it is not influential at all. The mean for the analysis of this question is 3.00 which is between the options of "moderately influential" and "very influential". The standard deviation that was calculated is 1.029 (Table 4.37) which demonstrates that the majority of the participants chose between "not very influential" and "very influential".

Table 4.31: The teacher's comments about Physical Sciences (Question 29)

	Frequency	Percentage	Cumulative %
Not at all influential	4	5.8	5.8
Not very influential	19	27.5	33.3
Moderately influential	24	34.8	68.1
Very influential	17	24.6	92.8
Extremely influential	5	7.2	100.0
Total	69	100.0	

Table 4.32 shows that the highest number of participants (39.7%) agreed that family and friend's comments about Physical Sciences moderately influence the learner's choice of Physical Sciences in Grade 10. Secondly, 29.4% think that family and friends comments about Physical Sciences are not very influential on a learner's choice of Physical Sciences. Thirdly, a smaller group participants (27.9%) did think that family and friends comments about Physical Sciences greatly influence the learner's choice of Physical Sciences. The mean for this question is 3.01. This mean is close to "moderately influential" and the standard deviation is given by 0.985 (Table 4.37). This standard deviation shows that most participants chose between "not very influential" and "very influential".

Table 4.32: The family and friends comments about Physical Sciences (Question 30)

	Frequency	Percentage	Cumulative %
Not at all influential	2	2.9	2.9
Not very influential	20	29.4	32.4
Moderately influential	27	39.7	72.1
Very influential	13	19.1	91.2
Extremely influential	6	8.8	100.0
Total	68	100.0	

When asked if the students' perceptions that science can have a negative impact on society, the majority of participants (33.3%) chose "moderately influential" (Table 4.33). About 25.7% think that learners' perceptions that science can have a negative impact on society has influenced their choice of Physical Sciences, while 16.7% believe that this is not very influential and only 24.2% said it is not at all influential.

Table 4.33: Students' perceptions that science can have a negative impact on society (Question 31)

	Frequency	Percentage	Cumulative %
Not at all influential	16	24.2	24.2
Not very influential	11	16.7	40.9
Moderately influential	22	33.3	74.2
Very influential	15	22.7	97.0
Extremely influential	2	3.0	100.0
Total	66	100.0	

Furthermore Table 4.37 shows the statistical mean of 2.64 for this question which is close to "moderately influential" and the standard deviation is 1.172. The value of the standard deviation shows that the majority of the participant's choices ranged between "not very influential" and "very influential".

The majority of the participants (34.8%) agreed that learners' decisions not to do Physical Sciences in Grade 10 is greatly influenced by the decline in the number of parents who encourage their children to take science courses (Table 4.34). The data shows that 26.1% of the participants recognised the decline in the number of parents who encourage their children to take science courses as moderately influencing the learner's decisions to choose Physical Sciences. Furthermore, 24.6% of the

participants are of the idea that the decline in the number of parents who encourage their children to take science courses is not very influential on learners' choice of Physical Sciences in Grade 10 while 14.5% noted that they believe this as not influential at all.

Table 4.34: A decline in the number of parents who encourage their children to take science courses (Question 32)

	Frequency	Percentage	Cumulative %
Not at all influential	10	14.5	14.5
Not very influential	17	24.6	39.1
Moderately influential	18	26.1	65.2
Very influential	16	23.2	88.4
Extremely influential	8	11.6	100.0
Total	69	100.0	

The mean for the statistical analysis of this question is 2.93 and this is between the options of "moderately influential" and "very influential". The standard deviation that was calculated is 1.240 (Table 4.37). This demonstrates that the majority of the participants chose between "not very influential" and "very influential".

In Table 4.35 the data shows that 35.3% of the participants agreed that the way mass media depicts science or scientists is highly influential in learners' choice of Physical Sciences in Grade 10. About 23.5% think that the way mass media depicts Science or scientists moderately influences learners' choice of Physical Sciences. Another 23.5% of the participants perceived the way mass media depicts science or scientists as not having a real influence on learners' choice of Physical Sciences while 17.6% thought it had no influence at all. When the participants were asked if the decrease in

the number of learners taking Physical Sciences is a result of the way the mass media depicts science or scientists, the statistics shows the mean of 3.87. This mean is close to "very influential" and the standard deviation is given by 1.268 (Table 4.37). This standard deviation shows that most participants chose between "not very influential" and "extremely influential" for this statement.

Table 4.35: The way the mass media depicts science or scientists (Question 33)

	Frequency	Percentage	Cumulative %
Not at all influential	12	17.6	17.6
Not very influential	16	23.5	41.2
Moderately influential	16	23.5	64.7
Very influential	17	25.0	89.7
Extremely influential	7	10.3	100.0
Total	68	100.0	

About 29.4% of the participants agreed that a lack of effort from science organisations and university faculties to encourage learners to choose senior science courses has a great influence on learners' choice of Physical Sciences in Grade 10 (Table 4.36). Again 27.9% think that this lack of effort has a moderate influence on students' choice of Physical Sciences in FET. Around 23.5% of participants perceived this lack of effort from science organisations and university faculties to encourage learners to choose senior science courses as not really influential on learners' choice of Physical Sciences. The statistical analysis of this question gives a mean of 2.78 which is close to "moderately influential" and the standard deviation is given as 1.256 (Table 4.37). This standard deviation shows that most participants chose between "not very influential" and "very influential".

Table 4.36: A lack of effort from science organisations and university faculties to encourage students to choose senior science courses (Question 34)

	Frequency	Percentage	Cumulative %
Not at all influential	13	19.1	19.1
Not very influential	16	23.5	42.6
Moderately influential	19	27.9	70.6
Very influential	13	19.1	89.7
Extremely influential	7	10.3	100.0
Total	68	100.0	

4.4.8 Summary of data from questions 28 to 34

For all these questions the responses ranged between “1 = not influential” and “5 = extremely influential” while all the questions had means close to 3, except for the questions which asked if the learners perception of science can have impact on society (Table 4.37). There is only one question with the standard deviation below 1 which is the question about the influence comments made by family and friends has. This shows that responses provided by the participants spread away from the mean while for this question the responses are closely spread around the mean.

Table 4.37: Summary of responses for questions 28 to 34

	N	Minimum	Maximum	Mean	Std. Deviation
A perception among students that there is a low demand for SET jobs	69	1	5	3.10	1.002
The teachers comments about Physical Sciences	69	1	5	3.00	1.029
The family and friends comments about Physical Sciences	68	1	5	3.01	0.985
Students’ perceptions that science can have a negative impact on society	66	1	5	2.64	1.172

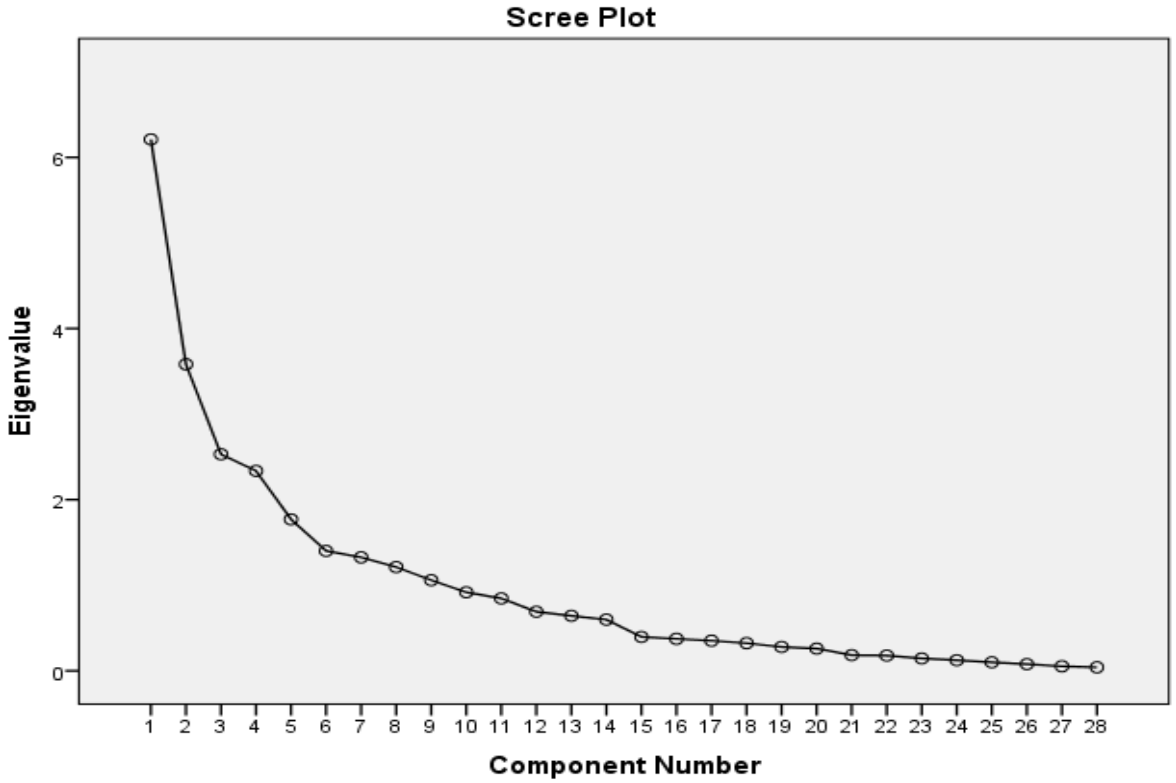
A decline in the number of parents who encourage their children to take science courses	69	1	5	2.93	1.240
The way the mass media depicts science or scientists	68	1	5	2.87	1.268
A lack of effort from science organisations and university faculties to encourage students to choose senior science courses	68	1	5	2.78	1.256

4.5 FACTOR ANALYSIS

Pallant (2005:172) indicates that questionnaires start with different questions and statements which can be brought together through the use of factor analysis. Factor analysis is utilised to refine and reduce these questions to combine those that are similar, hence producing a smaller number of coherent headings. Furthermore, factor analysis is used to "reduce large number of related variables to a more manageable number, prior to using them in other analyses such as multiple regression or multivariate analysis of variance" (Pallant, 2005: 172). The factors produced during the analysis could be too many and hence the screen test is utilised to help the researcher to decide on the specific factors that can be adopted. Pallant (2005: 177) has indicated that the screen test was proposed by Catell in 1966.

SPSS is utilised to take the different eigenvalues of each factor to demonstrate the shape or curve that shows a different slope. This slope changes direction until it becomes horizontal. Pallant (2005:177) shows that Catell recommended the use of all the factors that appear before the first sharp turn of the slope as these have the greatest contribution necessary to the explanation of the variance in the data set.

Figure 4.1: Scree Plot



The suitability of data for factor analysis was assessed using the Kaiser-Meyer-Oklin and the value that was obtained is 0.666 (Table 4.38) which is just above the recommended value of 0.6 (Pallant, 2005: 191), hence the use of factor analysis is appropriate for this study. All the questions and statements that were presented in the questionnaires utilised in this study, excluding those that were determining the biographical data of the participants, were subjected to principal components analysis using SPSS Version 22.

Table 4.38: Kaiser-Meyer-Olkin and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.666
Bartlett's Test of Sphericity	Approx. Chi-Square	875.507
	Df	378
	Sig.	0.000

Inspection of the correlation matrix revealed the presence of many coefficients of 0.3 and above. The scree plot presented in Figure 4.1 shows a steep decline between the first three factors and later again a sharp decline for another three factors. There is a clear break after the sixth factor.

Based on this scree test, six factors were retained for further analysis and comparison with the biographical data of participants in order to provide answers to the set research questions. Despite the change of slope after the third factor the researcher decided to also include the other 3 factors which also had a similar slope. This has been done to ensure the inclusion of more items from the questionnaire. These factors were then given a description depending on the specific items that are found in these groups.

The factors in their order will be named:

- Factor 1: External Factors: Out of school factors
- Factor 2: Teaching and learning in Physical Sciences
- Factor 3: Teaching and learning in Natural Sciences
- Factor 4: Possible options after doing Physical Sciences
- Factor 5: Student motivating factors
- Factor 6: Student personal experiences

The following sections and tables present the questions that were found in each of the factors.

4.5.1 External Factors

This factor was performed and this brought together seven questions listed in Table 4.39 above. This factor has the highest number, with seven statements. The statements are focus on external science organisations, student view of the impact of science to society, lack of parental encouragement, family and friends' comments and the media. This factor has been named "External Factors impacting on students' view of Physical Sciences" and mostly will be presented as just "external factors".

Table 4.39: Questions and statements that constituted factor 1 (External Factors: Out of school factors)

Statements	Values
A lack of effort from science organisations and university faculties to encourage students to choose senior science courses	0.851
Students' perceptions that science can have a negative impact on society	0.821
A decline in the number of parents who encourage their children to take science courses	0.790
The way the mass media depicts science or scientists	0.719
The teachers comments about Physical Sciences	0.590
A perception among students that there is a low demand for SET jobs	0.519
The family and friends comments about Physical Sciences	0.579

4.5.2 Teaching and learning in Physical Sciences

Table 4.40: Questions and statements that constituted factor 2 (Teaching and learning in Physical Sciences)

Statements	Values
The teaching approaches utilised in Physical Sciences classes	0.849
The content in Physical Sciences syllabus or curriculum	0.795
The teacher-learner relationship in Physical Sciences classes	0.791
The quality of teaching in Physical Sciences classes	0.772

The second factor is made up of five statements which are based on the curriculum, teacher-learner relationship, teaching approaches, quality of teaching and content in Physical Science classrooms. This factor is focusing on teachers' perceptions that the activities that are related to Physical Sciences have an impact on a student's desire to opt for Physical Sciences. Therefore this factor has been named "Teaching and learning in Physical Sciences".

4.5.3 Teaching and learning in Natural Sciences

The third factor has been made up of three statements which covers believed influences of the:

- content in Natural Sciences in the senior phase
- teacher-learner relationship within the Natural Science classrooms;
- quality of teaching taking place in Natural Science classes.

This factor has therefore been named "Teaching and learning in Natural Sciences".

Table 4.41: Questions and statements that constituted factor 3 (Teaching and learning in Natural Sciences)

Statements	Values
The quality of teaching in Natural Sciences classes	0.840
The teacher-learner relationship in Natural Sciences classes	0.822
The content in Natural Sciences syllabus or curriculum	0.737

4.5.4 Possible options after doing Physical Sciences

This factor is made up of three statements focusing on the wide range of subjects available to FET learners, the comments about Physical Science made by family and

friends and the increased competition in university entrance. This factor presents the teachers' perceptions on the listed statements and their impact on the student choices of Physical Sciences. This factor has therefore been named "Possible options after doing Physical Sciences".

Table 4.42: Questions and statements that constituted factor 4 (Possible options after doing Physical Sciences)

Statements	Values
The wide range of subjects available to FET learners	0.761
The family and friends comments about Physical Sciences	0.626
The increased competition in university entrance	0.612

4.5.5 Student motivating factors

The factor named "student motivating factors" has been made up of three statements which focus on the tendency for students to choose courses seen as less academically demanding, a decrease in the number of the role models in science professions and a decrease in the number of learners taking mathematics.

Table 4.43: Questions and statements that constituted factor 5 (Student motivating factors)

Statements	Values
A tendency for students to choose courses seen as less academically demanding	0.711
A decrease in the number of role models in science, engineering and technology (SET) careers	0.684
A decrease in the number of learners taking mathematics affects numbers in Physical Sciences	0.676

4.5.6 Student personal experiences

Table 4.44: Questions and statements that constituted factor 6 (Student personal experiences)

Statements	Values
A greater reluctance among today's students to persevere with repetitive tasks, as required in experimental work	0.742
Students' negative experiences in lower phases science classes	0.672

This last factor is made up of only two questions which are: greater reluctance among today's students to persevere with repetitive tasks, as required in experimental work and learners' negative experiences in lower phases science classes. Therefore, this factor has been named "student personal experiences".

4.6 Relationship between participants biographical information and the factors

The following section focuses on the different factors that were generated above mainly comparing them with the biographical information of the participants. This analysis is important as it provides the necessary check to see if the results are influenced by the different biographical information of each participant.

4.6.1 Participants' age

4.6.1.1 External Factors

Table 4.45 presents the statistical analysis which determined if there is relationship between external factors and age with the chi-square of 55.650. The analysis shows the degree of freedom being 75 with a significance level of 0.954 ($p > 0.05$). Therefore

the conclusion is that participants' age is not related to the view that external factors have on the choice of Physical Sciences.

Table 4.45: Chi-Square Tests for participants' age and external factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.650[a]	75	0.954
Likelihood Ratio	61.570	75	0.867
Linear-by-Linear Association	0.007	1	0.932
N of Valid Cases	74		
a. 103 cells (99.0%) have an expected count of less than 5. The minimum expected count is .05.			

4.6.1.2 Teaching and learning in Physical Sciences

Table 4.46: Chi-Square Tests for participants' age and Teaching and learning in Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	66.078[a]	57	0.192
Likelihood Ratio	58.499	57	0.420
Linear-by-Linear Association	0.013	1	0.908
N of Valid Cases	69		
a. 79 cells (98.8%) have an expected count of less than 5. The minimum expected count is .06.			

Table 4.46 presents the chi square value of 66.078 with the significance of 0.192. This shows the value of p being greater than 0.05 and 57 being the degree of freedom. This statistical analysis presents that there was no relationship between participants' age and their view of the impact of teaching that takes place in Physical Sciences. Therefore the age of the participants does not have any impact on the choice of teaching Physical Sciences as a factor influencing students' choice of Physical Sciences.

4.6.1.3 Teaching and learning in Natural Sciences

The Pearson chi square value for this analysis is 27.370 and the significance value is 0.604 ($p > 0.05$). This analysis also shows the degree of freedom as 30 (Table 4.47). Therefore this analysis demonstrates that there is no statistical relationship between the participants' age and their view of the impact of teaching that takes place during the Natural Sciences.

Table 4.47: Chi-Square Tests for participants' age and Teaching and learning in Natural Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.370[a]	30	0.604
Likelihood Ratio	34.151	30	0.275
Linear-by-Linear Association	1.996	1	0.158
N of Valid Cases	69		
a. 41 cells (93.2%) have an expected count of less than 5. The minimum expected count is .06.			

4.6.1.4 Possible options after doing Physical Sciences

The statistical relationship between age of the participants and the influence of possible options after doing Physical Science is presented in Table 4.47. The results presents a Pearson Chi square value of 26.089 with the degree of freedom of 33 and a significance value of 0.798 ($p > 0.05$). This shows therefore that there is no statistical relationship between the participants' age and their view of the impact of possible options after doing Physical Science.

Table 4.48: Chi-Square Tests for participants' age and possible options after doing Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.089[a]	33	0.798
Likelihood Ratio	32.141	33	0.510
Linear-by-Linear Association	0.645	1	0.422
N of Valid Cases	71		
a. 44 cells (91.7%) have an expected count of less than 5. The minimum expected count is .06.			

4.6.1.5 Student motivating factors

Table 4.49: Chi-Square Tests for participants' age and students personal evaluation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.753[a]	36	0.019
Likelihood Ratio	49.943	36	0.061
Linear-by-Linear Association	1.022	1	0.312
N of Valid Cases	70		
a. 49 cells (94.2%) have an expected count of less than 5. The minimum expected count is .06.			

The results shown in Table 4.48 presents the analysis of the participants' age and their perception of the influence caused by students motivating factors. The analysis presents a Pearson chi-square of 55.753 with the degree of freedom being 36 and the significance as 0.019 ($p < 0.05$). Therefore there is statistical relationship between the participants' age and their perception of the impact of student motivating factors on their choice of Physical Science.

4.6.1.6 Student personal experiences

Table 4.50: Chi-Square Tests for participants age and Student personal experiences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.461[a]	21	0.128
Likelihood Ratio	25.655	21	0.220
Linear-by-Linear Association	0.419	1	0.518
N of Valid Cases	69		
a. 28 cells (87.5%) have an expected count of less than 5. The minimum expected count is .06.			

4.6.2 Gender

4.6.2.1 External Factors: Out of school factors

Table 4.51: Chi-Square Tests participants' gender and external factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.214[a]	50	0.996
Likelihood Ratio	27.836	50	0.995
Linear-by-Linear Association	0.060	1	0.806
N of Valid Cases	71		
a. 76 cells (97.4%) have an expected count of less than 5. The minimum expected count is .01.			

The statistical analysis presented the relationship between external factors and gender with the chi-square of 27.214 (Table 4.50) and the degree of freedom being 50. Furthermore, the significance level of 0.996 is found which shows the value of p being greater than 0.05. Therefore the participants' gender has no statistical relationship with their view on influence of external factors on the choice of Physical Sciences.

4.6.2.2 Teaching and learning in Physical Sciences

Table 4.52: Chi-Square Tests for participants' gender and teaching and learning in Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	84.264[a]	38	0.000
Likelihood Ratio	32.029	38	0.741
Linear-by-Linear Association	.204	1	0.652
N of Valid Cases	66		
a. 58 cells (96.7%) have an expected count of less than 5. The minimum expected count is .02.			

Table 4.51 presents the chi square value of 84.264 with the significance of 0.00. This shows the value of p being less than 0.05 and 57 as the degree of freedom. This statistical analysis presents that there is a significant relationship between participants' gender and their view of the impact of teaching that takes place in Physical Sciences. Therefore, gender of the participants has an impact on the choice of teaching Physical Sciences as a factor influencing students' choice of Physical Sciences.

4.6.2.3 Teaching and learning in Natural Sciences

Table 4.53: Chi-Square Tests for participants' gender and teaching and learning in Natural Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.364[a]	20	0.903
Likelihood Ratio	15.759	20	0.731
Linear-by-Linear Association	0.000	1	0.989
N of Valid Cases	66		
a. 30 cells (90.9%) have an expected count of less than 5. The minimum expected count is .02.			

The Pearson chi square value for this analysis is 12.364 and the significance value is 0.903 ($p > 0.05$). This analysis also shows the degree of freedom as 20 (Table 4.52). This analysis demonstrates therefore that there is no statistical relationship between the participants' gender and their view of the impact of teaching that takes place during the Natural Sciences.

4.6.2.4 Possible options after doing Physical Sciences

The statistical relationship between participants' gender and the influence of possible options after doing Physical Sciences as a subject is presented in Table 4.53. The results present a Pearson chi square value of 20.538 with the degree of freedom of 22 and a significance value of 0.549 ($p > 0.05$). This depicts that there is no statistical relationship between the participants' gender and their view of the impact of possible options after doing Physical Science.

Table 4.54: Chi-Square Tests for participants gender and possible options after doing Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.538[a]	22	0.549
Likelihood Ratio	16.738	22	0.778
Linear-by-Linear Association	0.071	1	0.790
N of Valid Cases	68		
a. 32 cells (88.9%) have an expected count of less than 5. The minimum expected count is .01.			

4.6.2.5 Student motivating factors

Table 4.55: Chi-Square Tests for participants' gender and students motivating factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.791[a]	24	0.763
Likelihood Ratio	20.542	24	0.666
Linear-by-Linear Association	0.149	1	0.700
N of Valid Cases	67		
a. 36 cells (92.3%) have an expected count of less than 5. The minimum expected count is .01.			

The results shown in Table 4.54 presents the analysis of the participants' gender and their perception of the influence caused by students motivating factors. The analysis presents a Pearson chi-square of 18.791 with the degree of freedom being 24 and a significance value of 0.763 ($p > 0.05$). Therefore there is no influence in participants' gender on their perception of the impact of student motivating factors on their choice of Physical Science.

4.6.2.6 Student personal experiences

Table 4.56: Chi-Square Tests for participants gender and student personal experiences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	69.814[a]	14	0.000
Likelihood Ratio	14.662	14	0.402
Linear-by-Linear Association	0.040	1	0.841
N of Valid Cases	66		
a. 18 cells (75.0%) have an expected count of less than 5. The minimum expected count is .02.			

4.6.3 Highest qualification

4.6.3.1 External factors

Table 4.57: Chi-Square Tests for participants highest qualification and external factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	116.911[a]	125	0.685
Likelihood Ratio	105.144	125	0.901
Linear-by-Linear Association	7.661	1	0.006
N of Valid Cases	74		
a. 156 cells (100.0%) have an expected count of less than 5. The minimum expected count is .04.			

Table 4.56 presents the specific analysis which was to help to determine if there is a relationship between participants' highest qualification and the external factors. The analysis shows a chi-square of 116.911, the degree of freedom being 125 and a significance level of 0.685 ($p > 0.05$). Therefore this demonstrates that participants' highest qualification is not impacting on their view that external factors have on the choice of Physical Sciences.

4.6.3.2 Teaching and learning in Physical Sciences

Table 4.58: Chi-Square Tests for participants highest qualification and teaching and learning in Physical Sciences

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	133.947[a]	95	0.005
Likelihood Ratio	113.522	95	0.095
Linear-by-Linear Association	2.242	1	0.134
N of Valid Cases	69		
a. 120 cells (100.0%) have an expected count of less than 5. The minimum expected count is .04.			

Table 4.57 presents the Pearson chi square value of 133.947 with the significance value of 0.005. This shows the value of p being less than 0.05 and 57 being the degree

of freedom. This statistical analysis presents that there is a statistically significant relationship between participants' highest qualification and their view of the impact of teaching that takes place in Physical Sciences. Therefore, the qualification level of participants does have an impact on their choice of teaching Physicals Sciences as a factor influencing students' choice of Physical Sciences.

4.6.3.3 Teaching and learning in Natural Sciences

Table 4.59: Chi-Square Tests for participants' highest qualification and teaching and learning in Natural Sciences

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	53.284[a]	50	0.349
Likelihood Ratio	54.181	50	0.318
Linear-by-Linear Association	3.505	1	0.061
N of Valid Cases	69		
a. 65 cells (98.5%) have an expected count of less than 5. The minimum expected count is .04.			

The Pearson chi square value for this analysis is 53.284 and the significance value is 0.349 ($p > 0.05$). This analysis also shows the degree of freedom as 30 (Table 4.58). Therefore this analysis demonstrates that there is no statistical relationship between the highest qualification of participants and their view of the impact of teaching that takes place during the Natural Sciences.

4.6.3.4 Possible options after doing Physical Sciences

Table 4.60: Chi-Square Tests for participants' highest qualification and Possible options after doing Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.578[a]	55	0.927
Likelihood Ratio	42.321	55	0.895
Linear-by-Linear Association	0.613	1	0.434
N of Valid Cases	71		
a. 72 cells (100.0%) have an expected count of less than 5. The minimum expected count is .04.			

The statistical relationship between highest qualification of the participants and the influence of possible options after doing Physical Science is presented in Table 4.58. The results presents a Pearson chi square value of 40.578 with the degree of freedom of 55 and a significance value of 0.927 ($p > 0.05$). Therefore this shows that there is no statistical relationship between the participants' highest qualification and their view of the impact of possible options after doing Physical Science.

4.6.3.5 Student motivating factors

Table 4.61: Chi-Square Tests for participants' highest qualification and Student motivating factors

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	58.941[a]	60	0.514
Likelihood Ratio	54.472	60	0.677
Linear-by-Linear Association	1.208	1	0.272
N of Valid Cases	70		
a. 77 cells (98.7%) have an expected count of less than 5. The minimum expected count is .04.			

The results shown in Table 4.59 presents the analysis of the highest qualification of the participants and their perception of the influence caused by students motivating

factors. The analysis presents a Pearson chi-square of 58.941 with the degree of freedom being 60 and the significance value at 0.514 ($p > 0.05$). The result is that there is no influence caused by the level of qualification of the participants on their perception of the impact of student motivating factors on their choice of Physical Science as a subject in Grade 10.

4.6.3.6 Student personal experiences

Table 4.62: Chi-Square Tests for participants highest qualification and Student personal experiences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	45.452[a]	35	0.111
Likelihood Ratio	33.724	35	0.530
Linear-by-Linear Association	1.268	1	0.260
N of Valid Cases	69		
a. 47 cells (97.9%) have an expected count of less than 5. The minimum expected count is .04.			

4.6.4 Teaching experience

4.6.4.1 External Factors

Table 4.63: Chi-Square Tests for participants teaching experience and external factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	72.619[a]	75	0.556
Likelihood Ratio	70.081	75	0.639
Linear-by-Linear Association	0.601	1	0.438
N of Valid Cases	74		
a. 103 cells (99.0%) have an expected count of less than 5. The minimum expected count is .11.			

Table 4.61 presents the analysis conducted to determine if external factors have any relationship with participants' teaching experience. The Pearson chi-square result was 72.619. The degree of freedom was 75 with a significance level of 0.556. This shows that p is greater than 0.05 and that the conclusion is therefore that participants' teaching experience had no impact on their view that external factors have an influence on students choice to take Physical Sciences.

4.6.4.2 Teaching and learning in Physical Sciences

Table 4.64: Chi-Square Tests for participants teaching experience and teaching and learning in Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.275[a]	57	0.689
Likelihood Ratio	51.376	57	0.685
Linear-by-Linear Association	0.384	1	0.536
N of Valid Cases	69		
a. 78 cells (97.5%) have an expected count of less than 5. The minimum expected count is .12.			

Table 4.62 presents the chi square value of 51.275 with the significance value of 0.689, showing the value of p being greater than 0.05 and 57 being the degree of freedom. This statistical analysis presents that there is no statistical relationship between participants' teaching experience and their view of the impact of teaching that takes place in Physical Sciences. Therefore, the teaching experience of participants does not impact on the choice of teaching Physical Science as a factor influencing students' choice of Physical Sciences.

4.6.4.3 Teaching and learning in Natural Sciences

Table 4.65: Chi-Square Tests for participants teaching experience and teaching and learning in Natural Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.925[a]	30	0.857
Likelihood Ratio	27.224	30	0.611
Linear-by-Linear Association	1.885	1	0.170
N of Valid Cases	69		
a. 42 cells (95.5%) have an expected count of less than 5. The minimum expected count is .12.			

The Pearson chi square value for this analysis is 21.925 and the significance value is 0.857 ($p > 0.05$). This analysis also shows the degree of freedom as 30 (Table 4.63). This analysis demonstrates, therefore, that there is no statistical relationship between the teaching experience of participants and their view of the impact of teaching that takes place during the Natural Sciences.

4.6.4.4 Possible options after doing Physical Sciences

Table 4.66: Chi-Square Tests for participants teaching experience and possible options after doing Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.412[a]	33	0.892
Likelihood Ratio	28.423	33	0.694
Linear-by-Linear Association	1.092	1	0.296
N of Valid Cases	71		
a. 44 cells (91.7%) have an expected count of less than 5. The minimum expected count is .11.			

The statistical relationship between teaching experience of the participants and the influence of possible options after doing Physical Sciences as a subject is presented in Table 4.64. The results presents a Pearson Chi square value of 23.412 with the

degree of freedom being 33 and a significance value of 0.892 (p > 0.05). Therefore this shows that there is no statistical relationship between the teaching experience of participants and their view of the impact of possible options after doing Physical Science.

4.6.4.5 Student motivating factors

Table 4.67: Chi-Square Tests for participants teaching experience and student motivating factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49.853[a]	36	0.062
Likelihood Ratio	49.297	36	0.069
Linear-by-Linear Association	0.244	1	0.621
N of Valid Cases	70		
a. 49 cells (94.2%) have an expected count of less than 5. The minimum expected count is .11.			

Table 4.54 presents the analysis of the participants' teaching experience and their perception of the influence caused by students motivating factors. The analysis presents a Pearson chi-square of 49.853 with the degree of freedom being 36 and the significance value of 0.062 (p > 0.05) and therefore participants' teaching experience has no impact on their perception of influence of student motivating factors on their choice of Physical Science.

4.6.4.6 Student personal experiences

Table 4.68: Chi-Square Tests for participants teaching experience and student personal experiences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.059[a]	21	0.518
Likelihood Ratio	21.226	21	0.445
Linear-by-Linear Association	0.342	1	0.559
N of Valid Cases	69		
a. 28 cells (87.5%) have an expected count of less than 5. The minimum expected count is .12.			

4.6.5 Subject taught

4.6.5.1 External factors

Table 4.69: Chi-Square Tests for participants subject taught and external factors

	Value	df	Asy.mp. Sig. (2-sided)
Pearson Chi-Square	38.559[a]	48	0.833
Likelihood Ratio	35.177	48	0.916
Linear-by-Linear Association	0.336	1	0.562
N of Valid Cases	72		
a. 73 cells (97.3%) have an expected count of less than 5. The minimum expected count is .04.			

The analysis performed to determine if the participants' choice of external factors was influenced by the subject they were teaching is presented in Table 4.67. The results presents the chi-square of 38.559 with the degree of freedom being 48 and a significance level of 0.833 ($p > 0.05$). Therefore the subject taught by participants did not influence their choice of external factors.

4.6.5.2 Teaching and learning in Physical Sciences

Table 4.70: Chi-Square Tests for participants subject taught and teaching and learning in Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.334[a]	38	0.923
Likelihood Ratio	23.612	38	0.967
Linear-by-Linear Association	0.649	1	0.420
N of Valid Cases	68		
a. 56 cells (93.3%) have an expected count of less than 5. The minimum expected count is .04.			

Table 4.68 presents a chi square value of 26.334 with the significance value at 0.923. This shows the value of p as greater than 0.05 with 38 being the degree of freedom. This statistical analysis presents that there no statistical relationship between subjects taught by participants and their view of the impact of teaching that takes place in Physical Sciences. Therefore, the subject taught by participants does not impact on the choice of teaching Physical Sciences as a factor influencing students' choice of Physical Sciences.

4.6.5.3 Teaching and learning Natural Sciences

Table 4.71: Chi-Square Tests for participant's subject taught and teaching and learning in Natural Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.658[a]	20	0.480
Likelihood Ratio	16.624	20	0.677
Linear-by-Linear Association	0.446	1	0.504
N of Valid Cases	68		
a. 30 cells (90.9%) have an expected count of less than 5. The minimum expected count is .04.			

The Pearson chi square value for this analysis is 19.658 and the significance value is 0.480 ($p > 0.05$). This analysis also shows the degree of freedom as 20 (Table 4.69). Therefore this analysis demonstrates that there is no statistical relationship between the subject taught by participants and their view of the impact of teaching that takes place during the Natural Sciences.

4.6.5.4 Possible options after doing Physical Sciences

Table 4.72: Chi-Square Tests for participants subject taught and possible options after doing Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.630[a]	22	0.268
Likelihood Ratio	22.785	22	0.414
Linear-by-Linear Association	0.362	1	0.547
N of Valid Cases	70		
a. 32 cells (88.9%) have an expected count of less than 5. The minimum expected count is .04.			

The statistical relationship between subject taught by the participants and the influence of possible options after doing Physical Science as a subject in Grade 10 is presented in Table 4.70. The results present a Pearson Chi square value of 25.630 with a degree of freedom of 22 and a significance value of 0.268 ($p > 0.05$). This therefore shows that there is no statistical relationship between the subject taught by participants and their view of the impact of possible options after doing Physical Science.

4.6.5.5 Student motivating factors

Table 4.73: Chi-Square Tests for participant's subject taught and student motivating factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.484[a]	24	0.669
Likelihood Ratio	21.147	24	0.630
Linear-by-Linear Association	0.488	1	0.485
N of Valid Cases	69		
a. 35 cells (89.7%) have an expected count of less than 5. The minimum expected count is .04.			

Table 4.71 presents the analysis of the subject taught by participants and their perception of the influence caused by students motivating factors. The analysis

presents a Pearson chi-square of 20.484 with the degree of freedom being 24 and the significance value at 0.669 ($p > 0.05$). The subject taught by the participants therefore has no impact on their perception of influence of student motivating factors on their choice of Physical Science.

4.6.5.6 Student personal experiences

Table 4.74: Chi-Square Tests for participant's subject taught and student personal experiences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.490[a]	14	0.914
Likelihood Ratio	10.126	14	0.753
Linear-by-Linear Association	0.157	1	0.692
N of Valid Cases	68		
a. 19 cells (79.2%) have an expected count of less than 5. The minimum expected count is .04.			

4.6.6 Phases currently taught

4.6.6.1 External factors

Table 4.75: Chi-Square Tests for participants' phases currently taught and external factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	82.720[a]	72	0.182
Likelihood Ratio	84.559	72	0.148
Linear-by-Linear Association	0.338	1	0.561
N of Valid Cases	73		
a. 100 cells (100.0%) have an expected count of less than 5. The minimum expected count is .05.			

Table 4.73 presents the analysis intended to determine if there is a relationship between external factors and phases presently taught by the participants. The Pearson chi-square is 82.720 with the degree of freedom found to be 72 and a

significance level of 0.182 ($p > 0.05$). The conclusion therefore is that a participants' age is not related to the view that external factors have on the choice of Physical Sciences as a subject.

4.6.6.2 Teaching and learning in Physical Sciences

Table 4.76: Chi-Square Tests for participants phases currently taught and teaching and learning in Physical Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.821[a]	57	0.340
Likelihood Ratio	57.062	57	0.473
Linear-by-Linear Association	3.314	1	0.069
N of Valid Cases	69		
a. 80 cells (100.0%) have an expected count of less than 5. The minimum expected count is .06.			

Table 4.74 presents the Pearson chi square value of 60.821 with the significance value of 0.340 thus showing the value of p being greater than 0.05 and 57 being the degree of freedom. This statistical analysis presents that there no statistical relationship between phases currently taught by participants and their view of the impact of teaching that takes place in Physical Sciences in Grade 10. Therefore phases currently taught by participants does not impact on the choice of teaching Physical Sciences as a factor influencing students' choice of Physical Sciences.

4.6.6.3 Teaching and learning in Natural Sciences

Table 4.77: Chi-Square Tests for participants phases currently taught and teaching and learning in Natural Sciences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.534[a]	30	0.648
Likelihood Ratio	29.771	30	0.477
Linear-by-Linear Association	1.786	1	0.181
N of Valid Cases	69		
a. 42 cells (95.5%) have an expected count of less than 5. The minimum expected count is .06.			

The Pearson chi square value for this analysis is 26.534 and the significance value is 0.648 ($p > 0.05$). This analysis also shows the degree of freedom as 30 (Table 4.63). This analysis demonstrates then that there is no statistical relationship between the phases currently taught by participants and their view of the impact of teaching that takes place during the Natural Sciences.

4.6.6.4 Possible options after doing Physical Sciences

Table 4.78: Chi-Square Tests for participants phases currently taught and possible options after doing Physical Sciences

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.229[a]	33	0.130
Likelihood Ratio	42.917	33	0.116
Linear-by-Linear Association	0.591	1	0.442
N of Valid Cases	71		
a. 47 cells (97.9%) have an expected count of less than 5. The minimum expected count is .06.			

The statistical relationship between phases currently taught by participants and the influence of possible options after doing Physical Sciences is presented in Table 4.76.

The results present a Pearson Chi square value of 42.229 with a degree of freedom of 33 and significance value of 0.130 (p > 0.05), showing that there is no statistical relationship between the phases currently taught by participants and their view of the impact of possible options after doing Physical Science.

4.6.6.5 Student motivating factors

Table 4.79: Chi-Square Tests for participants phases currently taught and Student motivating factors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.182[a]	36	0.290
Likelihood Ratio	42.588	36	0.209
Linear-by-Linear Association	0.764	1	0.382
N of Valid Cases	70		
a. 51 cells (98.1%) have an expected count of less than 5. The minimum expected count is .06.			

Table 4.77 presents the analysis of the phases taught by participants and their perception of the influence caused by students motivating factors. The analysis presents a Pearson chi-square of 40.182 with the degree of freedom being 36 and the significance value at 0.290 (p > 0.05). Therefore the phases taught by participants has no impact on their perception of influence of student motivating factors on their choice of Physical Science.

4.6.6.6 Student personal experiences

Table 4.80: Chi-Square Tests for participants phases currently taught and Student personal experiences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.167[a]	21	0.335
Likelihood Ratio	26.325	21	0.194
Linear-by-Linear Association	4.083	1	0.043
N of Valid Cases	69		
a. 29 cells (90.6%) have an expected count of less than 5. The minimum expected count is .06.			

4.7 SUMMARY

The above chapter has presented the results based on the descriptive statistical analysis of the responses to all questions in the questionnaires which was then followed by a factor analysis. The factor analysis produced six factors which are made of two to seven statements. The next chapter presents the conclusion and recommendations based on the results.

CHAPTER 5

DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This study was designed to seek answers of the following research questions:

- What do Lejweleputswa District science educators perceive as the factors contributing towards the decline in Grade 10 Physical Sciences enrolments?
- Is there any relationship between the educators' views and their different biographical data?
- What role do educators think they have in the process of increasing enrolments in Grade 10 Physical Sciences?

This chapter provides a discussion on the results that were presented in Chapter 4 in order to provide some answers to the research questions that were originally presented during the design of this research project. The discussion looks at the results, the literature and then presents a specific conclusion. Finally, the chapter puts forward different suggestions that could be adopted in order to increase the number of learners opting for Physical Sciences in Grade 10.

5.2 RESEARCH QUESTION 1 (RQ1)

The first question that the study was designed to answer was: "What do Lejweleputswa District Science educators perceive as the educator factors contributing towards the decline in Grade 10 Physical Sciences enrolments?" The following intends to provide the answer to RQ1 by looking at the factors that science educators believe to

contribute towards the decline of students enrolling for Physical Sciences in Grade 10. This analysis is divided into three sections, namely: 1) influential and very influential; 2) moderately influential, influential and very influential; and 3) factor analysis. The first section focuses on individual statements by providing a rank order mainly focusing on the responses of “influential” and “very influential”.

5.2.1 Influential and very influential factors

When the statements were analysed based on the responses of the participants a rank order was produced in order to check which statement was voted for by most participants. The discussion on the top statements was presented only for those statements which received the votes of 40% and above while those below were left. “A tendency by students to choose courses believed to have less work” was noted as the highest statement with 57.1% (Table 5.1). This demonstrates that most teachers in this group believe that the main aspect they think is impacting on the decrease in the number of students opting for Physical Sciences in Grade 10 is due to the fact that students would like to do courses that are believed to require less work.

Secondly the decrease in the number of students taking mathematics has been noted as the second aspect that is impacting on students’ choice, at 52.9% (Table 5.1). Grove and Pugh (2015) also note that students who do not perform well in mathematics also perform poorly in chemistry. Hence this results in learners not taking mathematics, influencing their choice mainly of those subjects perceived to be related to mathematics, such as Physical Sciences.

Table 5.1: Combined responses of "influential" and "very influential"

A tendency for students to choose courses believed to require less work	57.1
A decrease in the number of learners taking mathematics affects numbers in Physical Sciences	52.9
The increased competition in university entrance	44.9
A tendency to choose courses seen as more interesting or engaging than science	44.1
The teaching approaches utilised in Natural Sciences classes	42.0
The quality of teaching in Natural Sciences classes	40.6
A decline in the amount of practical and experimental work undertaken in Natural Sciences classes	40.6
Students' negative experiences in lower phases science classes	39.1
A greater reluctance among today's students to persevere with repetitive tasks, as required in experimental work	37.3
The teacher-learner relationship in Natural Sciences classes	36.8
The quality of teaching in Physical Sciences classes	36.8
Students' lack of knowledge about the wide range of SET careers available	36.2
The content in Natural Sciences syllabus or curriculum	35.8
A tendency for students to choose courses seen as less academically demanding	35.7
A decrease in the number of role models in science, engineering and technology (SET) careers	35.7
The way the mass media depicts science or scientists	35.3
A perception among students that there is a low demand for SET jobs	34.8
A decline in the number of parents who encourage their children to take science courses	34.8
The content in Physical Science syllabus or curriculum	33.3
The teaching approaches utilised in Physical Sciences classes	32.4
The teacher-learner relationship in Physical Sciences classes	31.9
The teachers comments about Physical Sciences	31.9
A lack of effort from science organisations and university faculties to encourage students to choose senior science courses	29.4
Students' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid	29.0
Students' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points	27.9
Family and friends comments about Physical Sciences	27.9
Students' perceptions that science can have a negative impact on society	25.8
The wide range of subjects available to FET learners	24.2

Barton and Coley (2011) noted that all students would like to finish their high school education and go to university. This has increased the competition with students who would like to complete their professional qualifications at a university. Hence the

statement “the increased competition in university entrance” has been noted to take the third position in the rank order, with 44.9% (Table 5.1). The students desire to increase their chances influences the subjects that they choose.

The tendency for students to choose courses seen as more interesting and engaging than science has been noted as fourth on the order of influence at 44.1% (Table 5.1). The teachers believe that students are not choosing Physical Sciences in Grade 10 as they believe it does not provide enough engagement to attract them. Social Cognitive theory demonstrates that Science Community Representing Education (2008) has also noted that a lack of practical work and experiments could affect student’s views of science and therefore this is another way in which enrolments in science subjects is being affected.

The participants in this study have shown “the wide range of subjects available to the FET learners” having the least impact on the learners choice of subjects in Grade 10 at 24.2% (Table 5.1). The wide choice of subjects that schools offer to students seems to be perceived as having the least amount of impact on the decisions around subject choice. This is followed by “students’ perceptions that science can have a negative impact on society” at 25.8% (Table 5.1). Student’s belief that science could impact negatively of general societal life and well-being has been selected as the second lowest statement perceived to relate to low enrolment of learners in Physical Sciences in Grade 10.

Students' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points and the family and friends comments about Physical Sciences both got 27.9% (Table 5.1). This demonstrates that family and friends comments are perceived to have a low impact on a student's choice of subjects. Furthermore, effort that students believe is need to be able to pass science and its relation to the points allocation has been noted as also presenting a low impact on student's choice of subjects.

The fifth factor from the bottom has been noted as "students' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid" with 29.0% (Table 5.1). Lastly, "lack of effort from science organisations and university faculties to encourage students to choose senior science courses" is also low in the perception it has on affecting students choice of subjects in Grade 10, with 29.4%. Hence students choice of subjects in Grade 10 is influenced very little by the role played by different science organisations and by the salary level of those in science related professions.

5.2.2 Moderately influential, influential and very influential

There were three options that focused on the influence of each statement. This section brings together all the answers that were presented as "moderately influential", "influential" and "very influential". The top four statements focused on what happens in Natural Science classes. The statement that teachers believe is highly influential in students choosing science subjects is the quality of teaching in Natural Science classes with 84.1% agreeing with this statement (Table 5.2). This shows that the

experience of students in the previous phase where they were dealing with Natural Sciences is believed by teachers to have a high impact on their choice of subjects in Grade 10. Murphy and Whitelegg (2006:286) note learners' liking subjects during the compulsory years found as the most significant influence of their choices in later years. They find that even though teachers differed in their views on this there was nevertheless a significant indication that prior achievement in physics was considered influential in learners' choice of science subjects in the later years.

Table 5.2: Combined responses of moderately influential, influential and very influential

The quality of teaching in Natural Science classes	84.1
The teacher-learner relationship in Natural Science classes	82.4
The teaching approaches utilised in Natural Science classes	81.2
A decline in the amount of practical and experimental work undertaken in Natural Science classes	81.2
The teacher-learner relationship in Physical Science classes	81.2
Students' lack of knowledge about the wide range of SET careers available	81.2
A tendency for students to choose courses believed to require less work	80.0
The content in the Physical Science syllabus or curriculum	79.7
The teaching approaches utilised in Physical Science classes	79.4
The content in the Natural Science syllabus or curriculum	79.1
A tendency to choose courses seen as more interesting or engaging than science	77.9
The quality of teaching in Physical Science classes	77.9
A tendency for students to choose courses seen as less academically demanding	77.1
A decrease in the number of role models in science, engineering and technology (SET) careers	77.1
A greater reluctance among today's students to persevere with repetitive tasks, as required in experimental work	76.1
Students' negative experiences in lower phases science classes	75.4
A decrease in the number of learners taking mathematics affects numbers in Physical Sciences	75.0
A perception among students that there is a low demand for SET jobs	73.9
The increased competition in university entrance	72.5
Students' perceptions that the effort required to pass Physical Sciences may not be suitably rewarded in the calculation of university entrance points	69.1
Students' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid	68.1
The family and friends comments about Physical Sciences	67.6
The wide range of subjects available to FET learners	66.7
The teachers comments about Physical Sciences	66.7
A decline in the number of parents who encourage their children to take science courses	60.9
Students' perceptions that science can have a negative impact on society	59.1

The way the mass media depicts science or scientists	58.8
A lack of effort from science organisations and university faculties to encourage students to choose senior science courses	57.4

The second aspect is the teacher-learner relationship in Natural Science classes with 82.4% significance (Table 5.2). The third aspect is the teaching approaches utilised in Natural Science classes with 81.2% significance to those participating and the fourth most important is seen as the decline in the amount of practical and experimental work undertaken in Natural Science classes, with 81.2%. These four aspects are the responsibilities of the teacher during teaching and learning in the Natural Science classes.

The main factors, therefore, perceived by science educators to be contributing towards the decline in the enrolment of learners in Grade 10 Physical Science originates from their experience in previous grades when dealing with Natural Sciences. These experiences are all educator-related as the different aspects mentioned are their responsibility, namely the quality of teaching, the teacher-student relationship in class, adoption of teaching approaches and the planning of practical work for class. Murphy and Whitelegg (2006:296) also note that the students' evaluation of the quality of the curriculum as well as the teaching and learning process within science subjects impacts their choice of subjects later in their lives.

5.2.3 Major factors

The factor analysis also contributed in determining the perceived major factors affecting the decrease in learners choosing Physical Sciences as a subject in Grade

10. The analysis raised six factors by bringing together different statements to generate a specific factor. The analysis therefore found student's external factors as major contributors. These factors include lack of effort from science organisations and university faculties to encourage students to choose senior science courses, the learners' perceptions that science can have a negative impact on society and the decline in the number of parents who encourage their children to take science courses. The way the mass media depicts science or scientists, teachers' comments on Physical Sciences, the perception among students that there is a low demand for SET jobs as well as family and friends comments on Physical Sciences also have an impact on student's choices.

Teaching and learning in the Physical and Natural Science subjects was noted as also influencing learners' choice of Physical Sciences in Grade 10. The participants' analysis of teaching and learning in Physical and Natural Sciences included issues around curriculum, teaching approaches and teacher-learner relationships.

The issues relating to a wide range of subjects being available to FET learners and the increased competition in university entrance constituted possible options affecting students after that of doing Natural Sciences in lower grades was noted as having an impact on the learners' choice of Physical Sciences in Grade 10. The study by Cleaves (2005:483) also note that a lack of knowledge on possible science related occupations and work in science fields after high school tends to highly impact on learners' choice of sciences within high school. Providing students with relevant, accurate knowledge and support before they reach the time for making subject choices

could therefore increase the numbers of those enrolling for Physical Sciences in Grade 10.

Student motivating factors were also noted to contribute towards learners' choice of Physical Sciences. This factor covered issues such as the tendency for students to choose courses seen as less academically demanding, the decrease in the number of role models in science, engineering and technology (SET) careers and the decrease in the number of learners taking mathematics.

Lastly student's personal experiences were noted as a factor that is believed to influence learner's choice of Physical Science. This included issues such as a learners' negative experiences in lower phase science classes along with a greater reluctance amongst students to persevere with repetitive tasks, as required in science experimental work.

Murphy and Whitelegg (2006:296) note the influence of learners' perceptions of the difficulty of a subject on their choice of subjects which relates to the above evaluation. Similarly learners' prior achievement of a certain subject, like Natural Sciences, highly influence their choice of science-related subjects and professions. The type of classroom feedback and teacher-learner relationships within science have contributed to the learners expectations of themselves and perceptions of their personal abilities. This has then resulted in their evaluation of their personal ability to cope and succeed

in science which has been noted to influence learners to move away from science subjects.

5.3 RESEARCH QUESTION 2 (RQ2)

The second research question of the study was: “Is there any relationship between the educators’ views and their different biographical data?” The questionnaire requested the biographical information from the participants which included age, gender, highest qualification, teaching experience, subject and phase currently teaching. Biographical data has been noted to affect the views and behaviours of different people (Paustian-Underdahl *et al*., 2013:289). Hence, in this study it was necessary to determine if the biographical information of participants had an influence on the perceptions of certain factors.

Based on the analysis in Chapter 4, the results from the study show that external schools factors, teaching and learning in science, and possible career options after doing Physical Science do not have any statistical relationship with gender, age, teaching experience, highest qualification, subject and phases currently being taught (Table 5.3). Therefore the views and choices made by participants in this study were not influenced by any of this specific biographical information. This further means that the choice made by the participants on factors influencing learners subject choices were not related to gender (female or male).

Student motivating factors presented a positive relationship with age which demonstrated that views of the statements within this factor varied statistically with age. That is that older teachers had a stronger belief that motivating factors influence learners' choices when compared to younger teachers. Similarly, the factor of student's personal views did not vary with gender. The teachers' perception of the role of personal views in the process of choosing Physical Science in Grade 10 has been noted to vary with their gender. That means the male selection of the statements under this factor varied greatly from females selections.

Table 5.3: Relationship between the educators' views and their different biographical data

	Age	Gender	Highest Qualification	Teaching experience	Subject currently taught	Phase currently taught
External factors	X	X	X	X	X	X
Teaching & learning in Physical Sciences	X	√	√	X	X	X
Teaching & learning in Natural Sciences	X	X	X	X	X	X
Possible options after doing Physical Sciences	X	X	X	X	X	X
Student motivating factors	√	X	X	X	X	X
Student personal experiences	X	√	X	X	X	X

5.4 RESEARCH QUESTION 3

Finally the study was designed to also seek answers on "what role do educators think they have in the process of increasing enrolments in Grade 10 Physical Sciences?" This is discussed based on the top statements in the rank order above.

Generally the five top statements in the rank order for “moderately influential”, “influential” and “very influential” that are perceived be impacting on the decline of enrolments in Grade 10 Physical Sciences are directly related to the educator. The educator is responsible for the teaching and learning in the class. The educator’s teaching can therefore be said to be directly responsible for the decreased number of students enrolling in further science subjects. The teaching elements perceived by educators to impact on the number of enrolments includes the quality of teaching in Natural Science classes.

The quality of teaching and learning that is noted here has relationship with three aspects namely the teacher-learner relationship, adoption of effective teaching approaches and the use of practical work in the Natural Sciences. Therefore, based on these aspects, educators believe their teaching and learning programs in lower Grades (those doing Natural Sciences) contribute towards the decreased number of learners taking Physical Sciences in Grade 10. Cleaves (2005:483) also presents that learners’ disappointment with teaching and learning taking place in school sciences relates to their decision not to go further in science and science related fields. Hence educators could play an important role in the process of increasing the enrolment numbers in Physical Sciences in Grade 10 by improving their teaching level and quality in lower grades where students are doing Natural Sciences. This could be done through the adoption of effective teaching and learning approaches, improved teacher-learner relationships and increased number of practical work.

5.5 CONCLUSION

Learners' decision on enrolments after post-compulsory science subjects is not a foregone conclusion as they make such choices based on several experiences (Cleaves, 2005: 483). There are various factors that are perceived by educators to contribute towards the decreasing enrolment of learners in Grade 10 Physical Science. The major factors are mainly educator-related classroom aspects. Similarly, Cleaves (2005: 484) notes that research can be beneficial to professionals in various sectors with the advice required to help learners in their process of making subject choices.

Bandura (2001) goes further to indicate that within social cognitive theory, each cognitive factor determines the different personal encounters that will be noted, what it means, the effect it has on an individual and how it impacts on individuals' future. Therefore, social cognitive theory demonstrates that the teachers' perceptions of the different factors that impacts students choice of Physical Science in Grade 10 as cognitive constructs that have been develop through active interactions between individual teachers and their environment.

The findings in this study point out the importance of the role played by science teachers at different phases within the South African classroom through their teacher-learner relationship, teaching and learning approaches as well as the general science curriculum. The study therefore presents a strong indication that science teachers at their different phases could play a significant role in increasing the number of students opting for Physical Science in Grade 10 and hence break the stereotyping and perceptions that young South African learners have in choosing or not choosing Physical Science as a subject.

5.6 RECOMMENDATIONS

The recommendations presented here are based on the findings of this study and therefore cannot be generalised as the study was only focused on educators in the Lejweleputswa District. The recommendations for this area are as follows:

a) Science educators should improve their teaching by focusing on
    - Effective teaching and learning approaches relevant to science;
    - Increasing the number of practical work in science classes;
    - Improving the teacher-learner relationship during classes.

b) The government of South Africa through the Department of Basic Education and the Free State Department of Education should provide school-based support to science teachers in this area. Educators have been given support over the years but this should now be focussed and specific as the issues of quality of teaching and learning as observed above are unique to each educator and in each school.

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APPENDIX 1: PERMISSION TO CONDUCT RESEARCH DEPARTMENT OF EDUCATION FREE STATE

Enquiries: Phori JR
Reference: Research Approval
Tel: 051 404 9258
Fax: 086 667 8678
E-mail: phorij@edu.fs.gov.za

education
Department of Education
FREE STATE PROVINCE

OFFICE OF THE DIRECTOR:
STRATEGIC PLANNING, POLICY DEVELOPMENT & RESEARCH

Mr. Segola KB

RE: APPROVAL TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION:

1. This letter serves as an acknowledgement of receipt of your request to conduct research in the Free State Department of Education.

2. Research topic: **Educators' perceptions of their influence on learners' choice of physical sciences in grade 10: A case study of Lejweleputswa District.**

3. Approval is granted for you to conduct research in the Free State Department of Education.

4. This approval is subject to the following conditions:-

   4.1 The collection of data should not interfere with the normal tuition time or teaching process.

   4.2 A bound copy of the research document should be submitted to the Free State Department of Education (Strategic Planning, Policy Development & Research).

   4.3 You will be expected, on completion of your research study, to make a presentation to the relevant stakeholders in the Department.

   4.4 The attached ethics document must be adhered to in the discourse of your study in our department.

5. Please note that the costs relating to all the conditions mentioned above are your own responsibility.

6. This letter should be shown to all participants.

Thank you for choosing to research with us. We wish you every success with your study.

Yours faithfully,

Mothebe MJ
Director: Strategic Planning, Policy & Research.

28/01/2015
Date

Directorate: Strategic Planning, Policy Development & Research - Private Bag X20565, Bloemfontein, 9300 – Room 301, Old CNA building, Charlotte Maxeke, Bloemfontein 9300 - Tel: 051 404 9283/ Fax: 086 6678 678 E-mail: research@edu.fs.gov.za

APPENDIX 2: PERMISSION TO CONDUCT RESEARCH DEPARTMENT OF EDUCATION FREE STATE (DISTRICT DIRECTOR)

Enquiries : MS Mokgobo /rf
Reference:

education
Department of Education
FREE STATE PROVINCE

05 February 2015

KB Segola
20 Bonn Street
RIEBEECKSTAD
9459

REQUEST PERMISSION TO COLLECT DATA FOR MY DISSERTATION

1. Receipt of your request regarding the above-mentioned is hereby acknowledged and has reference.
2. Permission is hereby granted to you to collect data from different Schools in Lejweleputswa District as to complete your studies.
3. However, permission is only granted if your activity will not interfere with the smooth running of Schools. Learning and teaching time should be protected at all costs.
4. Proper consultation and arrangement should also be made with Principals.
5. Hoping you will find this to be in order.

MS MOKGOBO
District Director

Lejweleputswa District, Private Bag X30, Welkom, 9460
Anmercosa House, Cnr Stateway and Tulbach Street, Welkom
Tel: (057) 3917200 Fax: 0865191639

www.fsdoe.fs.gov.za

APPENDIX 3: INFORMED CONSENT FORM

CONSENT FORM
- I agree to participate in this research project. - I noted the information on the project and had an opportunity to ask questions about it. - I agree to my responses being used for research purposes on condition that my privacy is respected. - I understand that I am under no obligation to take part in this project and that I have the right to withdraw at any stage.
I want to remain anonymous. ***YES*** ***NO*** Please circle your answer. _X_____ Signature of Participant

APPENDIX 4: TEACHERS' QUESTIONNAIRE

Welcome to the Secondary Science Teacher Survey! We appreciate you taking the time to support this important study. It should only take about 5 minutes to complete. Please do not write your name on this paper.

Instructions: Please indicate your response to each question by ticking on the appropriate box. Some questions include space for additional comments if you have time.

SECTION A: GENERAL BACKGROUND INFORMATION

Please tick in the appropriate box or supply the answer in the space provided.

Please use a tick to indicate:

1. **AGE**

20 – 30 years [ ] 31 – 40 years [ ] 41 – 50 years [ ] 51 years and above [ ]

2. **GENDER:** Female [ ] Male [ ]

3. **HIGHEST QUALIFICATIONS**

STC [ ] DIP [ ] B. Ed [ ] B. Ed Hons [ ] M. Ed [ ]

Other education Qualification [ ] Other qualifications (not Education) [ ]

4. **TEACHING EXPERIENCE**

0 – 5 Years 6 – 10 years 11 – 15 years 15 years and above [ ]

5. **Which subjects do you teach:**

Mathematics [ ] Physical Sciences [ ]

6. **Which phase or phases are you currently teaching?**

Foundation [ ] Intermediate [ ] Senior [ ] FET [ ]

SECTION B: YOUR VIEWS ABOUT PHYSICAL SCIENCES (PS) ENROLMENTS

The last five years have seen substantial declines in the proportions of South African learners choosing Physical Sciences (physics and chemistry). Several factors have been suggested as contributing to these declines. How influential do you think the following suggested factors have been in contributing to the decline in science enrolments? (Please write any additional comments in the space provided at the end of the questionnaire)

NB: Raring scales:

1 = Not at all influential, 2 = Not very influential,
3 = Moderately influential, 4 = Very influential,
5 = Extremely influential

	1	**2**	**3**	**4**	**5**
7. The wide range of subjects available to FET learners	1	2	3	4	5
8. A decrease in the number of learners taking Mathematics affects numbers in physical sciences	1	2	3	4	5
9. A tendency for students to choose courses seen as less academically demanding	1	2	3	4	5
10. A decrease in the number of role models in science, engineering and technology (SET) careers	1	2	3	4	5
11. A tendency for students to choose courses believed have less work	1	2	3	4	5
12. A tendency to choose courses seen as more interesting/engaging than science	1	2	3	4	5
13. A greater reluctance among today's students to persevere with repetitive tasks, as required in experimental work	1	2	3	4	5
14. Students' negative experiences in lower phases science classes	1	2	3	4	5
15. The content in natural sciences syllabus or curriculum	1	2	3	4	5
16. The quality of teaching in natural sciences classes	1	2	3	4	5
17. The teacher-learner relationship in natural sciences classes	1	2	3	4	5
18. The teaching approaches utilised in natural sciences classes	1	2	3	4	5
19. A decline in the amount of practical and experimental work undertaken in natural sciences classes	1	2	3	4	5
20. The content in physical sciences syllabus or curriculum	1	2	3	4	5
21. The quality of teaching in physical sciences classes	1	2	3	4	5
22. The teaching approaches utilised in physical sciences classes	1	2	3	4	5
23. The teacher-learner relationship in physical sciences classes	1	2	3	4	5
24. Students' perceptions that the effort required to pass physical sciences may not be suitably rewarded in the calculation of university entrance points	1	2	3	4	5
25. The increased competition in university entrance	1	2	3	4	5
26. Students' perceptions that science, engineering and technology (SET) careers are not sufficiently well paid	1	2	3	4	5

27. Students' lack of knowledge about the wide range of SET careers available	1	2	3	4	5
28. A perception among students that there is a low demand for SET jobs	1	2	3	4	5
29. The teachers comments about physical sciences	1	2	3	4	5
30. The family and friends comments about physical sciences	1	2	3	4	5

SECTION C. SOURCES OF ADVICE ABOUT CHOOSING SCIENCE

How do you rate the influence of the following on students' decisions about taking senior science courses? (Please write any additional comments in the box at the bottom of this page)

	1	2	3	4	5
31. Students' perceptions that science can have a negative impact on society	1	2	3	4	5
32. A decline in the number of parents who encourage their children to take science courses	1	2	3	4	5
33. The way the mass media depicts science or scientists	1	2	3	4	5
34. A lack of effort from science organisations and university faculties to encourage students to choose senior science courses	1	2	3	4	5

APPENDIX 5: PRINCIPALS LETTER

20 Bonn Street,

Riebeeckstad,

Welkom, 9459.

11/09/2014

The Principal,

.....

.....

.....

Dear sir/madam,

RE: PERMISSION TO CONDUCT RESEARCH IN YOUR SCHOOL

I hereby ask for permission to conduct educational research in your school. I am presently busy with my dissertation, a compulsory requirement towards the completion of a MED in School of Teacher Education at the Central University of Technology (Welkom campus).

Attached is a letter granting permission to conduct research from the Lejweleputswa District, Department of Education office.

The topic of my dissertation is:

Educators' perceptions of their influence on learners' choice of Physical Sciences in Grade 10: A case study of Lejweleputswa District

I am prepared to observe the following stipulations:

1. Participation in the research will be voluntary.
2. Questionnaires will be administered during non-teaching hours.
3. All information obtained will be treated confidentially and used for academic purposes only.

Yours sincerely,

_____

Segola KB
Student No: **212414496**