Attitudes of grade 11 female students towards physical science in selected high schools in the Mafikeng District.

By
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Submitted in part fulfillment of the requirements for the degree of Master of Education (Science Education) in the Department of Professional Studies and Internship in the Faculty of Education, North West University.

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DECLARATION

I declare that the dissertation for the degree of Master of Education (science education) at the North West University hereby submitted, has not previously been submitted by me for a degree at this or at any other university. This is my own work in design and execution and that all materials taken from other sources contained herein have been duly acknowledged.

Signature 

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ACCEPTANCE FOR EXAMINATION

This dissertation: Attitudes of grade 11 female students towards physical science in selected high schools in the Mafikeng District, written by Barbington Chimhau, student Number 10609806 of the Department of Professional Studies and Internship in the Faculty of Education, is hereby recommended for acceptance for examination.

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ABSTRACT

This study investigated the attitudes of grade 11 female students towards the study of Physical Science in Mafikeng. Attitudinal measures, such as levels of student's interest and the perceived utility of science, were examined. The subjects of the study included grade 11 female students from selected high schools in the Mafikeng District.

A total of 300 female students participated in the study. A survey method was used in this study. A questionnaire was administered to examine the perceptions and attitudes of female students towards the study of Physical Science. A three-point positive/neutral/negative scale was utilized in sections B, C, and D in order to encourage students to make an attitude choice.

The research findings showed that the attitudes of grade 11female students in the selected high schools were affected by parents, teachers, peers, classroom environment, personal perceptions and aspirations.

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CHAPTER 1: OVERVIEW

1.1. Introduction and Background

Science and technology have a significant impact in our everyday lives. We cannot think of technological development without science education. Over the years, efforts have been made to understand and motivate interest in science education in children. Yet, in the last decade, policy-makers and educational researchers have become concerned about the decline of interest in science education among students.

The attitudes of girls in mathematics and science have been studied for many years (Wilkins, 2000). Research shows the attitudes towards science are as a result of environmental rather than biological factors (Wilkins, 2000). Students should pass mathematics and science courses at high school in order to prepare for future careers, in disciplines such as engineering and technology.

The importance of being scientifically literate and the ability to function in today's quantitatively complex society has been repeatedly documented by educators and employers (National Council of Teachers of Mathematics, 1989, Wilkins, 2000). Wilkins (2000) outlined a multi-dimensional framework for describing what it means to be scientifically literate. A scientifically literate person must possess;

(i) A functional level of scientific content knowledge.

(ii) An ability to reason scientifically; understanding of the social importance of science.

(iii) Understanding of the nature and history of science.

(iv) A positive disposition towards science.

According to (Wilkins, 2000), in order to raise the level of quantitative literacy, it is important to identify factors that influence successful development. The factors related to scientific achievement have been studied extensively. Considering the

multidimensional nature of quantitative literacy there is also a need to investigate factors that influence a student's development of the affective dimensions associated with quantitative literacy (Wilkins, 2000).

Walberg's model of educational productivity (1981, 1992) identifies nine key factors that relate to students' affective, behavioural, and cognitive development. These factors can be classified into three groups:

(1) Student personal variables such as prior achievement, age, and self-concept.

(2) Instructional variables such as the amount or quality of instruction.

(3) Environmental variables related to the home, teacher/classroom, peers, and media exposure.

These factors have been found consistently to predict students' attitudes and achievements in mathematics and science (Walberg, 1992; Young, Reynolds, & Walberg, 1996; Reynolds & Walberg, 1991; 1992).

According to Kennedy (2001), attitudes, self-efficacy, self-confidence, parental involvement, teacher attention, text book content, and the knowledge of future careers are the environmental factors affecting the drop-out rate of female students as they move from middle school to high school and to universities. For example, I have noted that the number of girls doing physical science was fewer than the number of girls doing other subjects (Table 1) in grade 11 at schools listed in Table 1 in 2004.

TABLE 1: Physical science and non physical science students in some of the High Schools in Mafikeng in 2004.

Name of school	Number of girls doing science	Number of girls not doing science	Total number of girls
Danville High School	9	38	47
Magokolodi-Masibi Comprehensive School	20	46	66
Tshohanyetso High School	18	45	63
Botloung High School	16	44	60
Mafikeng High School	22	41	63
Kebalipile High School	21	45	66
Lapolagang High School	19	50	69

Formal education for the indigenous population of South Africa was introduced by various missionary societies whose educational policy was to 'civilise the natives' rather than to educate them for self-reliance. This means before the introduction of democracy in 1994, education for Black South Africans was meant to give them basic literacy and numeracy skills. This would prepare a few, especially males, for clerical jobs in the colonial government, but it was designed not to encourage academic aspirations.

The Bantu Education system was unfair, discriminatory and fragmented, and was used to further the interests of the White Nationalist Government in providing a semi-literate black workforce for the labour market (Ramananandan, 1995). Education for the Black Africans was under-funded and was characterised by a high dropout rates.

Subsequently, very few black learners were encouraged to take scientific or mathematical subjects because the apartheid government regarded blacks as incapable of learning these subjects, and because the colonial government regarded blacks as inherently incapable of learning these subjects. The South African Prime Minister, H. F. Verwoerd, in justifying the implementation of apartheid education in 1945 in South Africa, said: "*What is the use of teaching a Bantu child Mathematics when it cannot use it in practice? Education must train and teach people in accordance with their opportunities in life... It is therefore necessary that native education should be controlled in such a way that it should be in accordance with the policy of the state*" (Ramananandan, 1995:12).

As asserted by Cohen (1994), the participation of some Black South African parents in education still lags behind that of some countries in Africa and particularly in the Southern African Development Co-operation (SADC) region. Women, prior to apartheid rule, received a limited education from missionary institutions, education was limited to "homemaking skills" and religious education. As a result, only a few learnt to read and write and as such, women's education lagged further behind that of their male counterparts. The trend continued unabated through the years of apartheid, when educational funding was given along race, gender and ethnic lines (Cohen 1994).

Generally in Africa and in South Africa in particular, it is especially difficult for rural girls to pursue further studies and follow a career. Davison (1993) in his study on attitudes of Malawian parents towards educating their daughters, came across a notion held widely by the society, that males are more intelligent than females. Since girls were perceived as less intelligent, their parents questioned the usefulness of educating them. These stereotypical attitudes are not so different from those many rural parents and teachers have towards female students in South Africa. Social theorists have suggested that in a society that differentiates roles in terms of gender; individual behaviour is influenced by what is considered to be sexually appropriate (Badger, 1981). It is therefore my intention to find out how the educational history

and social attitudes of the people have affected the attitudes of female students towards sciences.

In his recent study of attitudes, Gutbezahl (1995) concluded that the attitudes of teachers and society were negative towards female students who would excel in sciences. Female students themselves developed a negative attitude towards the subject because they associated the subject with "clever ones"; some considered it too difficult, and not for girls. Personal factors tend to inhibit students' opportunity to benefit from the provision of science education and to achieve satisfactory performance in science. One such factor relates to the reaction of students to experience with the subject. Girls tend to react negatively towards science because society perceived science as difficult and a male subject. This perception was further worsened by the apartheid system of education that was meant to sideline the black majority from participating in the economy of their country.

In some African societies girls have been perceived to be less intelligent than their male counterparts and it was considered not important to educate them because women were meant to do housework and bear children. According to Jeged, Agholor and Okebukola (1996), the role of women in the traditional African society is reduced to household chores including child bearing and rearing and providing labour on the farms. The implication is that girls attribute their failure to a particular situation.

According to Heider (1944), when we have experienced a failing or a success, we may locate its origin in another person or thing, in fate or in ourselves, and this might influence the way we relate to our performance in the subject in the future. That is, society's perception towards science as a subject can affect to a large extent, the attitudes of girls towards science. Maybe because some parents did not have the opportunity to do science at school, the information that they pass on to their children is that science is a difficult subject. Girls would internalise this perception and this would negatively affect their attitudes towards the subject.

Parents and teacher's expectations for girls learning mathematics and science have enormous impact on girls' performance. According to Karp, Candy and Linda (1998), we also strive to maximise success and minimise failures in our interactions with the world. Therefore, we develop favourable attitudes toward those objects that we perceive will facilitate success, and unfavourable attitudes toward those that we perceive will hinder success, or lead to failure. Besides developing such positive and negative affects toward correspondingly valenced objects, we also adopt the attitudes of peers, authority figures, etc. to conform and feel accepted. According to Karp *et.al* (1998), some girls mainly attribute their failure to external factors such as society's perceptions about science and female ability. Since society perceived science as 'a male subject', girls would attempt the subject with the preconception that they would not succeed; if they do succeed, it would be because they have worked especially hard. The attitudes of teachers towards female students in some science lessons, and the expectations of teachers and parents of girls in the sciences, also contribute to their lack of success in science. Teachers and parents expect girls to achieve on the same level as boys in science. This contradictory attitude causes confusion and puts pressure on the girls that affect their performances in the subjects (Gutbezahl, 1995).

It is therefore against this background that I decided to find out what has affected the attitudes of female students towards learning physical sciences in the high schools of Mafikeng in 2004.

1.2 Statement of problem

After visiting some of the high schools in Mafikeng I found out that most of the schools had more female students doing commercial subjects than Physical Science. Therefore I decided to find out the factors that might affect the female students when they select their subjects at grade 11.

The problem was to find out: Why there were few female physical science students in the high schools of the Mafikeng District?

1.3 Research questions

The research study was guided by the following research questions.

1.3.1 Do high school grade 11 female students have positive attitudes towards learning physical science?

1.3.2 What factors influence grade 11 female students' attitude towards physical science learning?

1.4 Purpose of study

The purpose of this study was to investigate the attitudes of Grade 11 female students towards physical science in selected high schools in Mafikeng. This study extended research on affective factors that might influence students' attitude towards physical science. As Nenty (1998) pointed out, technological and scientific advance of a nation can only be realized by its ability to tap a pool of scientifically and technologically literate persons; given that science is one of the subjects that play an important part in the development of any society.

This research was also intended to give an in-depth study of the challenges faced by students during science lessons and how educators impart the subject to the students, whether educators use experiments or demonstrations to impart knowledge to students. The research also looked at the availability of resources such as textbooks and science equipment in schools.

The research also focused on the influences of future carrier aspirations in the selection of subjects, as we know that at this stage students selected subjects according to what they would want to after school. It also focused on factors like parental, peer and environmental factors such as classroom and home as they play an important part in the formation of attitudes.

1.5 Significance of study

South Africa is in dire need of both males and females who are technologically and scientifically literate. The advent of globalization has put more pressure on countries to develop personnel who can compete technologically and scientifically at regional and at international levels. Thus the information generated through this study can contribute to the development of educational policies and practices that would encourage female students to opt for science subjects in schools.

It was hoped that this study would provide an insight into the challenges associated with the formation of attitudes of female students in Mafikeng. It would also help the education policy-makers to employ qualified science educators and encourage female students to do sciences. This research might highlight to the Department of Education the methods educators used to teach physical science in schools. Physical science is a practical subject where students use experiments for the construction of knowledge and can use the experiments to support some theories they learn in the subject. The research might encourage the Department of Education to provide science apparatus for schools to make both the teaching and learning of physical science interesting.

1.6 Limitations of the study

The limitations of this study were that:

I was not able to carry out the research in all the high schools in the district because it was going to be difficult for me to do the analysis.

Some schools were complaining about university students visiting there schools which was resulting in lesson disrupting, as a result they might not have explained well to the students what they were supposed to have done.

Students might not have understood the questions and they might have ended up answering questions for the sake of answering without getting the essence of the questions. As a result the sample from the selected high schools mentioned, was used to generalize the attitudes of female students towards science in Mafikeng.

1.7 Definition of terms

1.7.1 Attitude

It is a mental and neutral state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related (Sarnoff, 1970).

1.7.2 Behaviour

According to Hornby (1995), behavior is the way subjects act especially towards other people. In this proposal it will be used to refer to the way one reacts towards other people, objects and certain situations.

1.7.3 Cognitive development

It is the process of acquiring knowledge and understanding through thought, experience and senses (Hornby, 1995).

1.7.4 Environment

According to Hornby (1995) it is the conditions, circumstances affecting a person's life. In this work it will be used to refer to home, teacher, classroom, peers, media exposure and factors outside the person's own body and which will have effects on the person.

1.7.5 Peer

According to Hornby (1995), it refers to a person who is equal to another in rank, status or ability. In this work it will be used to refer to people of the same age who form the social group or friends of the individual.

1.7.6 Personality

According to Hornby (1995), it is the characteristics and qualities of a person seen as a whole.

CHAPTER 2: LITERATURE REVIEW ON ATTITUDES

2.1. Introduction

Simply put, attitudes are likes and dislikes. Social psychologists have given various definitions to the concept. Most of them view attitudes as inclinations or predispositions. Having reviewed the literature on the topic, Sarnoff (1970) defined an attitude to be a mental and neural state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which one is related. Later on, Eagly and Chaiken (1989) defined attitude as a relatively enduring organisation of beliefs around an object or situation predisposing a person to respond in some preferential manner.

Our response to an object is often in line with what we believe about, and how we feel towards that object. Attitudes are, thus, said to have a knowledge/belief (cognitive) component, an emotional or affective component and a connotative or behavioural component. Having an idea or belief about the object is the minimum condition for having an attitude with regard to it. When the object of which you have an idea becomes associated with pleasant or unpleasant events or with your aspirations and goals, you attach a corresponding affect or an emotional tinge to that object. This affected belief energises and directs your response with regard to the object. An attitude may thus be understood as an idea or belief charged with emotion predisposing an individual to act in a particular way to persons, things, situations, issues, etc.

Role models are essential to female success in engineering and technology careers. Psychological research proves that boys feel capable of completing tasks, while girls only feel capable of successfully completing a task they view as related to females (Karp, Candy and Linda, 1998). Young women need to be educated about the opportunities available to them through mathematics and science during high school. They need to understand the relevance of their lives in order to sustain their interest and confidence, in other words female students would want to understand the importance of what they would be learning in relation to application in the development of the society. Females do not want to associate themselves with

destructive science which is why many female students find biology easier than chemistry and physics.

2.2. Function of Attitudes

Eagly and Chaiken (1989), claim that to live in harmony with the world, humans have to, in some contexts, control the environment and in other contexts they need to adapt to the control of the environment. In order for a person to be able to do so, he/she first requires knowledge of the world he/she lives in. But the world contains millions of objects and events, enough to drive any person to his wits' end if he/she were to study each of them individually. A hit-or-miss approach in responding to individual stimuli, as and when they present themselves, would keep us incompetent to the end of time. As a feasible alternative, therefore, one has recourse to a parsimonious understanding: one classifies the stimuli, categorises them and simplifies one's dealing with them. Thus, one reduces the multiplicity by conveniently grouping the objects and phenomena and developing general or category-specific orientations to knowing them and dealing with them. Attitudes, thus, serve as a personal strategy or an informal and empirical theory, based on direct experiences and communications from others, to help reduce the anxiety in acquiring a working knowledge of the world.

According to Karp *et.al.* (1998), we also strive to maximise success and minimise failures in our interaction with the world. Therefore, we develop favourable attitudes toward those objects that we perceive will facilitate success and unfavourable attitudes toward those which we perceive will hinder success, or lead to failure. Besides developing such positive and negative affects toward correspondingly valenced objects, we also adopt the attitudes of peers, authority figures, to conform and feel accepted. Thus, attitudes help us lead a well adjusted social life. Also to protect ourselves from unpleasant truths about ourselves, we develop some attitudes, which predispose us to defensive behaviours such as projection and rationalisation.

One may also derive emotional gratification by expressing oneself in terms of attitudes appropriate to one's basic personal values and self-concept. That is, some attitudes provide an opportunity for expressing or materialising one's basic values and

give one immense pleasure of actualising oneself. For instance, if you had strong humanitarian values, you would develop positive attitudes toward the poor and the destitute. Aided by these attitudes, you would support their cause and thereby bring your values to fruition (Eagly and Chaiken, 1989).

According to Eagly and Chaiken (1989), attitudes help people to understand the world around them, to lead an adjusted life in the world, to protect their self-esteem, and to express their fundamental values. An attitude may perform one or more or even all of these functions. For example, a student might develop a hostile attitude toward a particular "clique" of fellow students for ego-defensive reasons. Quite soon this attitude guides one's selection of student acquaintances and friends, and thus, becomes instrumental in fulfilling one's needs to belong to a peer group. It can also lead one to assert one's views and derive satisfaction from being able to take an open stand on issues. It can also facilitate one's further dealings with the group by predisposing one to act in a clear-cut and well-defined fashion rather than feel fresh and lost every time one encounters the group or any of its members. According to Eagly and Chaiken (1989), sometimes students tend to choose certain subjects at school because their friends are doing the same subject. Sometimes students choose subjects because their parents pursued the same subjects when they were at school, or because they like the science teacher.

2.3. The Formation of Attitudes

We learn our attitudes from direct experience with attitude objects as well as from other people. Early in life parents are the source of our attitudes. As we grow up, the sources multiply. Veter and Green (1932) studied the genesis of anti-religious attitudes among the members of the American Association for the Advancement of Atheism that was an illustration of the sources of attitude learning after childhood. These investigators found that many of the members had accumulated atheistic influences from readings of history and science. For some members their atheistic attitude was a by-product of their general philosophy of materialism. Traumatic

experiences, like the death of a well-loved father, had driven some to atheism. Some others revealed that they had just adopted the view from friends. The fact that some girls develop negative attitudes towards science may be due to societal factors based on their philosophical traumatic experiences and simply their inability to attempt the study of physical science.

According to Eagly and Chaiken (1989), there is a considerable overlap of factors that influence the development of the three different components of an attitude. But, direct experience with the object and related material seems to contribute more to the development of the cognitive and affective components, and other people contribute more to the behavioural component especially when powers of sanction rest with them. Regardless of the source of one's attitudes, the function or role of an attitude is directly or indirectly concerned with suitably responding to one's phenomenological world, that is, the world as perceived by the individual. If the perceived changes in the environment demand a new "strategy", the individual will develop or adopt such adaptive orientations (attitudes) as will facilitate the person's personal way of coping with the environmental exigencies. At least on principle, therefore, attitudes are not immutable.

If attitudes are devices developed in response to needs and if needs are not static, then attitudes should not be static, either. In reality, however, attitudes resist change. One reason for this resistance may be advanced as follows: the scientific, technological and socio-economic progress around us is so fast that not all of us manage on our own to perceive or take cognisance of the changing needs, which are to be fulfilled in order to keep pace with the progress. It is often only a few individuals or groups who recognise the urgency of the needs and adapt themselves effectively. Some of them become leaders and agents of change among those who "lag behind". It is in this context that most young people will be facing the problem of attitude change (Eagly and Chaiken, 1989). From the above, it is noticed that attitude formation may be affected by the following; environment, peers, future aspiration, parents, teachers and perceptions on science.

2.4. Approaches to Attitude Change

According to Eagly and Chaiken (1989), attempts to change attitudes are as old as social life on earth. The head of a traditional family, the village headman, the religious priest, the social worker, the gang leader, the propagandist, etc. are all examples of people who influence the attitudes of others. With altruistic or selfish interests in mind, these people employ ways and means that are more intuitive than scientific. A systematic understanding of attitudes, however, can provide more serviceable guidelines to all those whose jobs require them to effect attitudinal changes in people. Numerous studies have been done on the subject matter of attitude change and over a dozen. Insko (1967) theories have been advanced to interpret and accommodate the facts related to the dynamics of attitude change. Here I will only take a look at a few salient points of the theories.

According to Insko (1967), the psychological structure of man is said to be composed of integrated sets of cognitions regarding himself/herself and the world. Any new information that enters his/her head if out of tune with the existing structure produces disequilibria, which gives rise to psychological discomfort. Such discomfort urges the person to alter the existing structure in him/her, (Insko, 1967).

Banking on the tendency of the attitudinal components to be consistent, one approach to change attitudes could well be to engineer any one of the three components. One may, for example, choose to change the cognitive component by introducing new, reliable and cogent information about the attitude object in question. The other two components will then tend to align themselves to the altered cognitive component, resulting in a new attitude. By the same logic, one may influence the affected part by associating the attitude object with pleasant or unpleasant experiences. Traumatic experiences are extreme cases of the affective component being influenced. If one wanted to start with behaviour itself, one could coax people into behaving in a way that is at variance with their present attitude and the resulting *cognitive dissonance* will motivate them to change their attitude in line with their new behaviour. The individual might also reject the new information and maintain the old cognitive

structure intact, if the information is perceived to be useless or the change required to accommodate it appears too cumbersome (Insko, 1967).

According to Insko (1967), it is believed that another approach to attitude change may arise from an analysis of the functions, in which a particular attitude fulfils for a person. If the attitude one is trying to influence has been serving a knowledge function, that is, if it has been helping the subject to structure and understand his/her universe, when one attempts to change it, it will be successful if one gives the subject information that serves the function even better. In the same way, one must show that the advocated attitude is instrumental in leading a better-adjusted life in his situation, if the attitude one wants to change in the person has been fulfilling an adjustive function. If the attitude in question were an offshoot of the subject's basic values, attempts to change just the attitude would be of little use; the person's basic values have to be tackled. Influencing attitudes that fulfil a person's ego-defensive function is a pretty difficult affair; one may have to study the person's self-concept and help him/her take a re-look at himself/herself.

2.5. Effective Communication on Formation of Attitudes

It is asserted by Eagly and Chaiken (1989), that no matter what approach is adopted for changing attitudes, communication of some kind (informational, persuasive or coercive) is always at the root of it all. While it is true, that not all communication or information leads to attitude change, any attitude change requires, and is related to, some information about the attitude object and about the consequences of the advocated attitude. Therefore, effective communication is a must for any attempt to succeed in changing others' attitudes.

Communication involves a source (who says), a message (what), a channel (in what medium), and an audience (to whom). The process of change as a result of communication has the following elements: attention, comprehension, yielding, retention, and action (Eagly and Chaiken, 1989). Various characteristics of the source, the channel, the message, and the audience interact in complex ways and

influence the dependent variables mentioned above (the elements in the change process). Such interaction effects have been demonstrated in studies, but as of today we do not have one comprehensive model to include all interactions. All the same, it would be useful for us to be aware of even some of the variables that characterise effective communication, if we were to attempt to influence and change people's attitudes and behaviour.

It is believed that people have a tendency to be selective in what they want to listen to (Eagly and Chaiken, 1989), they prefer information, which supports their attitudes, and avoid what is unsupportive. So, how would one first of all get them to listen to one's message? Mark Antony's style could help! As for the channels, mass media like the TV gets a lot of attention, but do not seem to effect change. What should one do? The idea of a two-step flow of influence may be utilised: the media message can be tailored for, and addressed to, opinion leaders, who would in turn influence the rest of the target population. Repetition of messages, active participation by the target person or group, creating new reference groups, providing a supportive environment, etc. help attitude change and facilitate sustenance of the change (Eagly and Chaiken 1989).

Group discussions and getting the persons to make a public commitment to behave in a particular way have proved to be more efficacious in bringing about attitude change than one-way persuasive communication. Subtle pressure towards uniformity in a group, coupled with the fear of being rejected from the group and the need to be accepted in it, is also a powerful way of influencing an individual's attitude. According to Eagly and Chaiken (1989), whatever approach one adopts to change attitudes, a practical assumption one can go by is that attitude change occurs because of some conflict, inconsistency or dissatisfaction with the status quo. Armed with this assumption, one may set out to create the appropriate conflict or dissatisfaction in the target population, offer the necessary support to resolve the conflict, and ensure adequate reinforcement to sustain the emergent change.

2.6. How are Attitudes Learned?

According to Eagly and Chaiken (1989), as individuals, with a free will and free mind, we are able to influence our behaviour by educating our minds. We do this by introducing, learning and nurturing attitudes. Our upbringing and our nurturing will cause the ego to shape our unique attitudes to life and to the people around us. Whereas, part of one's personality is somewhat predetermined by inherited genetic traits, and then one's attitudes are shaped largely by an ongoing series of learning experiences. If at the age of three, one placed one's hand in a flame, one would probably develop and nurture a wary, but useful attitude to all types of naked flames for the rest of one's life. This process of continuous learning will shape, influence, and re-shape one's attitudes and perceptions of life. Certain events in our lives, and the behaviour of people close to us, will influence our cognitive (mental) processes. This will include the way we think, as well as our emotional make up. It will also influence how we feel, act and react to these people and events. Our attitudes also determine how we perceive our roles and ourselves in society. The particular format of our nurturing background will influence our self-images and the self-evaluation of our being (Eagly and Chaiken, 1989).

In some African societies young people tend to [illegible] from their parents than from their peers. Some parents grew up [illegible] sideline them from acquiring scientific knowledge. [illegible] societies were in a way gender biased. There were [illegible] women were confined to household work, [illegible] went out to work for the family.

2.7 Reactions rather than responses

It is asserted by [illegible] (199[illegible]) that [illegible]

attitudes all influence our behaviour. [illegible] according to the surrounding [illegible]. We tend to act in accordance with [illegible] friends, for [illegible] crisis.

2.8 Peer influence on Attitude

According to Sarnoff (1970), attitudes can also be formed as a result of close social contact with an individual (partner or group (family, church, school). When a personal need base is reinforced and supported by [illegible] individual or the group attitudes take on a substantial and powerful influence over one's behaviour.

2.9 Attitudes and Behaviour

Attitudes signify what people think [illegible] they feel about [illegible], how they tend or intend to behave toward an attitude object. [illegible] on the actual behaviour of people? Could we predict a person's overt behaviour from our knowledge of his/her attitudes?" (Karp *et al.* 1993)

According to Karp *et al.* (1993), the overt behaviour of a person is determined not only by what one would like to do, but also by what one feels one should do, by what one is used to doing, and by the consequences of one's actions. There are social norms, peer expectations, established routines, habits, consequences, and situational factors that also influence one's behaviour. Attitudes are significant causes, but their strength may not always be sufficient to overcome the forces produced by other variables such as, social pressure. A boy may be fond of physical science but if neither of his brothers and sisters or even parents has done the same in the past, the boy is going to be hesitant to do the subject. When there are no constraints, however, between attitudes and other factors, attitudes are reasonably good predictors of behaviour. Further, real-life stimulus situations are complex and a person is likely to have different attitudes to the different elements that constitute a given situation.

2.10. Factors affecting Attitudes

As indicated by Bloom (1991), the idea about the impact of home environment on learning and achievement is not new. As early as the 1960s, Bloom (1991) recognized the home environment that parents provided for learning, as an important variable. The works of Bloom were significant because his discoveries duly changed the emphasis of educational study from the concern that previous research placed on the impact of socio-economic status and intelligence on school performance, to the role played by the home environment and the extent of parents' influence on the child.

Parents can influence their children's academic success in school by giving all the support they need from home. At home parents can exert their influence in ways that may affect overall performance, positively or negatively. Researchers hold the hypothesis that all parents and families want the best for their children and can help them succeed (Bloom, 1991). According to Ginsberg, Bempechat and Chung. (1992), parents being the children's first teachers can exert a great deal of influence on a child's life. In fact, research studies have revealed that high student achievement in school is closely related to positive parental participation in education (Epstein, 1987, Schimitt, 1986, Solomon, 1991). Epstein (1999) reiterated that each of the practices of parental involvement must have its own goals and answer to the needs of the parents in question. Not just any involvement with regard to school-parent practice of partnership will raise student achievement in test scores. It is therefore important for parents to encourage their daughters to do challenging subjects like science and to eliminate completely the perception that science is for males and is very difficult.

According to the US National Commission for Excellence in Education (1983), some countries have cited parental responsibility in the education of their children. The US National Commission for Excellence in Education (1983) has identified parents as children's first and most influential teachers, emphasizing parents' roles in fostering children's inquisitiveness, creativity and self-confidence, while actively participating

in their schoolwork. In Korea, it is well known that the mother has the primary responsibility for promoting the educational excellence of her children (Ellinger and Beckam, 1997). It is the same situation in some African societies; the mother plays an important role in the general education of the child because fathers are always away working for the family. The Bullock Report (1971) and other subsequent government education reports reflected Britain's preoccupation with the importance of fostering literacy and reading habits from the early years of a child's life, pointing to parental efforts in developing reading in the home. Notable among such projects involving parents in reading is the United Kingdom Reading Association's (UKRA) family reading programme and the guidelines for use by parents and family members (Beverton, 1993).

Reporting from Singapore, Ling *et. al.* (1995) in his research on parental involvement with primary school children's schooling revealed that parents of high achieving children were more anxious about maximizing every opportunity for their children including those not directly related to schoolwork. While in the home country, the Malaysian government has time and time again stressed that the school should work towards inculcating values in school children while simultaneously encouraging academic excellence in order to raise well-balanced citizens. Epstein (1999), in his talk to one Parent Teacher Association meeting pointed out the responsibility of parents in character building and in working together for children's success in school. As reported by Scott (1995), researchers who are experts in the field of parental involvement in school have advocated a number of parental involvement models for school success.

According to Karp *et. al.* (1998), parents can involve themselves in their children's schooling in many ways. One type of parental involvement is parent's interaction with the child at home. According to Scott-Jones (1995), there are four levels in this interaction: valuing, monitoring, helping and doing. The first level valuing is where parents convey the value of education to the child. Parents also monitor the child's behaviour and performance. Ginsburg *et. el.* (1992) define the first two interactions

as academic socialization. `Helping' interactions are focused on the acquisition of basic academic skills and are defined as cognitive socialization. At an early age we see parents as over involved in helping their child's schoolwork, whereby the parents or any other adults in the family, are actually doing the schoolwork for the child.

Parental involvement may mean different things to different people and covers a variety of interactions between parents, pupils and school. Epstein (1987) identified four components of parental involvement: basic obligation of parents, school to home communication, parent involvement at school and parent involvement in learning activities at home. In suggesting a checklist for an effective parent-school partnership, Epstein (1994), on another occasion suggested a set of guidelines for effective parent-school partnership practices of parental involvement based on five types of parental involvement: Parenting, Communicating, Volunteering, Learning at Home and Representing Other Parents. For each division or action, she included specific goals, practices and outcomes as a checklist for schools and parents. Some parents think helping their children with their homework is enough; parents need to be actively involved in every activity of their children at school such as attending Parents Teachers Association activities.

However, the task of educating the child is not easy. Research reveals that problems such as attitudes, values and habits tend to have the greatest impact on a child are learning (Herman and Yen, 1983). One example is the nature of parental beliefs about the ability of their children and the values they hold about education itself. Children's attitude towards school is also an important factor in influencing their school success. Such an attitude on the part of the child is believed to be directly influenced by parental beliefs about school and education, which is reflected in the socializing process. According to Herman and Yen (1983), parents who are involved in their children's school activities usually have a positive attitude towards school .They are more satisfied with their children's school and the progress of their children in school (Herman and Yen, 1983).

From the psychological point of view, there is another factor that influences school achievement that is related to self-efficacy beliefs of children and their parents (Schunk, 1991). Psychologists believe that self- efficacy of both parents and children have a role to play in the children's school achievement and success. Self-efficacy involves individuals' judgements about their ability to accomplish certain goals in particular situations (Schunk, 1991). Bandura (1993) reported that parental academic self-efficacy influences their children's self-efficacy resulting in better academic achievement. Parents' self-efficacy is normally determined by their socio-economic status or their quality of education. Parents with low self-efficacy have a tendency not to get involved in school activities. They even would not involve themselves with helping their children's schoolwork. This is common among parents who are not well educated and therefore feel inadequate. In such circumstances it is important that the schools maintain a good communication channel open for parents, encouraging them to become `educative partners'. Parents and school should work together for the betterment of the children in school. Many researchers support this view.

According to Bandura (1993, 26), "Self-efficacious parents regard education as a shared responsibility. The higher their sense of efficacy to instruct their children, the more they guide their children's learning and participates actively in the life of the school." Indeed parental influence on children's academic attitude has been shown in many other studies (Bandura, 1993, Schunk, 1991; Eccles, 1989). For instance, research indicates a significantly positive relationship between children's value in their English or mathematics studies and their perception of their parents' aspirations and beliefs in their ability to do well in such subjects. But schools or parents by themselves cannot work alone. They need to form a partnership and to work as a team towards a common goal for the betterment of the pupils. As cautioned by Epstein (1994), research findings about parent involvement should not be left on the shelves but need to be shared with the schools and translated into practical actions for school development and pupils' achievement.

According to Fennema (1976), in the United States of America, parents play an increasingly important role in whether their daughter enrols in mathematics and

science courses. This influence comes from behavioural involvement, such as communication with teachers and counsellors, participation in school volunteer programmes and parent-teacher organizations. Parents are involved with their children intellectually, such as discussions about school activities and planning academic programmes. A parents' intellectual involvement may be effected by the parents' own educational history (Ma, 1999:68).

Parents also have enormous influence on their child's personal feelings towards themselves and school (Kennedy 2001). "One theoretical explanation of how parental involvement works for children is that it improves children's cognitive skills that make them more likely to succeed in academic work." (Ma, 1999, 66). Another theory proposes that parental involvement affects enrolment because of affective influences rather than cognitive influences. Therefore, parental involvement has far-reaching consequences and plays a vital role in female enrolment in mathematics and science. The "critical filter" is especially obvious with students that have inadequate mathematics skills who unfortunately will have limited career options Ma (1999).

2.11. Environment and Culture

Recent research by Sanders and Peterson (1999) on the gender gap has documented the subtle environmental causes that affect a females' decision to drop out of mathematics and science. Studies prove that gender differences in mathematics and science achievement are due to social and cultural effects on expectations and confidence levels, rather than biological factors.

Gender bias in schools has been documented in some studies Gutbezal (1995). A subtle cultural support of sexism still exists in our society. According to Gutbezal (1995), there is overwhelming evidence of the importance of equal representation in textbooks (most science textbooks were written by man). Clearly a textbook which refers to males twice as often as it refers to females is not likely to inspire the girls or give them the confidence to participate (Parker, 1999). Mathematics and science textbooks responded to the feminist movement in the 60's and 70's by attempting to remove gender labels altogether (Sanders & Peterson, 1999). However, the effect is

now more abstract and unrealistic in the use of some examples that are meant to allow the learners to imply gender. This abstractness in student exercises subsequently still favours male mathematics and science domination by allowing stereotypes to continue. The type of experiences girls have in middle school and high school mathematics classes is often the critical filter that can lead to declining female enrolments and negative attitudes at the post-secondary level (Sanders & Peterson, 1999).

Studies have been conducted regarding the attention that the different genders receive from teachers. Male-dominance is still prevalent in middle schools and high schools across the United States. Boys receive more frequent and focused attention from the teacher than do girls. It is a well-known fact that attention from the instructor has positive affects on learning and retention (Sadker, 1999). This is a common feature in most African states due to their beliefs about the roles of women and men, although they are trying to get rid of such beliefs as a result of women organisations, which are lobbing for gender equity in all sectors of education.

According to the US National Commission for Excellence in Education (1983), a number of studies have recorded gender differences in attribution for performance in sciences. Gutbezahl (1995) found out that parents' and teachers' expectations for girls in mathematics and science have enormous impact on girls' performance. She also found out that girls internalize their teachers' and parents' negative expectations, which become self-fulfilling prophecies. She concluded that if girls believe that they cannot achieve in mathematics and science, they do not achieve in mathematics and science. Their prior performance reinforces parents and teachers' negative expectations and feeds the cycle of negative expectations and lack of achievement. Leach, (1994) found out that the low participation of girls and their negative attitudes towards mathematics and science are greatly affected by teachers' attitudes.

Blevins-Knabe and Musun-Miller (1991) carried out a study with parents of 4 and 5 year old children about their children's mathematics skills. Parents of boys indicated that their sons would be able to solve all mathematics tasks sooner than parents of girls who indicated that their daughters would not be able to solve all mathematics tasks. Stipek and Grunlinski (1992) asserted that girls do not try mathematics and science because they assume that they will not succeed. They said that girls studied biology rather than physics and chemistry. They also noted that girls internalise failure while boys externalise failure. Girls attribute their failure to lack of ability. Joffe (1986) and Rosser (1993) also pointed out that since most scientists are male, most scientific theories, practices and approaches reflect masculine views, and that women feel very uncomfortable with the destructive application for which males had used science.

2.12. Other variables that affect Attitudes

Measurement of personal variables is also an important facet of the research conducted by Gill and Judith in 1994. Co-relational studies measuring prior attitude and achievement in mathematics and science, self-efficacy, self-image, and self-confidence have brought to light the importance of the student's personal motivation on success. Gill and Judith (1994) pointed out that middle and high school girls have positive attitudes towards school but negative attitudes towards mathematics and science. They carried out a study focusing on the separation of boys and girls in Australian schools through the study of 7^{th}, 8^{th} and 10^{th} graders in coeducational programmes as well girls-only schools. The results indicated that even when girls are taught in all girls' schools, they still have negative attitudes towards science and mathematics.

Pettitt (1995) carried out a survey of 162 students about their career aspirations and their feelings about sex stereotype in certain professional fields. Students responded that society accepts many different careers for females and males. However, they tended to choose sex stereotyped careers when filling out the survey. Girls felt that

they would be capable of becoming doctors and veterinarians, but they did not want to have science-related careers as adults.

2.13. Background of South African learners in relation to Attitude development.

The black majority of South Africans were disadvantaged by the apartheid system which prohibited them from learning science subjects because the government did not want black people to participate in the economy of the country. No research was done on the attitudes of South African students, since the majority of black students were not allowed to do sciences. Soon after 1994 a lot of research was done in this field. The majority of the researchers have found out that South African students have positive attitudes towards science and mathematics (Howie, 1998).

According to Howie (1998), the problem lied more with teachers who did not motivate pupils to attend school. Pupils find science subjects difficult, but the context within which they learn these subjects is challenging. The lack of qualified, confident teachers and lack of equipment and facilities engender this lack of self-efficacy towards these subjects. There is an urgent need for programmes to be put in place that will nurture the apparent positive attitudes towards the subject, to build up pupils' fundamental knowledge and understanding of the basic concepts in both subjects as well as that of the teachers. Now that access to education and the right to learn has been established for the majority in the country, it is time to set key priorities for the country's future. If South Africa wants to succeed in a rapidly changing and competitive technological world, it will need to develop and protect its capacity to produce well-qualified human resources in science and mathematics. In order to improve the lack of change detected by The Third International Mathematics and Science Study-Repeat (TIMSS-R) from developing further, resources have to be put into a variety of well-designed, planned and effective programmes promoting and implementing mathematics and science. Greater collaboration within and between government and the private sector will be required to optimise energies and resources. This is urgently needed to increase the number of pupils with the adequate

and well-founded knowledge and skills in these subjects to create a critical mass of matriculants able to move into Higher Education, Business and Industry in the short, medium and long term.

2.14. Implications of the Introduction of Curriculum 2005 and OBE

In both Australia and the United States the word 'outcomes' has now largely replaced 'objectives' in official government discourse on assessment. It might seem at first glance that the two terms are roughly synonymous. According to one recent definition, "An outcome is a brief statement of what is to be learnt" (Hannen & Ashenden, 1996, p. 44). See also < http://www.sss.nt.edu.au/co4/co4.3.html>. In Britain the term attainment target' is used to convey the same idea. However, there are versions of Outcome-Based Education (OBE) which are focussed on the curriculum and others which derive from the real-world contexts in which students will have to live and work. It is in this latter sense that Cocklin (1995, p. 3) defines 'outcome' as "a culminating demonstration of learning, something a student can do or demonstrate, which is life role focussed". This definition is closely modelled on the way Spady (1988, pp. 4— 6) explains the idea:

An outcome is not the name of a concept, or the name of a competence, or the name of an attribute. Outcomes actually happen, somebody does something. Until they do it, an outcome has not been realised. An outcome is an actual demonstration in an authentic context...

An outcome is a culminating demonstration of the entire range of learning experiences and capabilities that underlie it. It occurs in a performance context that directly influences what it is and how it is carried out. The word 'based' means to direct, define, derive, determine, focus and organise what we do according to the substance and nature of the learning result that we want to have happen at the end.

When we put these two words together, the term 'outcome-based' implies that we will design and organise everything we do around the final intended learning demonstration...

Outcome-based education means to start with a framework and a set of expectations about the desired learning results. The curriculum and the organisational forms that are appropriate for achieving those results can then be built.

According to Spady (1988, p. 4) a culminating outcome is both a synthesis and an application of prior learning in significant performance contexts. Enabling outcomes are those "essential components of knowledge, competence, and orientations on which Culminating Outcomes ultimately depend" and discrete outcomes are those "isolated/disconnected content details and activities that do not serve as Enablers for significant, Culminating Outcomes".

As can be seen from the preceding quotation his argument is that the starting point for designing any course of instruction has to be a clear sense of the learning demonstrations we hope to see at the end

Spady (1993) explains that the theory of outcome-based education rests on three assumptions: (1) that every student can be a successful learner, a notion that was central to the work of Carroll (1963), Bloom (1976) and other writers who helped to develop the concept of mastery learning; (2) that success, once experienced, leads to more success; and (3) that school staff need to understand that they have control over the conditions which make it possible for success to be enjoyed by all students. In that sense, taking all three assumptions into consideration, the outcome-based model emphasises *achievement*, rather than simply *measurement*, and, because it is an instructional model which prizes individualised mastery learning and promotion based on achievement, it has been claimed (Glatthorn, 1993) that there are some similarities between this approach and the earlier philosophy of mastery learning (Block and Anderson, 1975).

After 1994 the democratically elected government of the Republic of South Africa introduced the new curriculum that is not based on gender, religion, political affiliation or race with the aim of giving all South Africans the right to education. In Curriculum 2005, the government intents to heal the division of the past and establish

a society based on democratic values, social justice and fundamental human rights. The promotion of values is very important not only for personal development, but also to ensure that the national South African identity is built on values very different from those that underpinned apartheid education. It also aims to improve the quality of life of all citizens and free the potential of each person through education.

The fact that blacks were not allowed to do sciences implies that there were so many people who were not able to free their potential because of past educational policy. The introduction of OBE (Outcome Based Education) enables learners to achieve their maximum ability because it encourages a learner centred and activity-based approach to education. The critical outcomes envisage learners, to be inspired by values, and to act in the interest of society based on respect for democracy, equality, human dignity, life and social justice. The new curriculum aims to create learners who are confident and independent, literate, numerate, multi-skilled, compassionate, with respect to the environment and the ability to participate in society as a critical and active citizen (Department of Education, 2002).

The Natural Science learning area statements try to create an awareness of the relationship between social justice, human rights and a healthy environment. It also ensures that all learners receive meaningful education that will help learners understand not only scientific knowledge and how it is produced, but also the contextual environment and global issues that are intertwined within the learning area. The Natural Science Learning Outcomes stress learners' ability to use science knowledge, not just acquire it. Students should use the knowledge they acquire in the learning of science in solving problems in their society (Department of Education, 2002).

The number of female students who are beginning to show interest in science is increasing every year. The number of females participating in scientific projects and the number of female students doing sciences has increased since the government has embarked on the overhaul of the education system.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This chapter outlines the methodology used to carry out the research study such as population sampling, research instruments, administration, collection of data, and the validity and reliability of the research.

3.2. Research Method

The objective of this research project was to determine the attitudes of grade 11 female students towards physical science. Therefore, I used the survey method as I thought that it was most appropriate. A survey method is one that seeks to investigate the attitudes, behaviour and opinions of a group of people usually by questioning them.

According to Trochim (2000), the advantages of the survey method are that it is relatively inexpensive and that one can easily describe the characteristics of a large population. The use of large samples is a big advantage in itself, because it makes the results statistically significant even when analysing multiple variables. The main goal of surveys is to provide facts and estimates that can be used by decision makers to gain insight into the relationship and difference of phenomena. It also provides understanding about the challenges and implications associated with attitudes of female students towards physical science (Trochin, 2000). The outcomes of the analysis of the data from the survey were generalised to the population of grade 11 female students in Mafikeng.

3.3. Population and sampling

The population consisted of 434 female students from some of the high schools in Mafikeng District as listed in Table 2 below. All the high schools from which the population was drawn offered physical science. Seven high schools were selected randomly by picking their names from a hat that contained names of all the high schools in the Mafikeng District.

Table 2: Population from which sample was taken

Name of High School	Non of students in the population
Danville	47
Magokolodi Masibi	66
Mafikeng	63
Tshoganyetso	60
Kebalipile	63
Lapologang	66
Batlong	69
Total	434

I wanted my sample to be 300 female students that is 69% of the population. I thought that a sample of 300 students would be manageable in terms of administering questionnaires, and representative. The results obtained from this sample would be generalized to the population.

The sample of 300 grade 11 female students consisted of 42% physical science students and 58% non physical science students as I wanted to get the views of both physical science students and non physical science students. I decided to use the stratified random sampling method. According to Salant and Dillman (1994), in stratified random sampling the population is divided into groups to ensure that members of the population with particular attributes are represented in the sample

group. Then a random sampling is applied to each of the stratum. In this research I had the following two stratums:

(i) Physical science students

(ii) Non physical science students.

Initially I wanted to have 150 physical science students and 150 non physical students so that the two groups were well represented in the sample, but I found out that the total number of grade 11 female physical science students was less than 150 as show in Table 3 below.

Table 3: Grade 11 Students who took part in the survey

Name of High School	**Physical Science Students**	**Non Physical Science Students**
Danville	9	25
Magokolodi Masibi	20	25
Mafikeng	18	25
Tshoganyetso	16	25
Kebalipile	22	25
Lapologang	21	25
Batlong	19	25
Total	125	175

So I decided to select all physical science students and only 25 of non physical science students. I used simple random sampling method to select the 25 non physical science female students. In simple random sampling a random sample is obtained by choosing elementary units in such a way that each unit in the population has an equal chance of being selected. Each non physical science students had to pick a piece of paper from a hat with a YES or a NO. I then took all those who picked YES and left those who picked No. This procedure was done at each of the participating schools in order to pick 25 non physical science students. There were 25 pieces of papers with a YES and 25 with a NO in the hat.

Although the number of non physical science students was greater than physical science students, this did not matter much to me because the research was not targeting physical science students. It was focused on the attitudes of grade 11 female students towards physical science. The research was not to carryout a comparison between the non physical science students and physical science students.

3.4. Instruments

I used the questionnaires adapted from the Center of Mathematics and Science Education (1986), as the instruments. I used closed questions to ensure that students did not lose focus. This ensured that students did not get bored as they tried to answer the questions, and also to minimize the time they spent on answering the questions. I did not use open questions, because some of the students might have provided irrelevant information or even not bothered to answer the questions. This would have resulted in re-administering the questionnaires Patton (1990).

A simple questionnaire was the instrument used to elicit the desired information from the respondents. The questionnaire was designed with structured demographic questions and attitudinal scales, such as the Likert and semantic differential. The semantic differential scale measured the respondents' attitude towards science and other factors that influence the attitudes of female students towards physical science. The Likert scale allowed students to choose a quantitative rating on a continuum scale that has bipolar adjectives at each end of the scale. In this way, they determine the point on the scale that best represents their attitude on each specific topic. The scale was used to collect data on the participant's ideas on the importance of science, perceptions and general attitudes and interests in physical science.

3.5. Administration

The questionnaires were given to teachers who later gave them to the female grade 11 students at a time convenient to them. In some of the schools, I was given the opportunity to administer the questionnaires myself.

3.6. Collection of Data

Since I administered the questionnaires in four of the schools, I did not take much time to collect the questionnaires. These schools were very supportive. The other remaining schools phoned me to collect the questionnaires. The information from the questionnaires was tabulated.

3.7. Reliability and internal validity

This section deals with reliability and threats to internal validity of the research.

3.7.1. Internal validity

Internal validity concerns the soundness of an investigation (Polgar and Thomas, 1997). It is the strength of our conclusions, inferences or propositions. According to Lock and Campbell (1979), they defined internal validity as the best available approximation to the truth or the falsity of a given inference, proposition or conclusion. However, in research studies there are threats to internal validity. The threats limit the extent to which the researcher can conclude that the different outcomes observed in groups of subjects are due to differential treatment administered to the groups.

3.7.2. Threats to internal validity

This section deals with threats to internal validity of this research.

3.7.2.1. Instrument error

Instrument error refers to the accuracy or precision of a measuring instrument due to respondents failing to understand the questions. In order to counter the threats to internal validity in this research study, the researcher used valid and reliable instruments. In order to minimize the threat to internal validity on questionnaires, the researcher ensured that all questions were simple and straightforward. The idea was to eliminate the chance that questions meant different things to different people. The questionnaires were tested on 20 students at the International School of South Africa before they were distributed to schools in order to find out whether the students

would understand the language and to also make sure that I would get the information I wanted.

3.7.2.2. Single group threat

According to Ratcliff (1995), single group threat applies when the researcher studies a single group. In this study, single group threat was absent because the population consisted of grade 11 female students from different high schools, and different backgrounds; some were rural schools and some urban, some were physical science students and some were not.

3.7.2.3. Selection threat

According to Ratcliff (1995) selection threat occurs when an effect may be due to the different kinds of people in one sample as opposed to another sample. In order to guard against selection threats this research had a research sample made up of grade 11 high school female students from seven different schools from rural and urban environments.

3.7.3. Reliability

Reliability is concerned with the accuracy of the actual measuring instrument or procedure (Ratcliff, 1995). To ensure reliability in this research study, the structure of the questions in the questionnaires were made simple so that the participants had only to choose whether they agreed or disagreed with the statement. The integration of both quantitative and qualitative methods in the analysis of the questionnaires makes the research findings and conclusion more reliable.

CHAPTER 4: ANALYSIS AND INTERPRETATION OF RESULTS

4.1. Introduction

This chapter reports on the analysis of the results of the investigation conducted to find out the attitudes of grade 11 female students towards physical science in the Mafikeng district. The research was meant to find out why there were few girls studying physical science in grade 11 at some of the high schools in the Mafikeng district.

4.1.1. Presentation of the results

There was only one source from where the data of the research was derived, that is the questionnaire from students. The research findings from this source were presented in the form of tables, followed by a brief discussion.

4.1.2 Analysis and interpretation of results

This research study combined both qualitative and quantitative research methods in the analysis of the responses given by grade 11 female students. Qualitative research techniques were used to analyse research data from questionnaires, which could not be expressed in numbers. Quantitative research techniques were used to analyse research data from structured questions.

The advantages of using quantitative analysis as indicated by Trochim (2000), is that it is objective, and it is believed that in gaining, analysing and interpreting quantitative data, the research remained detached and objective. It is deductive in that it tested theory, and it produced results that were generalized to new situations. It used data that was structured in the form of numbers (Fielding and Schreier, 2001).

In all the questionnaires the structure of the questions was in the form of Likert Scale. The advantage of using the Likert Scale as indicated by Trochim (2000) was that the results from the findings could be quantified; hence it was easy to apply the quantitative method.

However, quantitative analysis was not able to bring out more details of the research study in terms of the relationships between the factors that affect the attitudes of female students towards physical science. Hence, qualitative method was used to explain and interpret the quantified information obtained from the students.

According to Maxwell and Kaplan (1994), qualitative analysis basically involves interpretation of a given text corpus, e.g. a teacher-student dialogue. The dimensions of this interpretation depend on the specific interest of the researcher and on the research questions asked. Maxwell and Kaplan (1994) went on to say that qualitative analysis allows researchers to seek relationships between various factors that have been identified, or to relate behaviour or ideas to the attitudes of female students. It also allows the implications for policy or practice to be derived from the data, or interpretation sought of puzzling findings from previous studies. Qualitative analysis ultimately allows theory to be developed and tested using advanced analytical techniques. Qualitative analysis also generates detailed and valid data that contributes to an in-depth understanding of the context in which the phenomenon under study took place.

4.2. Results and analysis

The analysis was done question-by-question.

The questionnaires were divided into three groups:

1. Factors that influence female students when they choose subjects.
2. General views on the importance of physical science.
3. Perceptions towards physical science as a subject.

The students' responses were examined according to each of these categories and were tabulated into percentages (see Tables 2, 3, 4, 5). Table 1 was constructed to give a general demographic characteristic of the learners who took part in the research study.

Table 4: Numbers of physical science and non physical science students from the sample.

	Numbers	%
2.1 Physical science students	125	42
2.2 Non physical science students	171	58

Table 4 illustrates that 42% of grade 11 female students who took part in the study were physical science students and 58% of the female students were non physical science students.

Table 5: Influence on students' choice of subjects

Item	Number	%
3.1 Parents	114	38.5
3.2 Friends	11	3.7
3.3 Teacher	22	7.4
3.4 Future career	231	78.0

Of the factors that influenced grade 11 female students to choose their subjects (Table 5), 78% chose their subject in relation to their future careers; 3.7% were influenced by their friends; and 7.4 % were influenced by their teachers. As can be seen from (Table 5), 38.5 % were influenced by their parents. From table 5 it can be concluded that the greater number of students were driven by their career aspirations and their parents influence in their selection of subjects. Friends and teachers had very little influence on their selection.

Table 6: Reasons why students do not like physical science.

Item	A	%	U	%	D	%
4.1 Teachers do not teach the subject well	211	71.3	10	3.4	79	26.7
4.2 Teachers do not know their subject content	194	65.5	14	4.7	92	31.1
4.3 I find science difficult	194	65.5	2	0.7	104	35.1
4.4 My future career is not science based	149	50.3	38	12.8	113	38.2
4.5 No experiments are done during lessons	181	61.1	28	9.5	91	30.7
4.6 There are not enough text books at school.	204	68.9	30	10.1	66	22.3
4.6 I don't understand the importance of science	48	16.2	22	7.4	230	77.7
4.7 My parents discourage me from doing science.	79	26.7	0	0	220	74.3

Key A →Agree, U→ Uncertain, D→ Disagree

Of the students who do not like science, (Table 6), 65.5% considered science to be a difficult subject, compared to 35.1% who considered science to be easy. 50.3% considered science as not important for their future career compared to 38.2%. It is of concern that there is a big difference in percentages between those who said that teachers did not teach the subject well (71.3%) compared to 26.7% of students who thought that teachers taught the subjects well. 65.5% of the students said that teachers did not know their subject content compared to 30.7% who said teachers knew their subject content. It is of interest to note that the number of students who agreed with questions 4.1 and 4.2 is almost the same. However, it is interesting to note that the influence of parents on the selection of subject is not very significant as can be seen

from Table 6. 26.7% where those influenced by parents not to choose physical science were compared to 74.3% who were not influenced by their parents. It is also interesting to note that although most of the students did not do physical science, 68.9 % of those students agreed with the fact that there were no text books in schools, compared to 22.3% who did not have this problem. Despite the fact that most of the students did not do science, 77.7% of the participants understood the importance of physical science, compared to 16.2% of those who did not. 61.1% of the students acknowledged the fact that there were no experiments done during lessons.

Table 7: Reasons why students like science.

Item	A	%	U	%	D	%
5.1 I find science very easy	101	34.1	3	1	196	66.2
5.2 Learning science improves my reasoning capacity	178	60.1	21	7.1	107	36.1
5.3 My parents help me with my homework	51	17.2	0	0	241	81.4
5.4 My science teachers motivate me	69	23.3	12	4.1	219	74
5.5 Science is necessary in order to get a good job.	203	68.6	15	5.1	82	27.7
5.6 Learning science is a challenge I enjoy	102	34.5	17	5.7	181	61.1
5.7 Much of what is learnt in science is useful in everyday life	251	84.8	2	0.7	47	15.9
5.8 Science helps me understand the environment I live in	244	82.4	4	1.4	52	17.6

Key A→ Agree U→ Uncertain D→ Disagree

From the data 68.6% of the students liked physical science because of their future aspirations (Table 7). They considered physical science as an important subject for

their future careers, compared to 27.7% who did not. 66.2% of the participants found physical science to be a difficult subject compared to 34.1% of those who considered physical science an easy subject. It is also interesting to note that 84.8% of the students realized that science is important in their everyday life compared to 15.9% of those who did not think that way. 34.5% considered physical science to be challenging and they enjoyed the challenge they got from physical science.

Only 17.2% of the students indicated that parents helped them with homework compared to 81.4% who had no assistance at home. It is good to realize that 82.4%, compared to 17.6% of the students who included those who are not studying science realized that science helps them understand their environment. 74% of the participants did not agree that their science teachers motivated them compared to 23.3% of those who thought that they did. 60.1% of the students think that learning physical science improved their reasoning capacity compared to 36.1% who did not think so. The majority of the participants (66.2%) found physical science to be a difficult subject while 34.1% considered the subject easy.

Table 8: Students perception of science.

Item	A	%	U	%	D	%
6.1 Science is for clever people	72	24.3	28	9.5	200	67.6
6.2 It is important to do science in order to get good job	163	55	16	5.4	121	40.8
6.3 Science is useful for boys only	5	1.67	22	7.4	273	92.2
6.4 Science is dangerous	16	5.4	15	5.1	269	90.9
6.5 Science is very interesting	192	64.9	14	4.7	94	31.8
6.6 Science is for people who want to do science in future	142	47.9	77	26	81	27.4
6.7 Only those planning to get into science based careers need science	111	37.5	41	13.8	148	50
6.8 There are not many jobs for females that involve science	202	68.2	33	11.1	65	21.9

Key: A→ Agree: U→ Uncertain: D→ Disagree

From table 6, 67.6 % of the students did not agree with the perception that science is for clever people, as opposed to 24.3 % of students who agreed (Table 8). This showed that students were aware of the fact that everyone has the potential to do well in science. Most of the students had positive attitude towards science as shown by 55.0 % who agreed with the perception that it was important to do science in order to get a good job as opposed to 40.8% who saw it as unimportant. An overwhelming 92.2% of the students did not agree with the perception that science is useful to boys only as opposed to 1.67%.

On the perception that science is dangerous, 90.9 % disagreed with this perception as opposed to 5.4%. The majority of the participants 64.9% as opposed to 31.8% found

science interesting, including those who were not doing science. This reflected that students have positive attitudes towards science despite the fact that more than 50% of the participants were not doing science. This showed that grade 11 female students in Mafikeng District had positive attitudes towards physical science. 47% as opposed to 27% of the respondents agreed with the perception that science was for people who wanted to do science in the future. This was interesting because on table 2 the majority of the participates said that they chose the subject because of their future aspirations, and here again we see that they associated the selection of subject to their future aspirations. 37% of the participants agreed with the fact that only those planning to get into science based careers needed science as opposed to 49% who did not think that way. It is surprising to note that the majority of the students (67.3%) think that there were not many opportunities for females in science careers as opposed to 21.66%

CHAPTER 5: RESEARCH FINDINGS AND RECOMMENDATIONS

5.1. Introduction

This chapter of the research study deals with the following subsections:

Discussions: This will consist of a brief summary of each of the research questions being investigated and the results obtained.

Conclusions: This will consist of the implications of the findings, their meaning and significance.

Recommendations: This will refer to suggestions for further research.

5.2. Discussions of the factors that may affect female student attitudes towards physical science learning.

- These are some of the factors that affect female student attitudes towards the study of Physical Science.
- Effect of parental influence on the attitude of grade 11 female towards Physical Science.
- Influence of teachers on the attitudes of grade 11 female student towards Physical Science.
- Effect of the classroom environment peers and lack of textbooks on the attitudes of grade 11
- Female students towards the study of Physical Science.
- Influence of learner's own perceptions and aspirations on their attitudes towards Physical Science.

5.2.1 What is the effect of parental influence on the attitudes of grade 11 female students towards physical science?

From the research findings, the following were concluded:
Table 5 indicates that 38.5% of the participants indicated that parents influenced them to choose the subjects.

Table 6 shows that 74.3% of the students indicated that their parents did not discourage them from choosing physical science.

Table 7 shows that 81.4% of the students indicated that parents did not help them with their homework.

The findings on the research questions are consistent with Ginsberg, Bempechat and Chung (1992), who stated that parents being the children's first teachers can exert great influence on a child's life. Many research studies have revealed that high student achievement in school is closely related to positive parental participation in the education of their children. The US National Commission for Excellence in Education (1993) has identified parents as children's first and most influential teachers, emphasizing the parents' role in fostering children's inquisitiveness, creativity and self-confidence while actively participating in their schoolwork. Epstien (1987) identified 4 components of parental involvement: basic obligation of parents; school to home communication; parental involvement at school and also in learning activities at home. Ma (1999) indicated that parental involvement affects enrolment because of affective influence rather than cognitive influence.

In conclusion there was evidence that parents of students in Mafikeng have influence on the attitudes of grade 11 female students towards the study of physical science. It is sometimes important for parents to help their children choose the subjects they study at school, if the child has problem in identifying where his/her potential lies. If

the child knows where his/her potential lies then the child should be allowed to make his/her own choice. In most cases parents would like their child to do particular subjects because they themselves were very good at those subjects when they were at school or because they want the child to follow a certain profession or might prohibit the child from taking some other subjects because parents considered them to be very difficult.

5.2.2 What is the influence of teachers on the attitudes of grade 11 female students towards physical science?

From the research the following were concluded:

Table 5 shows that 7.4% of the students indicated that they were influenced by teachers to choose their subjects.

Table 5 shows that 71.3% of the students indicated that their teachers did not teach the subject well. 65.5% of the students indicated that teachers did not know their subject content.

Table 7 shows that 23.3% of the students indicated that their science teachers motivated them compared to 74.0% of those who said they did not.

Darling, Hammond and Hudson (1988), claimed that teachers play a primary role in each student's learning process. They further stated that the quality of science education depended on the quality of instruction that students receive, so indicators of teacher quality are very important in the assessment of science education. They indicated that teaching quality is determined by the teacher's overall performance as well as the teaching practices. Haladyna and Shaughney (1982) indicated that teacher quality variables such as academic preparation of the teacher in the specified field of science, hands on activities, cooperation learning, and student involvement in learning influence student attitudes towards science. Several researchers document the importance of the science teacher's role in stimulating interest in science. Among

the talented youth studied by Wright and Hounshell (1981) a great majority of students indicated that, within the school environment teachers were the greatest influence, and outside school, parents played a major role in stimulating interest in science. Investigations have shown that one of the major reasons why students like or begin to like a subject is due to the overall impression made by the classroom teacher (Gutbezahl, 1995). Teachers therefore have a responsibility to design lessons that are interesting and conducive to the development of positive attitudes in students to the study of physical science.

In conclusion, there was evidence that teachers in the selected high schools of Mafikeng influence the attitudes of grade 11 female students.

5.2.3. What are the effects of classroom environment, peers and lack of textbooks on the attitudes of grade 11 female students towards the study of physical science?

From the research findings the following were concluded:
Table 5 shows that 2.08% of the students indicated that they were influenced by their friends to choose their subjects.

Table 6 shows that:

65.5% of the participants found science difficult.

61.1% of the students indicated that no experiments were done during lessons.

68.9% of the students indicated that there were not enough science textbooks in schools.

Breakwell and Beardshell (1992) indicated that peers and friends influence attitudes towards science. The strongest support for the findings comes from the work of

Simpson and Oliver (1985), who found out that the influence of peers increased from age 11 onwards peaking at 14 years. They suggested that the effect is a kind of snowball phenomenon with students becoming influenced by group norms. However, a better explanatory model was provided by Head's (1985) account of adolescent as a period of moratorium where an individual is attempting to establish self-identity and, hence, is more strongly influenced by the normative expectations of peers.

Several studies have pointed towards the influence of classroom environment as a significant determination of attitudes (Haladyna et.al 1982; Myers and Fouts 1992; Talton and Simpson1987). In a detailed study by Myers and Fouts (1992) using 699 students from 27 high schools in America, it was found that most positive attitudes were associated with very high level personal support, a high level of involvement, strong positive relationships with classmates, and the use of a variety of teaching strategies such as experimental activities. Pinburn (1993) indicated that the use of experiments in science is one of the key factors in generating interest in science. Brown (1976) indicated that the nature of teacher- pupil interactions in the science classroom, the teacher's pattern of communicating with individual pupil and groups of pupils, the transmission of the teacher's expectation of the pupils, particular topics that are covered in the lessons and the strategies adopted by the teacher all play an important role in the development of positive and negative attitudes in students. Textbooks are a source of information; they help broaden knowledge in students. Most teachers when teaching concentrate on the aspects of the syllabus, they rarely venture into areas that are not in the syllabus in order for them to be able to finish the syllabuses before examinations and to have time for revising topics covered.

In conclusion, there was evidence that peers, classroom environment, and availability of textbooks influence the attitudes of grade 11 female students towards science.

5.2.4. What is the influence of a learner's own perceptions and aspirations on their attitudes towards physical science?

From the research the following were concluded:

Table 8 shows that 24.3% of the students indicated that science was for clever people.

Table 8 shows that 55.0% of the students indicated that it is important to study science in order to get a good job.

47.9% of the students indicated that science is for people who want to do science in future.

68.2% of the students indicated that there are not many jobs for females that involves physical science.

64.9% of the students indicated that they found science interesting.

The above findings are in agreement with Crawley and Black (1992); Havard (1996); Hendley et al (1996) who all identified students perceptions of science as a difficult subject, and as being a determinant of subject choice. Havard's investigations of uptake of science at A-level, point to the perceived difficulty of science as the major factor inhibiting uptake. Cheng, Payne & Witherspoon (1995), found out that the most significant factors correlating with uptake of physical science were the grades achieved at General Certificate for Secondary Education (GCSE) in science and mathematics. Studying science is perceived as a risk. Kahneman and Tversky (1984) found out that when the negative aspects of a course of action were emphasized, people preferred to take the choice that led to the definite avoidance of loss rather than risk an opportunity that may have no loss whatsoever. The students confronted with a choice that is high risk, although potentially with high financial gains (i.e. doing science with its concomitant risk of failure), and one of lower risk (i.e. the greater certainty of success with arts-based courses), will choose the low risk option

even though the financial rewards may be less. Students believed that physical science was a difficult subject as indicated by 64% of the students.

5.3 Recommendations

Based on the findings in the research, it is recommended that the Department of Education needs to make physical science textbooks available in schools. The Department of Education should also provide schools with laboratory equipment and chemicals so that teachers can carry out experiments during lessons. Schools should establish parent consultation days when parents can visit schools and meet their children's subject teachers so as to promote parental involvement in the education of their children. As a follow-up to this study it would be beneficial to assess the attitudes of students when they first enter junior high school so as to assess the changes in their attitudes towards physical science as they move from grade 7 to grade 12. Ideally, a longitudinal study of the same group over a six-year period would help to identify and measure attitudinal changes.

Teachers play an important part in the development of positive attitudes in students towards physical science. It is therefore imperative that teachers use effective methods when teaching physical science in schools. The following are some points that might be useful for teachers to consider when teaching. Teachers should set clear learning outcomes for students' learning; clarify lesson outcomes and activities for pupils; use previews and reviews of lesson content; help students to contextualize content in terms of their own experience and knowledge, as well as in terms of other learning outcomes and learning experiences; show some willingness to allow pupils to have input into learning outcomes and activity setting; a supportive social context designed by the teacher to help pupils feel accepted, cared for and valued; an ability and willingness to allow for different cognitive styles and ways of engaging with the learning process among pupils, through multiple exemplification, and the use of different types of illustration and modes of presentation, and offering pupils a choice

from a menu of possible ways of engaging; and a willingness to take into account pupil circumstances and to modify, pace and structure learning tasks accordingly.

5.4 Conclusion

This research study sought to provide a review of research on student's attitudes towards physical science. As asserted by Osborne (2003), the increasing attention to the topic by researchers is driven by recognition that there are generally few students willing to take up science subjects all over the world, and far too many pupils are alienated by a discipline that has increasing significance in contemporary life, both at a personal level and a societal level.

The research identified some of the factors that are associated with the development of attitudes in female students towards physical science. My view is that science educators have much to learn from the growing body of literature on the study of motivation, because teachers do not simply impart knowledge to their students, but they awaken the interest of students in it and makes them eager to pursue knowledge for themselves if they are motivated.

According to Bergin (1999) the common feature of much of the study of motivation is recognition of a distinction between individual, intrinsic interest, and situational extrinsic interest. The latter is simulated by contextual factors such as good teaching that stimulate interest and engagement. Hidi (2000) argued that the role of situational interest is highly significant, in classrooms or subjects, where students are disinterested in the subject at hand or are academically unmotivated. Collins and Osborne (2000) found out that pupils desired more opportunities in science for practical work, extended investigations and opportunities for discussions, all of which provide enhanced personal development. A better understanding of the attributes of science classroom activities that enhance task value might make a significant contribution to the development of positive attitudes towards physical science. Eccles and Wigfield (1995) described "task value" as the degree to which an

individual believes that a particular task is able to fulfill personal needs. The task value is made up of three components:

Interest or the enjoyment that a student derives from engaging in a task.

Importance: the degree to which students believe it is important to do well on a task.

Utility: the degree to which an individual thinks a task is useful in reaching some future goals.

Eccles (1987) argued that if task value beliefs are central to explaining the nature of students attitudes towards science, then it would suggest that identifying those tasks which are viewed positively, the reason why, and their differentiation by such factors as gender, social class and ethnicity should be a central concern for research on this domain if we are to offer prescriptive solutions and advice to science teachers on how to improve the quality of the classroom experience. Science teachers need to use science experiments and demonstrations as a way of motivating and awakening interest in students towards physical science. Students who are motivated in a particular subject tend to go further in trying to find out more about certain phenomenon. This in turn raises the interest of students in the subject.

In summary, the research has concluded that the attitudes of grade 11 female students were affected by parents, teachers, environment (peers, classroom environment), perceptions and aspirations. This shows that grade 11female students from the selected high schools in Mafikeng have positive attitudes towards physical science.

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APPENDIX A

Student Attitudes Towards Physical Science Student Questionnaire

Thank you for your co-operation in this survey project. The purpose of this questionnaire is to understand your ideas and attitudes towards science. It will take about 10 minutes to complete this questionnaire.

There is no right or wrong answer for any of the questions. Please answer the questions honestly and be as accurate as possible. Please do not write your name. For each of the following items, please tick (√) the choice that best describes you.

Thank you

Section A:

1 Personal information

	Yes	No
1 Are you currently doing Physical Science?		
2 Is Physical Science your best subject?		

1 Who/What influenced you to choose the subjects you are doing? (You may choose more than one)

2.1	Parents	
2.2	Friends	
2.3	Your teacher	
2.4	Future carrier	
2.5	Interest	

Section B:

3 Why don't you like science?

I don't like science because: (Read each statement and (√) whether you Agree (A), are Uncertain (U), or Disagree (D).

	A	U	D
3.1 The teachers do not explain well the content.			
3.2 Teachers do not know their subject content.			
3.3 I find science difficult.			
3.4 My future career is not science based			
3.5 There are no experiments done during lessons			
3.6 There are not enough text books at school			
3.7 I don't understand the importance of science.			
3.8 My parents discourages me from doing science.			

Key A→ Agree: U→ Uncertain: D →Disagree

Section C:

4 Why do you like science.

I like science because: Read each statement and (√) whether you Agree (A), are Uncertain (U), or Disagree (D).

		A	U	D
4.1	I find science very easy.			
4.2	Learning science improves my reasoning capacity.			
4.3	My parents help me with my science homework.			
4.4	My science teachers motivate me.			
4.5	Science is necessary in order to get a good job.			
4.6	Learning science is a challenge that I enjoy.			
4.7	Much of what is learnt in science is useful in everyday life			
4.8	Science helps me understand the environment I live in			

Key A→ Agree: U→ Uncertain: D→ Disagree

Section C:

4 Why do you like science.

I like science because: Read each statement and (√) whether you Agree (A), are Uncertain (U), or Disagree (D).

		A	U	D
4.1	I find science very easy.			
4.2	Learning science improves my reasoning capacity.			
4.3	My parents help me with my science homework.			
4.4	My science teachers motivate me.			
4.5	Science is necessary in order to get a good job.			
4.6	Learning science is a challenge that I enjoy.			
4.7	Much of what is learnt in science is useful in everyday life			
4.8	Science helps me understand the environment I live in			

Key A→ Agree: U→ Uncertain: D→ Disagree

Section D:

5 Perceptions towards science

The following are a number of statements describing perceptions towards science. Read each statement and (√) whether you Agree (A), are Uncertain (U), or Disagree.

	A	U	D
5.1 Science is for clever people			
5.2 It is important to do science in order to get a good job			
5.3 Science is useful to boys only			
5.4 Science is dangerous			
5.5 Science is very interesting			
5.6 Science is for people who want to use it in the future.			
5.7 Only those planning to get into science based careers need science.			
5.8 There are not many jobs for females that involve science.			

Key A→ Agree: U→ Uncertain: D→ Disagree

APPENDIX B

Dear Teacher,

In conducting this questionnaire I hope to obtain the most accurate information possible. In an attempt to do this would you please comply with the following guidelines:

Tell the students

1. The questionnaire is for a university research project.
2. Their names are not required.
3. The name of their school will be mentioned in the research paper.
4. The information they provide will have no bearing on their Science grades.
5. Their teacher will not see the answers of the questionnaire they complete.

Please ensure that this information remains confidential.

Your assistance is greatly appreciated.

Regards

B. Chimhau

APPENDIX C

Dear Principal

My name is Barbington Chimhau. I am doing a Masters degree in Education at Nortl West University. I would like to carryout a research on the attitudes of grade 1 female learners towards physical science in the Mafikeng District and would lik with your permission to carryout this research at your school.

I will need to give questionnaires to some of your grade 11 female learners with th assistance of one of your teachers. The exercise will take approximately 10 minutes.

Your assistance is greatly appreciated

Regards

B. Chimhau (Mr)