Learning strategies of successful high school science students.

by

Phehlane Churchill Lebuso

Submitted in partial fulfilment of the academic

requirements for the degree of

Master of Education in the

School of Science, Mathematics, and Technology Education

Faculty of Education

University of KwaZulu-Natal

November 2010

ABSTRACT

The purpose of this study was to explore the learning strategies that are used by successful science students. In addressing this purpose, a mixed methods approach was adopted in which both quantitative and qualitative methods of data production were used. The participants were both successful and less successful high school science students from grades ten to twelve inclusive. Quantitative data was collected through questionnaires and analysed. The qualitative data was collected through individual semi-structured interviews and focus group interviews. This was analysed using a qualitative thematic approach. The research questions were first about the learning strategies that successful science students seemed to use in order to do well academically, and secondly the question of the factors which influenced these successful students. The findings are that there are differences in the use of strategies between the successful students and their less successful counterparts. The successful students in general reported using more learning strategies more often than the less successful students. Successful students also reported that they engaged in strategies for regulating the effort they applied to work on difficult or boring tasks. They engaged more in cognitive strategies that involved deep processing of information, while the less successful students relied more on rehearsal and more superficial strategies like text underlining. Successful students also engaged more in self-regulatory activities that allowed them to monitor and regulate the way they learn. The findings also revealed that the successful students reported that they are influenced in their studies more by such factors as family support, the love of the subject and their goals or ambitions.

PREFACE

The work described in this thesis was carried out in the School of Science, Mathematics and Technology Education, University of KwaZulu-Natal, from July, 2009 to November, 2010 under the supervision of Prof Paul Hobden (supervisor).

This study represents original work by the author and has not otherwise been submitted in any form for any degree or diploma to any tertiary institution. Where use has been made of the work of others, it is duly acknowledged in the text.

Phehlane Churchill Lebuso
November 2010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENT

My heartfelt thanks go to:

My supervisor Professor Paul Hobden for his unwavering support and encouragement as well his expert guidance.

The administration, staff and students in which the study was conducted, for their patience and cooperation.

My loving wife and my son for their understanding, support and encouragement.

All friends and colleagues for their support and encouragement.

Dedication
This thesis is dedicated to my parents who had the wisdom of educating their children.

CHAPTER 1

INTRODUCTION

This study set out to find out how successful science students learn and study. It was particularly focussed on what learning strategies are used by these successful students, and also explored the factors which influence these students to work as they do. In this chapter, I present the background and rationale for the study, the purpose of the study and the research approach. Finally, I will indicate how the study will develop through each chapter.

1.1   BACKGROUND AND RATIONALE TO THE STUDY

The focus of this study is on the learning strategies that are used by successful science students in their learning of science. Learning strategies are a range of activities in which students engage in order to be effective learners. These involve mental activities of processing information as well as behavioural activities of monitoring and regulating progress. For example, a student might take summary notes and draw concept maps of what was presented in class as a strategy.

A lot of research has focussed on the concept of learning strategies (Cao & Nietfield, 2007). The reasons behind this appear to be the concern that a wide disparity of academic achievement exists between low achieving and high achieving students. It has been suggested that high academic achievement may be attributed to the effective use of learning strategies (VanZile-Tamsen & Livingston, 1999; Yip, 2007). Another concern is that students have a tendency to depend too much on their teachers for monitoring their progress in both the primary and secondary schools. This becomes a problem when they reach higher institutions where they are supposed to be more independent. Consequently learning strategies are considered key to helping learners become independent learners. Yet I have noticed that there is no instruction in learning strategies in the schools I have worked in, and very little consideration is given to them.

My interest in this topic stems from my observations and experience as a science teacher for fifteen years. I have noticed that there appear to be fewer successful science students every year in my school. In addition, there is also a general concern that the quality of education is going down especially in mathematics and science disciplines. For

example Nenty (2010) notes the findings of the Education Sector Survey that the quality of education seems to be declining at all levels but mostly at the secondary level. This problem seems to be more acute at the secondary level and has resulted in decreasing numbers of students in scientific and technical disciplines at tertiary level. It is also my feeling that the introduction of free primary education in Lesotho, which started in 2000, has resulted in increasing numbers of students in the secondary classrooms. This in turn has resulted in teachers being overwhelmed and overloaded, therefore not being able to teach effectively, which further exacerbates the situation.

From my experience and observations of more than fifteen years I have noticed that the concern for learning strategies is very minimal in my country, Lesotho. For a period of almost ten years now, there have been only about eight high schools with a high percentage of well-performing students in the national examinations. I am not attributing this to the issue of learning strategies only but I think it may be part of the problem. In most schools there are only a few students who are academically successful and one of the common comments of teachers is that the majority of students are not serious and do not work hard. In fact the most common comment in students' reports is that she or he "must work hard". I have also participated in many workshops and there has never been a single incident in which teachers or education inspectors raised a concern about the importance of learning strategies in relation to academic achievement. It seems as if the use of learning strategies are only useful during examination time as I have already indicated in most cases students are only encouraged to use them at such times.

My intention is thus that this study will inform us about the strategies that are used by successful students and some of the factors that influence them to use these strategies. It aims to raise the awareness among both students and teachers that learning strategies are important in improving academic performance. The study may also make teachers aware that it may be worthwhile to start teaching the students how to learn effectively rather that just advising them to work harder or encouraging them to use strategies only during examination times. The study may also influence curriculum designers to emphasise the importance of using learning strategies throughout the curriculum. This would encourage our students to adopt effective learning habits throughout their schooling.

This means teachers should understand the factors that influence the use of strategies by learners and should instruct students in the use of a variety of learning strategies. It is hypothesised that there are certain strategies that successful science students are using and an exploration of such strategies may provide an insight into their academic success. The

findings of this study may be used to help other struggling students to become effective learners and thereby increase achievement. They may also help teachers to realize the importance and effectiveness of these strategies and influence them to incorporate them into their teaching practices.

In my search of the literature, I have come to realize that this topic has been extensively researched especially in the First World or western countries (Lynch, 2006; Mayer & Weinstein, 1986; Pintrich, 1999; Wolters, 1998; Zimmerman & Martinez Pons, 1986). The idea of teaching learners strategies is supported by Risemberg and Zimmerman (1992) who pointed out that it is possible to teach students how to use learning strategies. This study will be filling a contextual gap as the topic has not been researched in my country, Lesotho. It will also be filling a methodological gap as many of the other studies have adopted a quantitative approach in both data gathering and analysis whereas this study will employ a mixed method approach to data production and data analysis.

In addition to finding out the learning strategies that are used by successful science students, this study also aimed at identifying the factors that influence these successful students. In order to achieve this purpose, the study was guided by the following research questions:

1. What are the learning strategies that are used by successful science students?
2. What influences these students to be successful learners?

In addressing these questions, this study was expected to yield findings that can inform practitioners in the field of teaching about ways that can be used to enhance the achievement of their students.

1.2 RESEARCH APPROACH

In this study, the research questions were answered by adopting a mixed methods approach that combined both quantitative and qualitative methods of data collection. This involved a survey in which a questionnaire was administered to 112 students, purposively sampled to include the successful and less successful ones. This generated quantitative data which was analysed using descriptive analysis approach to yield frequency tables. This enabled the researcher to get an idea of the self-reported use of learning strategies.

The researcher adopted a mixed method approach because it was found to be the most appropriate in addressing the research questions in this study. This is because through mixed methods one is able to address questions that seek to establish the extent of a

phenomenon through quantitative research approaches, and also explore the perceptions, experiences and understandings of participants regarding the same phenomenon through qualitative research approaches.

The qualitative data was generated through individual and focus group interviews. The interview participants were also purposively selected so as to have successful students only in the focus group while there was a mixture of both the successful and less successful students for individual interviews. The focus group consisted of six participants and there were eight participants that were individually interviewed. This enabled the researcher to both corroborate the information obtained from the questionnaire and obtain more detail.

1.3   THE CONCEPTUAL FRAMEWORK

The aim of this section is to provide the conceptual framework which forms the basis of this study. A conceptual framework forms a basis for the boundaries of a study. Smyth (2004) argues that it is a tool that assists the researcher to review relevant literature for the study. It also helps in designing appropriate methodological and data analysis procedures. In other words, it determines the literature, methods of data collection and data analysis. In support of this argument Henning (2004) points out that a conceptual framework highlights the key concepts on which the study is based. In this study the learning theory of constructivism, cognitive learning strategies, self regulation and resource management were considered to be the key concepts.

Constructivism: Having gone through the literature, I have realised that the main idea behind learning strategies is to get the students to be active learners who take responsibility for their own learning. This is in agreement with the concept of constructivism in which students are assumed to construct their own meanings, goals and strategies from the information available in the environment and existing information in their own minds (Pintrich, 2004). In other words, it is the learners who have to understand that they must personally undertake knowledge construction and not expect teachers to do it for them. This is in agreement with Bennett's argument (2003) that constuctivists hold the view that "people construct their own meanings from what they experience, rather than acquiring knowledge from other sources" (p. 25). This means that people do not just receive

knowledge passively but act on it to make it meaningful to them. This idea of active learners is also supported by Young (2008) who points out that learning involves "active meaning-making undertaken by the learner" (p. 45). According to Coll and Taylor (2001), the teacher acts as a facilitator in the process of learning, not as a dominating provider of knowledge.

This is an important concept in this study as the focus is on an active learner who employs a variety of techniques to facilitate the learning process. Even though there has been some criticism of constructivism it has also been argued by Taber (cited in Coll & Taylor, 2001) that most constructivists have become more pragmatic in that they accept the role of alternative conceptions in fostering learning without equating them to scientifically established ideas. This means that the ideas of constructivism can positively influence the way we understand learning (Coll & Taylor, 2001). Given that constructivism greatly influences my understanding of learning, it therefore is one of the concepts which will form part of the conceptual framework that will be guiding this study.

Cognitive strategies: The second concept is that of cognitive strategies. This concept presents learning as involving the use of learning strategies to improve academic performance. According to different authors (Bembenutty, 2009; Heikkila & Lonka 2006, Mayer & Weinstein 1986), cognitive strategies are mental activities responsible for acquisition and storage of information as well as the formation of links between stored and incoming information to facilitate understanding. This means that they are mental processes that are used in the processing of information. Students' cognitive learning strategies are categorised as rehearsal, elaboration, organisation and comprehension monitoring.

Mayer and Weinstein (1986) and Lynch (2006) have produced a detailed elaboration of these strategies. According to these authors, rehearsal involves activities such as underlining or copying portions of text and the repetition of lists of ordered items until they are committed to memory. Elaboration involves activities such as paraphrasing, summarising, note taking and creating analogies. Organisation involves strategies such as outlining, categorising and distinguishing between the main idea and supporting ideas. In the case of comprehension monitoring, students use activities such as self-questioning to check understanding and the use of questions at the beginning of a section as a guide to reading. The affective strategies involve activities that help to reduce distractions during studying.

Self-regulated learning: The third concept is that of self-regulated learning which views learning as involving activities that the students engage in order to plan, monitor and regulate their use of various cognitive strategies, motivation, affect and behaviour, as well as the environment in which they study. According to Heikkila and Lonka (2006) and Pintrich (2004), a self-regulated learning perspective takes into account the cognitive, motivational, affective and contextual factors in the learning process. This means that the students regulate factors such as anxiety, time management and their learning environment. In support of this perspective, Paris and Paris (2001) point out that self-regulated learning "emphasises autonomy and control by the individual who monitors, directs, and regulates actions towards goals of information acquisition, expanding expertise, and self-improvement" (p. 89). This means that self-regulated learning shares a common feature with constructivism in that it advocates for active involvement of the students. That is, students are capable of taking charge of their learning because they have acquired strategies that help them to be effective learners.

Resource management: The fourth concept is resource management which in this study refers to the management and regulation of time and the environment in which learning or studying is taking place. This involves activities such as engaging in group discussions, seeking help from friends and teachers, planning study schedules and trying to regulate the effort applied. This means that the student takes the initiative to see to it that his or her environment is conducive to learning and he or she makes use of the resources available.

When taken together and applied to the learner these concepts present learning as a process in which the student is an active participant in his or her own learning by engaging in activities that are intended to influence the encoding process. They outline the different actions that can be taken by the students in order to improve their academic achievement.

The explanations that have been provided for each of the different concepts have clarified the parameters of this study. This has given a clear direction of what these learning strategies are. It has also enabled the researcher to have an idea of what to look for, and thus made it easy to recognise or identify these learning strategies during the data collection phase of this study. In addition, these ideas have also been useful to the researcher as a guide during the data interpretation process.

1.4   STRUCTURE OF THE STUDY

This dissertation is organised into four further chapters which describe the different stages of the study. Chapter two deals with the review of literature that is related to the concept of learning strategies. It gives general information about learning strategies. It also describes studies that explore the relationship of learning strategy use and academic achievement especially those that focus on low and high achieving students. The conceptual frameworks that guide the scope of the study are also discussed in this chapter. Chapter three focuses on the research methodology that was followed in carrying out the research. This involved the research approach, the sampling procedures and methods of data collection as well as suggestions of data analysis. It also deals with ethical issues and those of validity and reliability. The fourth chapter deals with data presentation and analysis as well as the discussion of the findings in relation to existing literature. This led to the formulation of assertions which, according to Gallagher and Tobin (1991), are answers to the research questions. In chapter five is the summary of the study including that of the findings. It also includes the implications and concluding remarks.

CHAPTER 2
LITERATURE REVIEW

This review of literature covers several aspects on learning strategies and it is guided by the conceptual framework outlined in chapter 1. First, it is aimed at providing a definition of the term 'learning strategy' that will be used in this study. Secondly, it gives a brief discussion on the different categories of learning strategies. Thirdly, it discusses factors that influence the use of learning strategies. Fourthly, it discusses the role of learning strategies in the process of learning. Then it provides a rationale for my interest in this issue.

2.1   LEARNING STRATEGIES

The interest in the study of how students can become active participants in their own learning has led researchers to investigate techniques that students can be taught to use in learning (Mayer & Weinstein, 1986). This interest stemmed from the concern of tertiary institutions that first-year students often perform badly and have to repeat (Kitsantas, Winsler & Huie, 2008). These techniques have been referred to as learning strategies, but there are different definitions depending on different authors. The aim of this section is therefore to review different definitions and provide one that will be appropriate in this study.

One of the earliest definitions of learning strategies, proposed by Mayer and Weinstein (1986), is that they are behaviours and thoughts that learners engage in during learning, and that are intended to influence their encoding process. This is further expanded by Weinstein (1987) who writes that they are activities or steps by which information is processed together with prior knowledge to knowledge that is stored in long term memory or applied. This means that learning strategies help students in handling incoming information by organising it so that it can be integrated into the existing knowledge within the brain.

This view is supported by Ashman and Conway (1997), who define learning strategies as "the many ways in which we take in (encode); store and retrieve (decode) information." (p. 43) This processing of information is aimed at enhancing the learning process as outlined by Daigle, Rachal and Rachal (2007) who define learning strategies as

thoughts and behaviours that facilitate the enhancement of knowledge retrieval and integration in order to improve learning. This is also supported by Schmeck (1988) and Alexander and Murphy (2006), who view learning strategies as the sequence of procedures, mental operations or techniques that are used to enhance learning. The emphasis in most of these definitions is on mental activities, as further exemplified by Paris and Paris (2001), Lynch (2008) and Bembenutty (2009) who define learning strategies as cognitive actions or mental activities that students perform in order to master academic tasks or attain particular learning goals. It therefore means that they are confined to processes that occur in the brain without any visible actions.

This restriction is removed by Cantor (1990) who provides a more comprehensive definition. According to Cantor, learning strategies are cognitive, affective and behavioural processes that students use to achieve academic goals and also to evaluate their actions. This seems to cover a wider range of processes which gives allowance for someone to check some of the activities that shows the use of learning strategies other than mental processes. It is also important to make a clear distinction between learning strategies and other terms which may confusingly be used interchangeably such as skills and learning styles.

Kirby (1988) gives a very comprehensive distinction between skills, strategies and styles. According to him, "skills are existing cognitive routines for performing specified tasks, and strategies are the means of selecting, combining, or redesigning those cognitive routines," (p. 230). This means that skills are routine activities that have been acquired after someone has performed a certain task several times so that he or she can do it perfectly without much thinking. Kirby defines styles as the habitual use of a class of similar strategies. This shows a hierarchical relationship with skills at the base, then strategies, and styles at the top of the hierarchy.

My understanding from the above discussion is that firstly, learning strategies are different from skills and learning styles. Secondly, they are not only about the mental processing of information but they also involve affective and behavioural processes. I therefore find the definition that is given by Cantor (1990) very appropriate and that will be the one adopted in this study. This definition is therefore expected to be broad enough to cover the different categories of learning strategies encountered in this study. In the next section the categories of learning strategies are discussed.

2.2   CATEGORIES OF LEARNING STRATEGIES

According to Lynch (2008) and Mayer and Weinstein (1986) learning strategies can be divided into three main categories. Learning strategies involve a wide range of activities that students engage in to enhance their learning process. These activities have been classified into three broad categories according what they are used for in the process of learning. These are presented in this section in order to give a picture of the activities that will be explored in this study.

The first category is referred to as the cognitive strategies and it is further divided into sub-categories such as rehearsal, elaboration, organisation, critical thinking and comprehension monitoring (Mayer & Weinstein, 1986). Rehearsal involves activities such as memorising, mnemonics and copying. Elaboration involves activities such as paraphrasing, creating analogies and summarising. Organisation involves outlining, clustering and creating diagrams to show relationships. Critical thinking involves application of knowledge to new situations and making critical evaluations of ideas. Comprehension monitoring involves activities such as self-questioning and self-assessment.

The second category is the metacognitive strategies. This involves metacognitive self-regulation strategies that students use to regulate, monitor and evaluate their own learning activities. These involve activities such as self-evaluation, developing study schedules, record keeping and goal setting. For example, a student who is about to write a chemistry examination may do the following. First she may draw a study schedule and select a suitable place that would enable her to concentrate on chemistry. Secondly, she may gather material resources such as textbooks, past question papers and notes.   Thirdly, she would review her notes, then she would check her understanding by using past question papers. She may have to rehearse some definitions and gather more information from text books. Then she would attempt the questions again and if she still encounters problems she would review her strategies. She may then decide to join classmates for discussions or consult her teachers. This category of strategies is expected to enable the students to take control or responsibility of their own learning. This is because, through self-regulation, students are expected to be able to choose, monitor and control their use of learning strategies, modifying them according to the demands of the tasks (Zimmerman, 2000). Self regulation has another aspect which involves the regulation of motivation and affect. According to Yip (2007), motivation and attitude are very important learning

strategies and can even be considered to be more important than all the other strategies. He argues that students' use of learning strategies depends on their motivation and attitude. Therefore, students who are confident and self-motivated to learn spend more time and effort learning and have a better academic performance. According to Yip (2007) this means that they tend to use more appropriate learning strategies and they are more persistent in their drive to achieve their goals.

The third category is the resource management strategies. These strategies involve the regulation and monitoring of an environment that is suitable for learning. They also involve such activities as peer learning, seeking help and the regulation of effort. By using these types of strategies, the students are therefore using the resources that are around them in order to enhance the learning process.

It has also been found that it is possible to categorise the cognitive learning strategies yet again into two main categories according to their depth of information processing. One category is that of surface processing strategies which includes rehearsal strategies such as memorising, underlining or highlighting. They are considered to be "passive and unreflective" activities (Pintrich, 1999, p. 460). According Lynch (2006), these strategies are good for learning by taking in separate bits or pieces of information without forming any linkages or relationships between ideas. Therefore, they do not enhance student's understanding of the learned material.

The other category is that of deep processing strategies which include organisation and elaboration strategies (Salovaara, 2005; Soric & Palekcic, 2009). According to Soric and Palekcic (2009), these strategies enable students to organise learned materials and to create linkages or relationships between learned and new knowledge. These authors argue that the way in which these strategies process information leads to enhanced understanding of the material that is being learned. Therefore, students who tend to use these strategies more often will enhance their academic performance.

These categories show that students' actions may involve the use of one or a combination of different strategies. According to Dembo and Eaton (2000), students use different learning strategies to achieve different goals. They point out that rehearsal strategies can be helpful in memorising information but do not help in creating links between incoming and stored information. The implication here is that a student can use one strategy for a certain task but may require a combination of strategies to master that task effectively or to ensure that there has been effective learning.

This argument is supported by the findings of Weinstein (as cited in Weinstein & Mayer, 1986). She found that students who have been trained to use a combination of elaboration strategies performed far better than those who were not trained. This means that the use of one single strategy may limit the learning capabilities of an individual. Some studies have also found some interrelationships between certain strategies. For example, Nota, Soresi and Zimmerman (2004) have found that students who engaged in rehearsal strategies also tended to engage environmental structuring when studying. This is quite logical in the sense that when one is memorising something, one needs a place where there are no distractions.

This section has shown that there is a wide variety of strategies that students can use to enhance their learning. It has become clear that different strategies can be used to achieve different learning goals but they are more effective if they are used in the right combinations. This is because the use of one strategy may support the effectiveness of another strategy. It is also clear that some of these strategies are used to achieve one goal and therefore can be grouped into one category. Those that are used to monitor and regulate the learning process and the use of other strategies fall under the category of metacognitive self-regulation. This classification is important in this study as it will enable the researcher to analyse the actions of students and match them with the appropriate strategy.

2.3   FACTORS THAT AFFECT USE OF LEARNING STRATEGIES

It has been found that the use of learning strategies by a student is influenced by several factors. The section is going to discuss different factors and the research evidence which shows that they influence the use of learning strategies. This will help in interpreting the findings of this study by providing an explanation of why students engage in strategy use the way they do.

According to Garner (1990), the use of learning strategies is dependent on the setting, situation or context. She argues her case by using a theory of settings which states that the nature of strategic activity often changes when the context changes. This means that some situations may invoke the use of learning strategies while others may not. The idea that strategy use is dependent on context has also been proposed by Paris and Paris and by Zimmerman (as cited in Salovaara, 2005) who states that "self-regulation is a

situation-dependent and contextually embedded process" (p.40). In fact, several studies have confirmed the influence of the context on subjects' use of strategies. For example, DeLoache, Cassidy & Brown (1985) and Ceci & Bronfenbrenner (1985) found that familiar home environment and the laboratory environment both affect the subjects' use of strategies. In their study, DeLoache et al. investigated the success with which a child could retrieve a toy that he watched being hidden after being allowed to play with other toys for some time. This experiment was carried in both a familiar home environment and an unfamiliar laboratory setting. It was found that children were more successful in the laboratory setting than in the familiar home environment. The results indicated that the children were engaging some strategies to remind them the location of the hidden toy when faced with the strange laboratory setting than when in the familiar setting. This has let some authors such as Garner to suggest that some settings evoke the use of strategies while others do not. It therefore means that the context is a very important factor which determines the students' use of learning strategies.

Another factor is students' conceptions of learning. According to Vermunt and Vermetten (2004), "a conception of learning is a coherent system of knowledge and beliefs about learning and related phenomenon." (p. 362) This means that each student has his or own interpretation or understanding of what learning is all about and this influences the way he or she approaches the learning process. In support of this argument, Trigwell and Prosser (1996) point out that the student's conception influences the way the demands of an academic task are interpreted and the way it is tackled. It therefore means that the students' use of learning strategies can be influenced by the student's conception of learning. Studies have shown that there is a difference in strategy use between the students who hold a quantitative or reproductive conception of learning and those who hold a qualitative or comprehensive conception of learning (Chan & Lai, 2005; Douglas, Hattie & Purdie, 1996). Douglas et al. (1996) investigated this issue using sixteen to eighteen year-old students in their final year of schooling from Australia and Japan. These researchers used a survey to capture responses from these students about the learning strategies that they use and also the conceptions of learning that they hold. Their findings revealed that those students who hold a qualitative conception of learning demonstrated a greater overall use of learning strategies. This indicates that there is a link between the way the students view the learning process and their use of learning strategies.

The students' use of learning strategies is also linked to their learning orientations. These refer to their personal goals, expectations, attitudes and intentions with regard to

their studies, (Gibbs, Morgan & Taylor, 1984). Students' learning orientations fall into two main categories, which are mastery goal orientation and performance goal orientation (Ames & Archer, 1988). The mastery goal orientation is concerned with development of new skills and achievement is attributed to effort. The performance goal orientation on the other hand is concerned with ability and outperforming others; achievement is attributed more to ability than effort.   It therefore means that it is those students that attribute their academic success or failure to effort who are more likely to use learning strategies. In fact, Ames and Archer (1988) found out that when students adopted a mastery goal orientation, they were more likely to use learning strategies. This is supported by Garner (1990), who argues that if students do not attribute success or failure to their level of effort, they are unlikely to use learning strategies.

Some studies have shown that these beliefs are linked to students' use of learning strategies. According to Stipek and Gralinski (1996), students who believe that one's intelligence is fixed from birth tend to engage in more superficial learning than thoughtful and deep learning. This means that if a student believes that she or he was born intelligent, she or he tends not to apply effort in learning and does not engage in any activities that help in learning, such as learning strategies. Such a student believes that learning is supposed to occur quickly and easily. In their study on the relationship between beliefs about knowledge and learning, and the use of learning strategies, Dahl, Bals and Turi (2005) confirmed this argument. They carried out a survey of eighty one undergraduate students to elicit their beliefs about knowledge and learning. They also elicited the students' self-reported use of learning strategies. They found that when students believe that their learning ability is fixed, they reported the use of very few strategies. In fact they have found that the more students believe that knowledge is fixed, the less likely they are to report using elaboration, critical thinking, metacognitive and self-regulation strategies. They tend to use more rehearsal strategies which indicate that they are engaging in superficial learning.

It has also been argued that the use of learning strategies is linked to students' self-efficacy. According to a number of authors, self-efficacy refers to the confidence that a student has in his or her ability to master the course demands. (Lynch, 2006; Pintrich, 2004; Zimmerman, 2002) In other words, it is the beliefs of students that they are capable of learning or performing effectively (Sungur & Tekkaya, 2006). In fact, Zimmerman (2002) argues that self-efficacious students are more motivated to learn in a self-regulated manner. This means that they have a tendency to take responsibility for their own learning.

The findings of research carried out by Pintrich (1999) and Sungur and Tekkaya (2006) are that students high in self-efficacy were found to engage more in cognitive strategies and self-regulatory strategies.

From these arguments, it is clear that the use of learning strategies is not an automatic or straightforward process. It does not necessarily mean that knowing about strategies will lead to using them (Garner, 1990). As it has already been discussed, there are several factors which influence students' use of learning strategies, such as context, conceptions of learning, goal orientation and beliefs about knowledge and learning. However, only when these factors are kept the same for all students, might the learning strategies used by successful students account fully for all their success. It therefore implies that whatever learning strategies students may report using, one should bear in mind that their use is influenced by many factors. For example, a student might not be able to use particular strategies even though he or she is skilled at using them due to home environment which prevent their use. The next section turns the focus to the role these strategies play in the learning process.

2.4   THE ROLE OF LEARNING STRATEGIES IN LEARNING

The purpose of this study is to explore the learning strategies which are used by successful science students. It is assumed that this category of students use certain strategies in learning that make them more successful than other students. This follows the argument of Flavell (1979) that the more successful learners use learning strategies to learn and to monitor their learning progress. This section is going to present research evidence on the role of learning strategies in learning.

Several studies claim that learning strategies enhance learning. In fact, Garner (1990) argues that successful students use strategies to enhance learning and again use strategies to monitor their progress in learning. This means that academic success of students may be attributed to their use of appropriate learning strategies. This claim that the use of learning strategies enhances learning is supported by research evidence from many different researchers (Baker & Lombardi, 1985; Bothma & Monteith, 2004; Conner & Gunstone, 2004; Lubbe, Monteith & Mentz, 2006; Pintrich & De Groot, 1990; Yip, 2007; Zimmerman, 1990; Zimmerman & Pons, 1986).

Their studies focused on the use of general cognitive strategies and self-regulated learning and their findings show a strong relationship between the use of learning strategies and academic performance. This means that successful students were found to have a higher tendency to use learning strategies than unsuccessful students. For example, Conner and Gunstone (2004) investigated knowledge, the use of learning strategies, and essay outcomes. Their studies involved sixteen students in their final year of a high school biology class. They carried out observations and interviews to ascertain students' knowledge of and use of learning strategies. Their findings revealed that the use of strategies was more evident for students who achieved higher marks in their essays.

Such findings have also been reported by other researchers some within South Africa. For example, Postma (1991) investigated the influence of various variables on learning among chemistry students in a South African university. It was found that the students' achievement in chemistry could be attributed to the use of learning strategies. Mahuma (1996) investigated the influence of learning strategies and metacognition among others on academic achievement of Standard 10 Biology students in the Mankwe region in South Africa. He found that the self-testing aspect of metacognition was related to students' academic achievement.

Another example is the study in which Pintrich and De Groot (1990) investigated how motivation and self-regulation strategies are related to performance on classroom academic tasks. They found that higher levels of cognitive strategy use and self-regulation were associated with higher levels of achievement on all assignments. It appears from the literature that most of the authors (Bothma & Monteith, 2004; Lubbe et al., 2006; Zimmerman, 1990) had focussed their research mainly on self-regulation and academic achievement relationship.

Their findings suggest that the use of self-regulated learning strategies results in superior academic performance. Their findings also suggest that the learning strategies can be accorded different status with self-regulation strategies at the top of the learning strategies hierarchy. In fact, Pintrich and De Groot (1990) argue that the use of cognitive strategies without the support of self-regulatory strategies cannot result in superior academic performance. This is also supported by Schunk (2000) who argues that students use self-regulation in formulating their learning strategies. This implies that the use of other strategies is highly dependent on it.

Self-regulation refers to an activity in which students are controlling and monitoring the use of cognitive strategies (Wolters, 1998). This means that they are in a position to

select appropriate learning strategies for their academic tasks, evaluate their effectiveness and change them if deemed necessary in order to succeed. It can also be said that such students are aware of the way they are learning and the necessary improvements. What I have realised from my classroom experience is that teachers usually encourage students to use some of the strategies under self-regulation only during preparation for examinations. The problem with this practice is that students think it is only for examination time not for everyday learning.

According to several researchers (Bembenutty, 2009; Pintrich, 1999; Sungur & Tekkaya, 2006; Zimmerman, 2008), self-regulated learning is a process in which students take an active role in their own learning in order to achieve academic goals. In other words, self-regulated students are active learners who take responsibility for their own learning. It also means that such students become independent learners who will be able to engage in life-long learning.

While these studies have focussed on the relationship of strategy use and academic performance, other researchers have taken this further by exploring strategy use among low achievers and high achievers. These studies were specifically intended to relate high academic achievement to increased use of learning strategies, the argument being that high achieving students tend to use learning strategies more often than low achieving students. It is therefore this difference that results in the superior academic performance of the high achieving students.

For example, VanZile-Tamsen & Livingston (1999) examined differences between high achievers and low achievers in the use of self-regulated learning strategies among college students. Their findings are that high achievers report a significantly greater degree of engagement in self regulatory strategies than do low achievers. Their results are similar to other researchers who were also investigating the differences among low and high achievers on the use of learning strategies. Ruban, Lilia, Reis, and Sally (2006) studied patterns of self-regulatory strategy use among the low achieving and high achieving university students. Albaili (1997) studied the differences among the low, the average and the high achieving college students on the learning and study strategies while Kosnin (2007) investigated the ability of self-regulated learning to predict academic achievement among undergraduates in Malaysia. All these studies find that high achievers are better users of learning strategies than low achievers.

The findings of these studies have revealed that the use of learning strategies enhances learning and is responsible for the differences in academic achievement between

the low achievers and high achievers. This means that high achievers tend to engage more in learning strategy use than their low achieving counterparts, resulting in their superior academic achievement. It is against this research background that some researchers suggest that students be taught how to use learning strategies.

Mayer and Weinstein (1986) argue that students should be taught these strategies in order to help them become effective learners. They believe that good teaching should "include teaching students how to learn, how to remember, how to think, and how to motivate themselves." (p. 315). The importance of teaching students these strategies is also supported by the Centre for Research on Learning of the University of Kansas (2009). They claim that "students who do not know or use good learning strategies often learn passively and ultimately fail in school" (p. 1). They therefore argue that teaching students how to use strategies makes them active learners who take the learning process as their responsibility and therefore become successful learners.

But there are also other factors which have been found to affect the academic achievement of students. These factors may be responsible for influencing the way that students learn and study as well as their use of learning strategies resulting in high achievement. Such factors include among others family support, ambitions or goals of students and the student's love of the subject.

The importance of family support has been the focus of a number of research studies and their findings reveal that it is positively related to high academic achievement. For instance, Garrett, Antrop-Gonzalez and Velez (2010) explored factors to which high-achieving Puerto Rican male high school students attributed their academic achievement. Their findings were that these students attributed their success to the influence of their families, especially their mothers and sisters who provided support. This was in the form of helping with homework and offering encouragement. They also found that due to support by the family the students felt they had to please their families by obtaining good grades. Similar results were obtained by Wilson (2009) who investigated the relation among parental factors and achievement of African American urban youth. The findings showed that students who are being monitored by their parents perform better at school.

Most of the studies on learning strategies have been carried out in the first world countries which are well-resourced such as the United States and Europe. There are some studies which have been carried out in the Republic of South Africa for example, Postma (1991), Paterson (1996), Mahuma (1996), Du Toit (1999) and Mpshe (1996), but I could not find any in other African countries. It therefore means that this study will be carried out

in the different context of a third world African country with generally limited educational resources. The challenges of teaching and learning in developing countries are very different and may result in different priorities which may not be the teaching of learning strategies.

The most common feature among the studies is that they have used large samples and quantitative methods of data analysis, and all their findings suggest that instruction in the use of learning strategies will result in improved performance. This means that their aim was to draw conclusions that can be generalised. Another feature is that they were mostly done on tertiary education students. This means that it is probably the concern of lecturers at tertiary institutions that students enter these institutions without proper learning strategies. From experience, I know that there is a concern in my country that many students who performed well in high school often fail and are excluded from our university. Consequently, this study will hopefully be able to inform their practice.

In this literature review, guided by the conceptual framework in the introductory chapter, I have provided an account of my research area by giving the following. First, I have established the definition which will be used for learning strategies in this study, and given a brief account of their different categories. Secondly, I have discussed the different factors that affect the use of learning strategies. Then I provided an account of the role played by these learning strategies in the process of learning with some research evidence to support the importance given to the use of learning strategies.

It has been found from the literature that students' use of learning strategies is influenced by factors such as context in which learning is taking place. Other factors include students' conception of learning, learning orientations, beliefs about knowledge and learning and self efficacy. It has also been found from the literature that learning strategies play an important role in enhancing the academic achievement of students.

This has been confirmed by studies which found that high-achieving or successful students tend to use learning strategies more effectively than the low achievers or less successful students. This review has also established that high academic achievement can also be attributed to other factors such as family support and the educational goals such as the carriers that students would like to take in future.

It was surprising that after reviewing the literature on learning strategies I could not find strong relationships which have been established between learning strategies and specific subjects, after considering a wide variety of subjects. For example, I have not

found out if there are certain strategies, which are used more by science students than by geography or business studies students. This says that these learning strategies may be more general than specific and may apply equally to each subject. What became clear is that learning strategies can serve different cognitive purposes within the different subject domains (Levin, 1986).

According to Almeida (2008), Levin (1986), and Paris and Paris (2001) different strategies are used for different purposes such as reading and writing, and storing and remembering information. For example, strategies for reading and writing include paraphrasing, summarising and identifying main ideas while the strategies for remembering are mnemonics and paired associates strategies. These are general strategies that can be used in any subject. It therefore means that the learning strategies that are being explored in this study are not specific to any particular subject.

These are the ideas which form the focus of this study; to explore the learning strategies that are used by science students, to find out if there is a difference in strategy use between the successful and less successful students and to find out other factors which may have contributed to the success of the high achievers.

CHAPTER 3
RESEARCH METHODOLOGY

The aim of this chapter is to provide a clear description of how this study was designed and carried out. The description includes the paradigm within which the study is placed, the strategies that were adopted and the methods of data collection that were used. According to Henning (2004), research methodology is about explaining the choices that are made by giving reasons for using certain data collection methods and strategies. This means that the researcher has to defend the appropriateness or the suitability of the methods chosen for answering the research question. This description also reports how issues of validity and reliability were addressed as well as the ethical issues in conducting this study.

The purpose of this study was to explore the learning strategies that successful science students use in the learning of science. Therefore the main research question was: What learning strategies are used by successful science students? The second research question was: What influences the students to be successful learners? The unsuccessful students' strategies were also included in the study. This was done in order to find the common strategies used by both groups so that the ones used more frequently by the successful student could be identified.

3.1   DESIGN OF STUDY

In this study a pragmatic approach was followed resulting in a mixed methods design for the collection and analysis of the data. I decided to explore the phenomenon under study by employing an approach that seemed to be the most appropriate for answering the research questions, given the limitations in time and resources available. According to some authors (Creswell, 1994; Lodico, Spaulding & Voegtle, 2006; Patton, 2002), a pragmatic approach is concerned with what works or what will help the researcher to achieve his or her goals. They argue that both qualitative and quantitative methods can be combined within one study in order to fully answer the research question. In fact Onwuegbuzie (2002) states that pragmatists advocate the use of mixed methodologies, combining qualitative and quantitative research designs, which allows for efficient use of

both paradigms in order to understand educational and social phenomena. Johnson, Onwuegbuzie and Turner (2007) assert that the "philosophy of mixed research is that of pragmatism" (p. 113). According to these authors, pragmatism acknowledges both subjective and objective viewpoints encompassing those of positivism and constructivism. In support of this argument Cherryholmes (1992) points out that pragmatic research is driven by the end-product that is useful to the society. This means that it is geared to address the problems of the society. In other words, pragmatists argue that research should be responding to the question of its usefulness to the society. This means that researchers should focus more on the usefulness of the research activity rather than focussing or adhering to certain paradigms. Therefore, Krauss (2005) argues that the methodology that is chosen should depend more on the aims of the study. This is to say that it must fit the phenomenon that is being studied.

I decided that the best way to answer the research questions was to find out from the learners what strategies they used in general, i.e. to explore the extent to which the use of learning strategies was spread among both the successful and unsuccessful students, and then to obtain more detailed information from a smaller group of learners by obtaining their views and perspectives. Therefore this study combined an approach that had aspects of a constructivist/interpretivist paradigm, and one that has aspects of a post-positivist paradigm. The constructivist/interpretivist paradigm states that reality is a social construction that leads to multiple meanings, that different individuals bring different understandings to a situation based on their subjective world of human experiences and that this influences their perception of that situation (Cohen, Manion & Morrison, 2007). It dictates that a researcher should employ qualitative methods of data collection such as interviews to obtain these perceptions. The post positivist paradigm states that there is one true reality that exists out there and is discoverable by the use of objective scientific procedures (Feilzer, 2010). It implies that a researcher could employ quantitative methods of data collection such as a survey to gather information from the group as a whole.

By using a combination of both qualitative and quantitative methods, the researcher was employing what is referred to as the mixed methods approach or mixed research (Johnson, Onwuegbuzie, & Turner, 2007). According to Johnson et al. (2007) a mixed methods approach "is a synthesis that includes ideas from qualitative and quantitative research" (p. 113). This is also the view that is held by several authors (Chen, 2006; Creswell, Shope, Plano Clark & Green, 2006; Johnson & Onwuegbuzie, 2004; Teddlie & Tashakori, 2006), who argue that a mixed method approach involves the systematic use of

combined qualitative and quantitative research methods or approaches to collect, analyse data and draw inferences, in a single study. But it is Johnson et al. (2007) who have suggested a definition for this type of research. They define mixed methods approach as:

> The type of research in which a researcher or a team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breath and depth of understanding and corroboration (p. 123).

Denscombe (2008) takes the argument further by arguing that the mixed methods approach is the third major research approach that occupies the middle position between the two extreme approaches which are the qualitative and quantitative approaches. This approach is purported to have advantages over the use of one single research method. The first advantage is that in this approach, the first method of data collection that is used informs the second one, or the second one supplement the first, and this leads to a better understanding of the phenomenon being studied (Creswell, 1994). According to Baxter and Jack (2008) quantitative survey data can be integrated with qualitative descriptive data to facilitate reaching a holistic understanding of the phenomenon under study. They therefore argue that the use of multiple sources of data enhances data credibility. It also increases the integrity of the study if these sources are triangulated. In support of this argument Henning (2004) points out that lived experiences cannot be adequately captured through the use of survey questionnaires alone and in the same way, interviews cannot portray the extent of a wide variety of issues. This means that to fully cover these aspects within one study, a combination of methods can be used. Other advantages for mixed methods given by different authors (e.g. Bergman, 2010; Denscombe, 2008) include:

- Improved accuracy of data.
- The production of a more complete picture by combining information from complementary kinds of data or sources.
- Enrichment of overall results by complementary subsets of results.
- Avoidance of bias which may be intrinsic to single-method approaches

These points are summed up by Carvalho and White (1997) who point out that the use of mixed methods makes it possible for the researcher to examine, explain, confirm, refute and enrich data from different sources used in the study. This means that the researcher can verify and explain the findings from one approach by comparing with those from another approach. It also means that rich data can be produced by closing gaps that are left by the shortcomings of the one approach.

Therefore, I found it appropriate to use a mixed-methods approach in this study, which comprised of a phase involving quantitative methods, followed by the one involving qualitative methods. The study thus involved the use of a survey questionnaire followed by semi-structured individual interviews and a focus group interview. This enabled me to confirm or corroborate the results from the two methods through methodological triangulation, which, according to Jick (1979), is the use of multiple methods to study the same research problem. The same author argues that this has the advantages of uncovering any contradictions that may be in one set of data, will lead to a thicker and richer data, and finally allows the researcher to be more confident of his or her results. Other authors (Cohen et al., 2007; Creswell & Miller, 2000) point out that triangulation is a validity procedure which is used to check convergence within the variety of data sources, thus reducing bias or subjectivity while enhancing validity.

According to different authors such as McMillan and Schumacher (2010), there are different types of methodological triangulation. They have come up with three major ones which are sequential explanatory, sequential exploratory and concurrent triangulation. In this study the researcher opted for concurrent triangulation in which quantitative data and qualitative data are collected at about the same time. In this design there is almost equal emphasis given to both qualitative and quantitative approaches even though one follows the other (McMillan & Schumacher, 2010). The two sets of data were analysed using both quantitative and qualitative methods.

In this study the focus is on learning strategies used by successful science students and the findings are expected to inform practice in schools. This means that science teachers' understanding of the importance of learning strategies will hopefully be improved. They will then be in a better position to help the less successful students. It also entails that this is an instrumental research study which is intended to lead to an understanding of the role of learning strategies in improving academic performance. According to Fraenkel and Wallen (2007) an instrumental research study is carried out in order to understand something more than just from the particular group of learners who participated in the study but to draw conclusions that apply beyond it. In other words, the findings of this study may be applied to situations that others feel are similar to this one.

3.2   THE PARTICIPANTS

This study was carried out in one of the schools in the urban area of the Maseru district in Lesotho. It is a mixed school which comprises of boys and girls with a large population of learners from grade eight to grade twelve. It has a very good record for academic performance such that there is a high competition for enrolment in grade eight. This has given it the advantage of selecting only those students who have performed exceedingly well at the primary final examination in Lesotho, obtaining a merit or first class pass. This enables it to maintain the spirit of competition and hard work among the students in order to remain among the best performing schools in the country. The students come from different classes of the society as enrolment depends on performance. Some of the students whose homes are far from the school stay within the school premises in hostels. But those whose homes are closer to town still commute from home. The students are not streamed according to abilities but are in mixed ability classes. The class sizes are in the range of 40 to 45 students per class. Therefore the school was chosen on the basis that it has more successful students than can be found in other schools with a poor record of academic performance. Another factor was the accessibility of the school, given the limited time and funding available to the researcher, who could not thus cover a number of schools.

The participants who were surveyed in this study were from grades 10, 11 and 12. Students in these grades were chosen because they have been in high school system for more than two years and they have developed some learning habits and they are therefore in a better position to describe their learning experiences. This goes along with what Patton (2002) describes as the selection of information-rich cases from which the researcher can learn most about the phenomenon under study. These grades were selected on the bases that all the students in these grades at this school were taking at least two science subjects which met the criteria of being science students. The questionnaire was administered to all these science students in the classes (296 students) in order to avoid a situation in which some would feel that they were not chosen or they were chosen because they were successful or they were not successful at science.

Subsequently, the completed questionnaires were sorted out so that the researcher was left with only the successful and the less successful students. This was done with the help of their academic records provided by the school, which showed their performance at the end of the previous grade. It also meant that the researcher was able to select only the

more successful students and the less successful students from each class for the purpose of data collection. The cut-off point for the successful students was those who had obtained an average of 60% and above (i.e. clearly passed and not marginal) in the end of year examination in 2009. The less successful ones were those who obtained less than 40% . This left the researcher with two groups defined as successful (61 students) and less successful students (51 students) for the analysis. The researcher felt that these distinct groups would give a clear indication of differences in strategy use whereas the middle group may consist of those who use some strategies and not others.

3.3   VALIDITY AND RELIABILITY

Because of the use of a mixed methods approach in this study, it follows that the issues of validity for the qualitative component were addressed from the qualitative point of view while those of the quantitative component were addressed from the quantitative point of view. According to Creswell (2003) researchers using mixed methods deal with this issue by checking the validity of the quantitative procedures and the accuracy of the findings from the qualitative phase. This means that in the quantitative phase issues such as the validity and reliability of instruments used are discussed. In the qualitative phase the discussion will be on strategies used to check accuracy of findings such as triangulation of data sources and detailed description (Creswell, 2003).

The qualitative research approach to these issues is different from that of a quantitative research. Different authors (Kvale, 2002; Merriam, 1998; Patton, 2002; Robson, 2002) express their support for a more appropriate terminology for qualitative research such as trustworthiness, credibility, dependability and confirmability. This means that qualitative research uses a different approach to address issues of validity and reliability. In supporting this argument McEwan and McEwan (2003) point out that in qualitative study the burden of proof falls on the researcher to constantly offer reasons and evidence why the reader should find the causal explanations believable. Therefore, in the current study the researcher has tried to provide enough detail about the steps followed, choices made, reasons behind those actions and literature that supports them in order for readers to find the conclusions sensible. He has also tried to provide a detailed description of the context to allow for transferability to similar situations.

Apart from the provision of detailed descriptions of the research process Merriam (1998) and Yin (2003) suggest other strategies, such as the use of multiple sources of data with triangulation and collaborative modes of research. They argue that triangulation ensures that information is corroborated and enables one to view a phenomenon from alternative perspectives. They also argue that it strengthens the trustworthiness of the results. Therefore the researcher had to adopt a mixed-method approach that enabled him to use multiple sources of data with triangulation for validation. The different sources of data in this study were the questionnaire, individual interviews and the focus group interviews.

The researcher constructed a questionnaire by selecting items from existing questionnaires which have been used before and whose validity have already been well established. These were the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia & McKeachie, 1991) and the Learning and Study Strategies Inventory (LASSI) (University of Cincinati, 2003). Because the focus of the study was on learning strategies, the researcher selected only those items related to use of learning strategies. Other activities that the researcher engaged in were the piloting of the data collection instruments such as the questionnaire and interview before the actual data collection for the study. The questionnaire was presented to the supervisor for assessment; it was then piloted to check for statements that may not be clear or easily misunderstood due to language. The researcher also used audiotape to capture the interview in order to get all the details that could be missed if taking notes. These actions were intended to increase the validity of the study findings.

3.4   ETHICAL ISSUES

The issue of ethics in research involves moral obligations of researchers to treat their participants with respect and sincerity. Greig, Mackay and Taylor (2007) argue that it is the responsibility of the researcher to make sure that the participant's best interests are protected. This means avoiding activities that could have any negative impacts on the child either physically, emotionally or psychologically. According to a number of authors (e.g. Cohen et al., 2007; Greig, et al., 2007; and Merriam, 1998) it is advisable that participants are well informed about the research. This means the participants have to know the purpose of the research, their role in the research and how the data or results will be used.

They also suggest that the participants should be made aware of their rights. This is done in order to enable the participant to make an informed decision as to whether he or she wants to participate or not and to be aware that he or she can withdraw at anytime if she so wishes. Slavin (2007) advises that the researcher must ensure the confidentiality of any data that could traced back to the participants, such as test records or any such work done by the participants. He argues that such data may cause embarrassment, anxiety or distress depending on its nature if it falls in the wrong hands.

The last issue involves seeking permission from the people who are responsible for safeguarding the interests of others and who can give formal or informal permission for the research to proceed (Greig et al., 2007). Such people are often referred to as gatekeepers. These include school principals and department of education officials, if the research is within the field of education. According to Cohen et al. (2007), the researcher has to clarify the precise nature of the research with the gatekeepers so that they will be aware of the demands that will be made on both the participants and the organisation. They argue that this gives both the researcher and gatekeepers an opportunity in anticipating the likely problems and solutions and contributes to building good relationships for acceptance and support. These are some of the issues that a researcher has to consider when carrying out a research.

With these issues in mind, the researcher has tried by all means to comply with the proper code of conduct in undertaking this research. Before the researcher could contact the gatekeepers he had to apply and obtain ethical clearance from the University of KwaZulu-Natal. Then he had to follow the following steps: first the researcher requested permission from the education officials and the school principal to carry out the research. Secondly, informed parental consent was sought with the help of the school administration. Lastly, the research informed the students about the research and made them aware of their rights to participate or not. This was followed by requesting their informed assent.

At this point, it must be pointed out that two of the students who were chosen for interviews reported that their parents did not grant the consent to take part in the study. This was a surprise to the teachers that were assisting me at the school because it was something that had never happened before. The assumption has always been that, as long as the school granted a researcher permission to carry out a study, the parents would not have any objection.

3.5 METHODS OF DATA COLLECTION

It has already been outlined in the previous sections of this chapter that the researcher adopted a mixed methods approach in this study. This means that this study employed methods and techniques from the qualitative and quantitative research approaches for the collection and analysis of data. This was carried out in two phases with the use of a questionnaire in the first phase, and detailed individual interviews and focus group interviews in the second phase. This means that the study used data that is reported or given by participants. As it has been argued earlier in this chapter, the data generated by the questionnaire formed a basis for the interview sessions. This is because it provided a clear picture about the extent of the use of learning strategies by both the successful and the less successful students.

3.5.1 Questionnaire

The use of a questionnaire in this study was to determine the extent of the use of learning strategies (commonly mentioned in the existing literature) by the successful as well as the less successful science students. This generated quantitative or numeric data that was analysed so as to form a basis for interviews. The survey had the advantage of collecting data from a large sample within a short time which could be quickly analysed by statistical procedures (Gay & Airasian, 2000). This meant that I was able to collect the data, analyse it and use the results to determine the important points that could be followed up in the interviews. In this way, the use of the questionnaire informed the decisions that were made about the next step of data collection.

The questionnaire items were sourced from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia & McKeachie, 1991) and the Learning and Study Strategies Inventory (LASSI) (University of Cincinati, 2003). The items that were selected dealt only with cognitive learning strategies, metacognitive strategies and resource management. The questionnaire then consisted of forty items with a five-point Likert scale (i.e. 1 = Almost never, 5 = Almost always). The questionnaire was piloted in a different school to the one in which the study was conducted. The piloting was done in order to refine it by revealing problems such as lack of clarity and limitations of the questions in diagnosing the problem or in extracting desired data (Marshall & Rossman, 2006). This

involved twenty six participants from a Grade 12 classroom. The results were analysed and discussed with the supervisor. This led to a few modifications in the wording of some of the statements that seemed to be confusing to students. For example, a statement that said "I start studying two weeks before the examinations and I pace myself" was changed to "I start studying before the examinations not just the day before and I pace myself". The idea of two weeks was found to be too confining or too specific and therefore confusing to the students. Piloting also resulted in the dropping of one item that was seen as repetition. One item was "I try to find a quiet place for studying" while the other said "I isolate myself from anything that distracts me when I study". Therefore the second item was dropped. Therefore the final questionnaire that was used had 39 statements after the changes which were brought about through the pilot process.

The questionnaires were administered with the help of science teachers. It was organised in a manner that the willing science teachers allowed the researcher to use their lessons. This gave the researcher an opportunity to explain the purpose of the activity, the ethical issues and how the questionnaire was to be answered. All the students in each chosen class were allowed to participate. Only during data capture and analysis were the questionnaires sorted into the successful and less successful ones. This was done by consulting the school records that were provided by the school.

3.5.2 <u>Interviews</u>

Interview was selected as the main method of data collection for the qualitative stage in this study because it offered an opportunity for the researcher to interact personally with the participants. This enabled the researcher to gather an in depth understanding of the issue that was being researched through thick descriptive data (Flick, 2007). Several researchers (e.g. Kvale, 2007; Mason, 2002; Nieuwenhuis, 2007; Patton, 2002) consider an interview as the best way of exploring the participants' construction of knowledge and reality from their own perspectives. They argue that it allows participants to describe their actions, experiences, opinions, views and behaviours in their own words. Other researchers (e.g. Birmingham & Wilkinson, 2003; Cohen, et al., 2007; Henning, 2004) point out that an interview allows for a multi-sensory communication in which the researcher is able to capture both the verbal and non-verbal responses. It means that the researcher will be able to note the body language and the tone of the response. This then results in rich descriptive data which, according to Silverman (2006), gives an authentic insight into the participants' experiences. Therefore interviews were considered a suitable method of data collection in

this study as they expose the experiences, opinions and actions in relation to the use of learning strategies. The types of interviews used in this study were the semi-structured and focus group interviews.

Semi-structured interviews were chosen because it placed the researcher in control of the process while at the same time giving the interviewee a sense of freedom in his or her responses. According to certain researchers (Kvale, 2007; Lodico, et al., 2006; Opie, 2004; Robson, 2007), in a semi-structured interview the researcher plans the overall focus, the main areas to be covered and the sequence ahead of time, but it remains flexible. This flexibility is due to the fact that it allows the researcher to modify the wording and sequence of questions to suit each participant. They also argue that it allows for probing and clarification as well as for pursuing themes that may emerge during the interview.

Therefore the researcher conducted individual, semi-structured interviews on eight participants, of which six were successful students while two were less successful, lasting an average of twenty minutes each (Appendix B). These were carried out in the school library which was intended to be a quiet place. Due to the cold weather, the librarian and other workers could not leave the warmth of the heater in the library and carried on with their conversation, which was a distraction even though they tried to lower their voices. Unfortunately that was the only place I could use as all the classes and laboratories were always occupied. These interviews were audiotaped and later transcribed for analysis.

Focus group interview

A focus group interview offers some additional advantages as it creates an atmosphere in which participants feel free to discuss the issues under focus with each other rather than in a constrained atmosphere of the one-to-one interview. According to Fraenkel and Wallen (2007), it allows the researcher to get participants' various views in a social context; they hear the views of others and consider theirs accordingly. Kvale (2007) argues that it facilitate or stimulates participants so as to bring to the surface ideas which may be forgotten or taken for granted. The process of discussion also provides a way of checking and balancing false or extreme views thus providing data of better quality as the researcher can assess its consistency and diversity (Patton, 2002). Cohen et al. (2007) argue that this method removes the dominance of the researcher from the scene and therefore the participants have a feeling of not being judged by an adult who knows more. This means

that the focus group interview was suitable in this study as it encouraged the young participants to feel freer to discuss issues amongst themselves.

The researcher purposively selected the successful students for the focus group interview with the assumption that they would shed more light on the strategies used by successful students. Six students were involved in the focus group from different levels of study from grades 10, 11 and 12. This made it a bit difficult to get the discussion going at the beginning but eventually they got used to the situation and started to talk freely. This was audiotaped and then transcribed for analysis.

In conclusion, a detailed description of the following issues was addressed in this chapter. First the research design and its appropriateness for the study were discussed, then the sampling procedures and their justifications described. The third issue dealing with validity and reliability was addressed. Finally, the methods of data collection and their suitability or appropriateness was discussed. In the following chapter the findings from the interviews and survey questionnaire are presented and discussed.

CHAPTER 4
DATA ANALYSIS AND DISCUSSION

The previous chapter dealt with the way that data was generated in this study. It was outlined that the researcher used a mixed method approach which involved the use of both the qualitative and quantitative approaches in the gathering of data. This involved data gathering instruments such as a questionnaire, semi-structured interviews and a focus group interview.

The questionnaire was completed by students from grade 10, grade 11 and grade 12 totalling 296 in all. These students were then divided into three categories of the successful students, the average students and the less successful students depending on their end of year mark in science from the previous grade. The questionnaire responses from the category of average students were not considered as the interest in this study was mainly on the successful students, while the less successful ones were used in order to make comparisons. Therefore, the final number of questionnaires analysed was 112, with 61 from successful and 51 from the less successful students.

It has already been mentioned earlier that the school in which this study was conducted is one of the best in the country in academic performance. The competition for spaces is so high that it has the advantage of taking only those students who performed well in the primary leaving examination and in the Junior Certificate examination that is written at the end of grade 10. The school is therefore very concerned about keeping the standards so high that it resorts to certain measures in order to ensure this state of affairs as I realised. I had expected to find a larger number of the less successful students (with end of term mark of less than 40% in science) than the more successful students (end term mark above 59% in science) as is usually the case in many schools. But in this case, I found out that the number of the more successful students was higher than that of the less successful ones. And the largest number was of those which I considered the average performers, with marks between 41% and 59%. Figure 4.1 below shows the distribution in percentages, which is based only those students who answered the questionnaire.
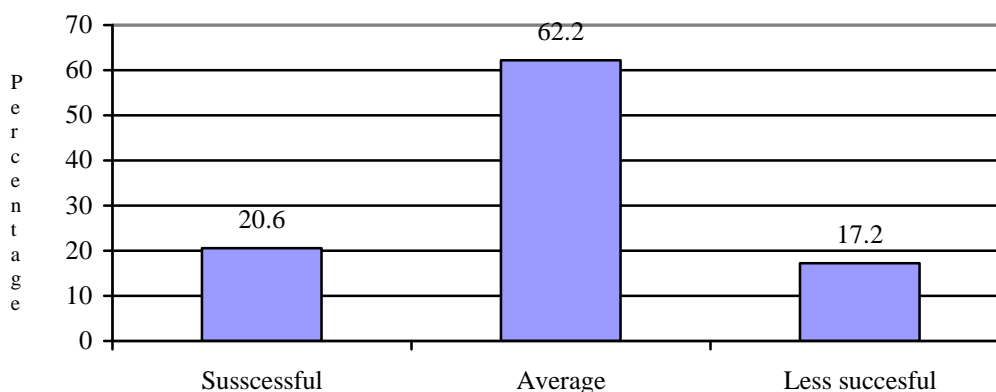
Figure 4.1   The percentages of successful, average and less successful students.

The figure shows that 20,6% of the 296 students fall into the successful category, 62,2% in the average and 17,2% in the less successful category. I found that the reason for this is that if a student does not perform satisfactorily in grade 9, he or she has to repeat or leave the school and the same applies to those in grade 11. Only those that will produce good results in external examination remain. This is one motivational factor which ensures that students work very hard.

The rest of this chapter will present the findings that resulted from the analysis of the data generated through the different data gathering instruments. These findings are addressing the following research questions: What are the learning strategies that are used by successful science students in the learning of science? This is based on the assumption that successful students are the ones who make use of learning strategies. The second research question is: What influences the students to be successful learners? The assumption here is that there are certain factors which influence the successful students to be successful. It therefore means that each research question can be addressed by an assertion which will then be supported by evidence from either the questionnaire or the interviews or both. In other words, these assertions are answers to the research questions (Gallagher & Tobin, 1991). The table 4.1 below shows the relationship between the research question and the evidence from the questionnaire and the interviews.

Table 4.1   Relationship between research question, assertion and evidence

Research Question 1: What learning strategies are used by successful science students?		
Strategy	**Assertion**	**Source of evidence**
Resource management strategies	Effort regulation	-Questionnaire -Interviews
	Regulate and monitor time and study environment	-Questionnaire -Interviews
Cognitive learning strategies	Rehearsal	-Questionnaire, Interviews, Focus group
	Comprehension monitoring	-Questionnaire, Interviews, Focus group
	Elaboration	-Questionnaires, Interviews, Focus group
	organising	-Questionnaire, Interviews
Metacognitive self-regulation strategies	Seeking Information	-Questionnaires, Interviews
	Seeking social assistance	-Questionnaires, Interviews, Focus group
	Self-evaluation	-Questionnaire, Interviews
	Record-keeping	-Questionnaire, Interviews
Research Question 2: What influences them to be successful?		
Motivation	**Assertion**	**Source of evidence**
	Family Support	-Interviews
	Love of the subject	-Interviews, Comments on questionnaire
	Ambition or goals	-Interviews

The responses from the questionnaire have been summarised in Appendix C. This shows the distribution of strategy use or the extent to which different learning strategies are used by the different groups. It shows those that are used more by either the successful students or less successful students and those that are used almost equally by both. These are discussed together with the other data in the following sections. I decided to use 10% as a cut off strategy for display purposes as it indicated a clear difference. I considered that a strategy was used more if the percentage difference was greater than 10%. If the percentage difference was below 10%, then I considered that the strategies were used almost equally by both groups.

4.1   RESOURCE MANAGEMENT

Assertion One: **Successful and less successful students deal with resource management such as effort regulation and study environment differently.**

It has already been shown in the literature that the use of learning strategies is one of the differentiating factors between successful and less successful. The argument put forward is that generally the more successful students were found to use more learning strategies than their less successful counterparts. Resource management is one such category of strategies and a difference was found in this study between the successful students' resource management strategies and the less successful students. This assertion can be broken down into a number of sub-assertions.

4.1.1   Effort Regulation

Successful students apply more effort in carrying out difficult and uninteresting educational tasks.

The findings from both the questionnaire and interviews reveal that the successful students expend more effort in carrying out educational tasks. This means that they show more interest in their school work and even force themselves to continue working when faced with difficult or boring tasks.

There are two statements in the questionnaire that are addressing the issue of effort regulation. The first one is number 36 which says that "even when work is dull and not interesting, I still study hard until the work is finished". The second one is number 37 which says that "when the work is hard, I leave those parts out and study the easy parts." These two statements give an idea of how dedicated and persistent an individual is in learning. Table 4.2 below shows the responses of both the successful and the less successful students.

This and other tables in this chapter give a detailed distribution of the responses, but for better understanding, the categories of response are conflated and grouped together when reporting the percentages. Therefore the two responses; *many times* and *almost always* were grouped together and referred to as "often" when discussing the responses. The other two responses; *almost never* and *very few times* were grouped and referred to as "occasionally".

Table 4.2   Responses to statements dealing with effort regulation.

Statements	Number of successful and unsuccessful	Almost never	Very few times	Sometimes	Many times	Almost always
Even when the work is dull and not interesting, I still study hard until the work is finished.	Successful (61)	6.6%	11.5%	21.3%	26.2%	34.4%
	Less Successful (51)	3.9%	21.6%	39.2%	21.6%	13.7%
When the work is hard, I leave those parts out and study the easy parts.	Successful (61)	50.8%	19.7%	23.0%	4.9%	1.6%
	Less Successful (51)	9.8%	15.7%	27.5%	23.5%%	23.5%

This table shows that 60.6% of the successful students said that they *often* (many times + almost always) keep on working even when the subject or lesson is boring and not interesting while only 35.3% of the less successful students do the same. It also shows that 47% of the less successful students *often* (many times + almost always) leave out difficult parts when studying while only 6.5% of the successful students do the same thing. This is a very clear indication of the level of dedication or persistence between the two groups, with the successful ones being more persistent, and applying more effort to complete educational tasks.

This is also supported by evidence from the interviews with the participants. One of the less successful grade 10 students when asked what he thinks his problem is said,

> I do not read seriously at all. When I read, I sometimes tell myself that I am reading but after about three pages I feel tired and lose interest and then leave them and say I will see them some other time. Or I find it difficult when I am reading it, not understanding it; I skip it and read another one. (Morena, interview, 04/05/10)

The very same student when asked what he has specifically found difficult he said, "At the time when we were doing equations that is where I came to believe that science is difficult for me. From there I did not bother to do anything. I left it like that, feeling that it is hard" (Morena, interview, 04/05/10).This shows a case of a student who has almost or totally given up on learning science. The level of motivation is very low; he has lost interest in the subject and stopped all efforts of trying to understand. He admits that he is not reading seriously at all and he easily loses interest.

But an interview with a successful student gives an opposite picture altogether. Moroesi, a successful grade 10 student, had this to say about her approach to learning, "You should have interest in something so that if you find maths difficult you do not give up quickly. You should have an interest until you understand" (Moroesi, interview, 06/05/10). The point here is that, one should not easily lose interest but should be persistent until he or she understands the subject.

From the evidence obtained from the questionnaires and the interviews with the participants it has become clear that in this study there is some disparity in the level of applied effort between the successful and the less successful students. While the successful students seem to be more persistent, the less successful ones lack this characteristic.

4.1.2   Regulation and monitoring of study environment

The successful students regulate and monitor the environment in which they learn and study, more than the less successful students.

In this case, students are expected to be in control of the way they study by making the place of study conducive for the purpose. Furthermore, if a student is not able to change the situation in his favour he or she can try and find another more favourable place. The table 4.3 below shows the responses from the questionnaire in relation to the issue of regulation of the study environment.

Table 4.3   Responses to statement dealing with management of study
                    environment

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I try to find a quiet place for studying which has no distractions	Successful (61)	13.1%	9.8%	16.4%	21.3%	39.3%
	Less Successful (51)	5.9%	9.8%	5.9%	23.5%	54.9%

The results show that 60.6% of the successful students often try to find a quiet place for studying. This is much lower than that of the less successful students which is 78.4%.

This is a surprising finding which goes against the expectation that it would be the successful students who will be more particular about an environment with no distractions.

The idea of seeking places with no distractions for studying was not one of the common strategies mentioned during the interviews. When asked as to how they manage to balance their study activities with other social activities, some participants reported that they do not go to parties, they watch only a few and educational programmes on television or they value their studies more. They did not mention any strategy such as creating or changing the environment to enable them to study. Only one successful participant from grade 11 mentioned that she prefers to be alone in order to understand what she is learning. This is what she had to say when asked if she works with others; "If there is no class I move away so that I can sit where I am alone" (Lebohelang, interview, 04/05/10).

The questionnaire evidence in this case contradicts the expectation that successful students will engage more in environment management than the less successful ones. There is minimal evidence that supports this assertion from interviews.

4.1.3   Discussion

The findings in this study suggest that in general many students use resource management strategies, but to different degrees. It has been found that successful students are the ones who engage more in effort regulation activities than the less successful students. The successful students seem to have a determination to do well by putting more effort into their school work while the less successful ones give up when work is hard. This finding is similar to that of Kosnin (2007), in a study that investigated whether self-regulated learning was effective in predicting academic achievement among undergraduates in Malaysia.   He found that students who engaged in more resource management activities are academically more successful than those who do not. The finding is also similar to those of Chen (2002), in a study that investigated the learning strategies which were related to achievement in an information systems course. It was found that effort regulation was the one that was associated with achievement.

A surprising finding was that the less successful students engage more in environmental structuring activities more than the successful students. This is surprising because it is not related to high academic performance as could be expected. In fact this is in contrast to the findings of Hong, Sas and Sas (2006) that high achievers managed their study environment more than did low achievers.

According to some researchers (Britton & Tesser, 1991; Tuckman, 2003) good grades are obtained by students who are good at time management and are able to put themselves in situations that are without distractions when studying. This means that it is expected that it should be the successful students who will often create a suitable study environment not the less successful ones.

But it seems like it is not totally uncommon for participants to respond in a manner that contradict their status. Ley and Young (2005) had also come across the same phenomenon. They suspected that lower-achieving students were choosing socially acceptable responses to some of the Likert scale items. It can therefore be suspected that this is the case with this finding as the creation of suitable study environment is a strategy that is associated with high achievement status.

From this discussion it has become clear that successful students reported that they tend to use effort regulation strategy more than the less successful students and this may be one of the factors that have contributed to their superior academic achievement.

4.2 COGNITIVE LEARNING STRATEGIES

Assertion Two: **Successful students employ more cognitive strategies than the less successful students. They engage more in such strategies as rehearsal, comprehension monitoring, elaboration and organisation.**

4.2.1 Rehearsal

Successful students learn and study by memorising facts and practising in order to store information.

At this point the focus is on the different activities that the students engage in, in order to make sure that the information that is being learned is effectively stored in the brain for later use. This means it is memorised so that it can be reproduced later. This is sometimes referred to as rote learning and it is a very superficial way of learning information. The table 4.4 below shows the questionnaire responses to statements relating to information storage.

Table 4.4   Responses dealing with information storage.

Statements		Almost never	Very few	Sometimes	Many times	Almost always
I memorise key words in order to remind myself of what I have learned.	Successful	9.8%	6.6%	39.3%	27.9%	16.4%
	Less Successful	5.9%	11.8%	52.9%	19.6%	9.8%%
I practice similar sorts of examples so that I can remember how to do similar ones in a test.	Successful	8.2%	9.8%	24.6%	29.5%	27.9%
	Less Successful	13.7%	15.7%	17.6%	27.5%%	25.5%
I read my notes over and over again when studying	Successful	3.3%	19.7%	29.5%	21.3%%	26.2%
	Less successful	9.8%	7.8%	23.5%	27.5%	31.4%

The findings from the questionnaire show that 44.3% of the successful students indicated that the successful students reported that they often memorise key words as opposed to 29.4% of the less successful students and this is a large difference between these two groups. It further shows that percentage of the successful students who often practise similar sorts of examples (57.4%) is not very different from that of the less successful students (53%). There is a very small difference, whereas when it comes to reading notes over and over again, the percentage of the less successful students (58.9%) is higher than that of the successful students (47.5%)

These findings are strongly supported by the evidence from the interviews and focus group interviews, in which almost all students reported that they engage in memorising and practising in order to understand. For example, one of the successful grade 12 students reported that he reads repeatedly to make sure that the information goes into his short-term and then long-term memory. He then gave the following response when asked as to what he does in order to remember the stored information;

> everytime that I read ah......maybe I.....I encode the notes in such a way that I remember them. For example, I try to find sequences so that if I think about eh... key word, it will bring that order of the information read. (Kulo, interview, 05/05/10)

Another student, Motaba, said that information is stored easily by doing the following; "Reading over and over again. By doing this, things that I have read don't easily go out

because I repeat what I have read before making it easy to be stored" (interview, 06/05/10). He also reported that for a concept that requires some deep thinking he tries to put it in his own words before storing it in his head.

It was interesting to find that during the focus group discussion the participants qualified their use of memorising. They were saying that one should not just memorise things but he or she should make sure that they understand them first before memorising them and only key words. One of the successful students, Moruti, gave this advice, "If a person uses it, it should only be for the key words and for something that one understands" (interview, 06/05/10).

Even though most of the students felt that memorising was a good strategy there was one participant from the focus group who felt very strongly that memorising was not a good strategy. This student had this to say about memorising;

> I disagree because memorising takes a great deal of time to do and in exams, questions are asked not on what you know but what you understand. Some students fail maths because they memorise mathematical problems. Say, Mpho has just learned that... from class that 4 squared equals to 16 and she memorises it. In the exam 5 squared appears, then she fails to answer the question because she did not understand what happens when a number is squared. (Lethola, interview, 06/05/10)

What was found was that when it comes to reading notes over and over again, the less successful students used this strategy more often than the successful ones as 58.9% percent of them reported that they often read notes over and over while for the successful ones it was only 47.5%. This shows that there are certain strategies on which the less successful students rely on. In this case it maybe because they solely depend on the given notes while the successful students use other strategies and resources, such as their own notes. In fact one of the less successful students, Morena, when asked as to how he prepares for tests or exams said, "I don't have any particular method.....I just read, I keep on repeating, repeating and repeating those things" (interview, 04/05/10). This is an indication of an individual relying solely on memorising the notes without any other additional strategy.

The evidence gathered from both the questionnaire and interviews shows that generally the successful students tend to engage in rehearsal strategies more often than their less successful peers.

4.2.2   Comprehension monitoring

Successful students do more in trying to understand what they are learning.

The focus at this point is on activities in which the students engage in order to improve their understanding of concepts. This involves activities such as working on practice exercises and setting questions for oneself. The table 4.5 below shows questionnaire responses towards statements on the monitoring of understanding.

It is evident from this table that the successful students seem to be using a comprehension monitoring strategy more than their less successful counterparts. In the area of self-questioning, it is 68.8% of the successful students who said that they often do it against 60.8% of the less successful ones. Then it was also found that 37.7% of the successful students reported that they often work on practice exercise and answer end of chapter questions while only 19.6% of the less successful students often use this strategy. More successful students (50.8%) were found to transform ideas from textbooks and notes into their own words, as compared to 29.4% of the less successful students. There seems to be a remarkable difference between the successful and less successful students from the questionnaire evidence.

Table 4.5   Responses dealing with comprehension monitoring.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I ask myself questions to make sure I know and understand the subject information.	Successful	4.9%	4.9%	21.3%	29.5%	39.3%
	Less Successful	9.8%	5.9%	23.5%	29.4%	31.4%
I work on practice exercises and answer end of chapter questions.	Successful	11.5%	23.0%	27.9%	21.3%	16.4%
	Less Successful	25.5%	15.7%	39.2%	13.7%	5.9%
I put important ideas from notes and textbook into my own words	Successful	8.2%	18.0%	23.0%	18.0%	32.8%
	Less successful	21.6%	19.6%	29.4%	13.7%	15.7%

Comprehension monitoring has come out as one of the favourite learning strategies during both individual interviews and focus group interviews. Five out of six successful

students reported that they ask themselves questions and work on practice exercises, while all members of the focus group agreed that they do the same in order to improve their understanding. For example, one of the successful students from grade 10 said that in order for her to understand she designs questions for herself and tries to answer them. Palesa had this to say on the issue of improving understanding, "even the activities at the back....I also try them even if we were not instructed to work on them, I try and do them" (interview, 04/05/10).

On the same issue, Kulo reported that he works on past examination papers, answering questions and marking himself; "Well, I just eh, write down the answers and then after that I, like a teacher when he or she does a memo and then I check from different textbooks to find out the ...the real answers and mark myself with that" (interview, 05/05/10). In this case comprehension monitoring is not only done through end of chapter exercises but also through using past question papers.

Overall, it was found that successful students reported that they use comprehension monitoring strategies more often than the less successful ones. There is therefore strong evidence from both the questionnaire responses and from the interviews to support the above assertion.

4.2.3   Elaboration

Successful students tend to summarise and make connections between the main ideas and relate what they are learning to what they already know.

At this point, attention is given to those activities that students engage in so that they can foster deeper processing of information. These activities enable them to understand how ideas or concepts are related and also relating information to life experiences. The findings from this study have revealed that on the whole the successful students tend to engage in elaboration activities much more than the less successful students. The table 4.6 below shows responses to the questionnaire related to elaboration.

Table 4.6   Responses dealing with elaboration.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I write summaries of the main ideas from class notes and textbooks.	Successful	39.3%	23.0%	11.5%	9.8%	16.4%
	Less Successful	35.3%	37.3%	19.6%	2.0%	5.9%
I make notes when I am reading a topic in a textbook.	Successful	24.6%	13.1%	23.0%	16.4%	23.0%
	Less Successful	25.5%	17.6%	29.4%	21.6%	5.9%
I try to relate or link new information to what I already know	Successful	0.0%	9.8%	13.1%	32.8%	44.3%
	Less successful	9.8%	17.6%	29.4%	23.5%	19.6%
I learn new ideas or concepts by imagining a situation in which they occur.	Successful	16.4%	11.5%	26.2%	14.8%	31.1%
	Less Successful	21.6%	21.6%	25.5%	25.5%	5.9%

The table shows that 26.2% of the successful students reported that they often write summaries of the main ideas while only 7.9% of the less successful students do the same thing. It also shows that 39.4% of the successful students make notes when reading as against 27.5% of the less successful ones. Finally it shows that while 77.1% of the successful students reported that they often relate new information to what they already know only 43.1% of the less successful students often engage in that activity.

The data from the interviews revealed that five out of the eight participants engaged in one or the other activities of elaboration but not a single one reported using all the activities. Two successful students reported that they make notes. For example, Lethola informed the researcher that "Yes we are given notes but I in most cases make my own which I know I will understand" (interview, 05/05/10). Similarly, the other one said he makes notes, especially when he reads a book.

An interesting confession was the one from the less successful student, Morena. This is what he had to say when asked if he makes any notes when he is reading;

No, as for the notes I have just realise it recently when my mother told me that when I am reading I should close the book and write down what I am reading. It

is only recently that she told me. All along I was just reading. (interview, 04/05/10)

On the same issue of making own notes, one of the successful students, Moroesi, reported that she only takes information that she sees as important. She does not write a lot but concentrates on key points only. This shows that the act of making notes goes hand in hand with summarising.

It was also fascinating that during the focus group one of the strategies that the members of the group strongly believed in was "making sure you understand". When asked as to how they do that, the following response was given by Moruti; "On the issue of understanding, I can say that when you read you try not to read in a hurry (hlaha-hlaha-fethe fela). You should read, then when you have finished, relate it to real life situation" (interview, 06/05/10).

On the whole the combined evidence from both the questionnaire and interviews is, in support of the assertion, that it is the successful students who tend to engage more on elaboration activities than their less successful counterparts.

4.2.4   Organisation

Successful students tend to be more involved in selecting, arranging and organising information of the material that they are learning than the less successful students.

The concern here is about the activities that lead the students to understand how the particular subject matter is organised. These may involve the use of diagrams, clustering of similar ideas or selecting sections that need to be learned. The table 4.7 below shows questionnaire responses to statements relating to organisation strategies.

In this case, the table shows that there slight differences between the two groups when it comes to using simple diagrams to organise ideas and also on the use of plans in answering questions. It was found that 21.3% of the successful students often make simple diagrams to help them organise and understand ideas, while it was 15.7% for their less successful counterparts. The two groups are again not that different when it comes to making plans for answering question as 62.2% of the successful often do this as compared to 56.8% of the less successful students. But surprisingly it was found that the less successful student held an upper hand when it came to marking or highlighting important sections in textbooks or notes with a very big margin. In this case it was revealed that 70.6% of the less successful students often engaged in this activity as opposed to 52.5% of the successful ones.

Table 4.7   Responses dealing with organisation.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I make simple diagrams to help me organise and understand my ideas.	Successful	50.8%	9.8%	18.0%	9.8%	11.5%
	Less Successful	43.1%	19.6%	21.6%	3.9%	11.8%
I mark or highlight important sections in the textbook or notes given by teacher.	Successful	21.3%	13.1%	13.1%	14.8%	37.7%
	Less Successful	3.9%	7.8%	17.6%	25.5%	45.1%
I think about what I must do and make a plan before I answer test or examination questions.	Successful	9.8%	6.6%	21.3%	31.1%	31.1%
	Less successful	5.9%	15.7%	21.6%	23.5%	33.3%
I go through my notes and try to find the most important points.	Successful	8.2%	16.4%	9.8%	29.5%	36.1%
	Less Successful	11.8%	7.8%	21.6%	31.4%	27.%%

It was found that only one participant amongst the eight interviewees reported engaging in this organising strategy. Even during the focus group discussion this strategy was not mentioned. This particular participant, Lethola, reported he started using diagrams when he was preparing to write the Science Olympiad. He said he did this because he had to study and understand science concepts that were not taught at school. Therefore, in order to understand he said, "I make flow diagrams that I can understand" (interview, 05/05/10). When asked as to where he learned this method, he said he thinks from primary school because there were always pictures or diagrams on the walls which helped them to pass.

The evidence from both the questionnaire and interviews shows that the differences in the use of the organising strategy are slight. It shows that the successful students tend to engage in organising at almost the same extend as the less successful students. It has also been revealed that the less successful students seem to use underlining and highlighting much more than their successful counterparts.

4.2.5   Discussion

The evidence from both questionnaires and interviews strongly supports the assertion that successful students are the ones who tend to use cognitive strategies more than the less successful ones. In this study, it has been found that successful students engage more in the following rehearsal strategies; memorising, practicing similar examples and putting important ideas in their own words. In fact rehearsal seems to be the most favourite trusted strategy in this study as indicated by the individual interviews and focus group discussions.

It has also been found in this study that the successful students reported that they tended to engage more in comprehension monitoring and elaboration strategies than their less successful counterparts. But their use of organising strategies seems evident only from the questionnaire responses as there was very little mention of it in interviews. On the whole, though, the successful students seem to use these cognitive strategies more often than the less successful ones. The evidence showing the extent of strategy use by each group from the questionnaire is summarised in Appendix C.

These findings are similar to those of Hong, Sas & Sas (2006) who investigated the test-taking strategies of high and low mathematics achievers. They found that the high achieving group used such cognitive strategies more often than their low achieving counterparts. Albaili (1997) carried out a study to examine the differences among low-achieving, average-achieving and high-achieving students on the Learning and Study Strategies Inventory scales.   The finding of that study showed that low-achieving students scored significantly lower than the average and high-achieving students on all scales. This supports the main assertion that successful students tend to make use of cognitive strategies more than their less successful counterparts.

But it was found that even though the less successful students engaged less in those strategies, they were found to read notes much more often than the successful students. This was a surprising finding as it was expected that the successful ones would surpass the less successful in the use of all these strategies. It was also surprising to find that the less successful students seemed to engage more in practices such as the marking or highlighting of important sections than their more successful counterparts. But this may be understandable when one considers what other researchers have found.

According to Cao and Nietfield (2005) and Carrier (2003) the action of reading over and over again is one of the most common strategies among the students. Furthermore other researchers (Mackenzie, 1994; Craik & Tulving, 1975; Winne & Hadwin, 1998)

consider it an ineffective strategy which involves shallow processing and which does not provide feedback.

One can therefore suggest that it may be easy for the less successful to use as it requires no effort but it does not lead to academic achievement. This also shows that both the successful and less successful students use learning strategies but differently. According to Kitsantas (2002) some are more effective than others and lead to better academic performance. It has been also been found that high achievers tend to use effective strategies more frequently than low achievers (Kitsantas, 2002; Pintrich & Schunk, 2002).

The evidence provided by this study shows that in general the successful students engage more in the use of cognitive strategies than their less successful counterparts. This is also confirmed by the results from other studies dealing with learning strategies.

One of the striking results was that the less successful students seemed to engage more in repetition activities. This means that they depend more on rehearsal strategies without trying to understand what they are reading. In other words, they are not actively engaged cognitively. They can just read notes over and over without making sense of the content or highlight words they feel are important without making sense of them or by putting ideas into their own words or linking new information to what they know. According to Dahl, Bals and Turi (2005) they are engaging in superficial learning. This may be an indicator that they believe their learning ability is limited or fixed (Dahl et al., 2005) or that they do not appreciate that their strategies are limited and not very effective.

4.3   SELF-REGULATION LEARNING STRATEGIES

In this section the focus is placed on the students strategies which indicate that they are in control of their learning. Such actions involve the regulating of the learning process, and monitoring if learning has taken place. This include such activities as information-seeking, the keeping of records, requesting assistance, evaluating one's actions, setting goals and revising what has been learned. This has been translated into the following assertion;

Assertion Three: **Successful students exhibit characteristics of being in control of their own learning in terms of regulating and monitoring their learning activities.**

4.3.1   Seeking information

Successful students are more adept in acquiring information than the less successful students.

One of the striking characteristics of the successful participants that was revealed in this study is their love for reading. They seem to have an understanding that in order to succeed they have to gather as much information as possible from many sources, even information that is not part of the topics that they are doing in class. Therefore, it can be asserted that they have that hunger for information. The table 4.8 below shows the questionnaire responses to the statements that are meant to find out about this issue.

Table 4.8   Responses to statements dealing with acquisition of
information.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I read other books (not only my textbook) on the topic that is being done in class.	Successful	6.6%	13.1%	26.2%	23.0%	31.1%
	Less Successful	19.6%	13.7%	19.6%	21.6%	25.5%
Before I write an assignment or project, I gather as much information as possible.	Successful	13.1%	19.7%	31.1%	18.0%	18.0%
	Less Successful	13.7%	15.7%	45.1%	19.6%	5.9%

It is clear from this table that the percentage of successful students who exhibit this characteristic is somewhat higher than that of their less successful counterparts. It shows that 54.1% of successful students reported that they often read books, other than their textbook, on topics that are being done in class while 47.1% of the less successful ones do the same. It also shows that 36% of the successful students report that they often gather as much information as possible before they write an assignment as opposed to 25.5% of their less successful counterparts.

This questionnaire evidence is corroborated by that from the interviews with the participants and also the comments from the questionnaire. As one of the successful students responded; "I always make sure I learn something, a new concept in science before I sleep." When asked if he ever encounters any difficulties, he responded, "I find that I am learning in advance by learning concepts that are not being taught in class" (Kulo, interview, 05/05/10).

In this case the participant had reported that he studies even those concepts that are not taught at high school level. He is therefore far ahead of what is being done at this level which makes him to understand things easily. Another student said this:

> If I don't understand I will take the textbook which has that concept that I don't understand. I will consult the notes and other textbooks or I.... even here in the library there are books that I look into. So, I try to understand a concept in other different ways, not only the way it appears in my textbook. (Lethola, interview, 05/05/10)

One participant who put this issue across so vividly was Lebohelang from grade 11. This piece from our interview really portrays her true perceptions:

> Things that work for me... one which I know that it works for me a lot in science is reading. I like to read and I have seen that it helps me. Even though I am a person who is not able to understand very quickly.... the fact that I read a lot enables me to understand something by gathering information. This piece and that piece make it easy for me to understand. (Lebohelang, interview, 04/05/10)

The evidence from the comments in the questionnaire is equally compelling. For example, two students had these to say about studying science. The first one wrote that; "If you want to pass science, here is a little advice; concentrate in class when experiments are made, memorise important points and gather as much information as possible and make sure you understand clearly". And another one gave an almost similar point of view when she said that "Science is all about researches so if people do not do their researches they might leave out some important points and information they have to know".

This evidence from the interviews and comments from questionnaire also point to the same fact that the successful students work hard to gather information.

4.3.2   Seeking assistance

Successful students tend to ask for help from different sources more than the less successful students.

The results from the questionnaire show that the two categories of students have different preferences when it comes to asking for help. It has been found that the successful students seem to prefer their teachers more than other sources while the less successful seem to prefer the other sources rather than their teachers. Table 4.9 below shows questionnaire responses relating to seeking assistance.

Table 4.9   Responses to statements dealing with seeking assistance.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I ask the teacher to help clarify things that I did not understand.	Successful	24.6%	18.0%	23.0%	16.4%	18.0%
	Less Successful	33.3%	13.7%	35.3%	13.7%	3.9%
When confused, I ask my parents, brothers or sisters to help by explaining difficult things.	Successful	21.3%	4.9%	23.0%	13.1%	37.7%
	Less Successful	13.7%	9.8%	13.7%	27.5%	35.3%
If I encounter a problem, I ask a friend to help by explaining to me or helping with an assignment	Successful	3.3%	6.6%	23.0%	31.1%	36.1%
	Less successful	2.0%	2.0%	5.9%	29.4%	60.8%

The table shows that 34.4% of the successful students reported that they often ask the teacher to help clarify things while for the less successful students it is 17.6% that often ask the teacher to clarify things. This is a large difference between the two groups. As for seeking help from the members of the family, the less successful (63.1%) seem to engage in them more than their successful counterparts (50.8%) even though the difference is small. In addition, the table shows that 90.2% of the less successful students reported that they often ask help from a friend whereas it is 67.2% in the case of the successful ones.

These results are corroborated to a very large extent by those from the interviews. Five out of six successful students reported that they usually ask help from the teacher

while the two less successful students that were interviewed reported that they don't ask help from their teachers. For instance, one of the successful students, Lebohelang, said, "I usually try to find books or ask for help......I ask for help from the teachers" (interview, 04/05/10). In contrast Morena, who is one of the less successful students said "I never go to teachers, I would rather keep quiet" (interview, 04/05/10).

But a surprising thing was that, during the focus group session the successful students admitted that even though they do seek help from teachers, it is not easy. They said they go to teachers when they have exhausted other available options. One common reason given for this is that they are afraid of the teachers or that teachers are not approachable. The majority of the participants, five out of eight, said they do seek help from family members or colleagues.

Even though almost all the participants reported asking a friend for help, while half of them admitted requesting help from a family member, there were some exceptions. One of the successful students put it strongly that he doesn't seek assistance from other students saying, "I never ask help from them. It is such that they are the ones who ask help from me" (Kulo, interview, 05/05/10). Another successful student said he only works with others in class group work or on a project where they have to share ideas, but not to actually go to them for help.

The evidence in this case shows that in general the successful students tend to seek assistance from teachers while the less successful ones use friends more often. The less successful students seldom ask help from teachers as is evident from questionnaire responses and interviews.

4.3.3   Self-evaluation

Successful students are the ones who more often evaluate their work and actions than the less successful students.

At this point the focus is on strategies or behaviours which suggest that the students are monitoring and judging their actions and the quality of their work. On the whole, it is found that it is the successful students who seem to engage in such actions more than the less successful students. The table 4.10 below show the questionnaire responses in relation to statements about self-evaluation.

Table 4.10 Responses to statements dealing with self-evaluation.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
If I don't finish my work or study in time, I think about my actions and try to see why I did not finish.	Successful	13.1%	16.4%	9.8%	23.0%	37.7%
	Less Successful	13.7%	23.5%	21.6%	19.6%	21.6%
I go over my work and check to see if I did it right.	Successful	0.0%	13.1%	14.8%	32.8%	39.3%
	Less Successful	0.0%	13.7%	29.4%	23.5%	33.3%

The results in this table show that 60.7% of the successful students reported that they often think about their actions if they did not finish their work on time, while only 41.2% of the less successful students do likewise. It also reveals that 72.1% of the successful students often go over their work to check if they did it right in comparison with 56.8% of their less successful counterparts. These results give the impression that there is a wide gap between successful and less successful students in terms of self-evaluation.

It needs to be clarified that, despite the difference, this was not a favourite strategy amongst either group, as there was no emphasis on self-evaluation strategies during the individual interviews or the focus group discussions. But the questionnaire responses show that the successful students engage more in self-evaluation activities than their less successful counterparts which is in support of the assertion put forward in this section.

4.3.4   Record keeping

Successful students tend to be more vigilant in keeping records than the less successful students.

At this point the focus is about activities that students engage in, that show that they keep records of the work that they have done. These involve the taking of notes and the keeping of past tests or examination questions, together with their feedback. The table below shows the questionnaire responses to statements relating to the keeping of records.

Table 4.11   Responses to statements dealing with record-keeping.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I listen carefully during class discussions and take note of what is said.	Successful	4.9%	4.9%	18.0%	34.4%	37.7%
	Less Successful	9.8%	15.7%	35.3%	21.6%	17.6%
I keep a file of all my tests and examinations papers.	Successful	8.2%	4.9%	9.8%	11.5%	65.6%
	Less Successful	5.9%	3.9%	9.8%	5.9%	74.5%
I keep a record of questions which I got wrong.	Successful	31.1%	11.5%	23.0%	13.1%	21.3%
	Less successful	51.0%	15.7%	13.7%	13.7%	5.9%

The results in this table show that 72.1% of the successful students often take notes of class discussions while only 39.2% of the less successful students do the same. One unexpected result was the finding that the percentage of the less successful students (80.4%) is a bit higher than that of the successful students (77.1%) who often keep a file of their tests and examination papers. The findings also show that 34.4% of the successful students often keep a record of questions that they got wrong as compared to 19.6% of their less successful counterparts.

The results from the interviews revealed that this may not have been a very common strategy. The participants in the focus group reported that they listen attentively in class but they only mentioned the idea of taking notes when probed as to whether they just listen. The section below is an example of the discussion between the interviewer (I) and the group members.

Puleng: The most effective learning strategy for me is memorising and understanding. Listening attentively in class also produces good results because it is easier to read the textbook as most of the keywords are now familiar.

Palesa: It is just listening and understanding what is ....what is right.

I: Listening and understanding? How? Just listening?

Puleng: And taking notes.

Another student also felt very strongly about the importance of being attentive in class. He reported that "The first thing... I can say in class.... in class especially when something is being explained. I listen more than anything else. That is the one I do more than anything else" (Motaba, interview, 06/05/10).

Some of the participants reported using past question papers from different sources such as teachers or internet which implied that they may have them filed. Only one participant specifically reported reviewing his own past tests. When he was asked as to what else he does when studying he said, "Apart from that I look at... I try to answer tests especially where I got wrong answers but where I was right I just read. I also look at feedback for previous tests" (Moruti, interview, 06/05/10).

On the whole the evidence supports the assertion that successful students tend to be more vigilant in keeping records. This is shown by significant differences in reported usage between the two groups, in the cases of keeping a record of questions that one got wrong, and recording notes of class discussions. But it has also become evident that in the case of keeping files of past papers both groups are almost at a par with each other.

4.3.5   Reviewing

Successful students tend to prepare better for lessons and tests than the less successful students.

The focus at this point is the measures that students take to make sure they understand the subject content in preparation for classes, tests and examinations. These involve revision activities such as going through notes, textbooks and previous tests, assignments or examinations. The table 4.12 below shows questionnaire responses addressing reviewing actions.

The results in this table 4.12 reveal that the successful students seem to engage in reviewing activities more than the less successful students. It has been found that while 27.9% of the successful students often go through their notes and textbooks before each class, only 11.7% of the less successful students often do it. It also shows that 57.3% of the successful students often go through their previous assignments and tests when preparing for a test as opposed to 41.2% of the less successful ones. There is a large difference between the two groups of students regarding the two strategies. But it shows that 96.8%

of the successful students often read their notes when preparing for a test in comparison
with 92.2% of their less successful counterparts, which is not a significant difference.

Table 4.12   Responses to statements dealing with reviewing.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I prepare for each class by going through my notes and textbooks before class.	Successful	26.2%	26.2%	19.7%	16.4%	11.5%
	Less Successful	29.4%	21.6%	37.3%	7.8%	3.9%
I prepare for tests by going through all the assignments and tests I have previously done.	Successful	9.8%	21.3%	11.5%	18.0%	39.3%
	Less Successful	13.7%	7.8%	37.3%	13.7%	27.5%
When preparing for a test I read my notes.	Successful	1.6%	0.0%	1.6%	14.8%	82.0%
	Less successful	2.0%	2.0%	3.9%	9.8%	82.4%

From the interviews it was found that there was hardly anyone who reported that he
or she prepared for each class by going through notes and textbooks before class. Rather it
was found that most of the participants prepare for the following day during study time in
the evening. This is probably due to the fact that normally there is not much time between
lessons to allow any meaningful preparation. But preparation for tests was reportedly
better.

It was found that most of the participants prepared for the tests by reading their
notes. For example one of the successful students gave this response regarding preparation
for tests, "I keep on reading them over and over well ahead of exams or test time, then I
just repeat a little during the exam or test times" (Lebohelang, interview, 04/05/10). Even
one of the less successful students reported that even though he does not have any
particular strategy he did read his notes for a recent science test and passed it.

4.3.6   Goal-setting and planning
Successful students prepare earlier for examinations than the less successful ones.

In this case the focus is on the actions that students say they take when preparing for such activities as examinations. These involve actions like making revision timetables. The findings from the questionnaire revealed that the successful students tend to start their preparations a bit earlier than their less successful counterparts, but, surprisingly, the less successful students seem to be a bit better in drawing up timetable plans for the examinations. But in both cases the difference is minimal. The table 4.13 below shows the questionnaire responses relating to goal-setting and planning.

Table 4.13   Responses to statements dealing with goal-setting and planning.

Statements		Almost never	Very few times	Sometimes	Many times	Almost always
I start studying before the examinations not just the day before and I pace myself.	Successful	9.8%	13.1%	14.8%	32.8%	29.5%
	Less Successful	9.8%	9.8%	27.5%	27.5%	25.5%
As part of my exam preparation, I make a time-table showing when I must study different topics.	Successful	31.1%	24.6%	8.2%	9.8%	26.2%
	Less Successful	17.6%	15.7%	25.5%	15.7%	25.5%

The table shows that 62.3% of the successful students reported that they often start studying for examinations not just the day before and pace themselves. This is a slightly higher percentage when compared to 53% of the less successful students. The results also show that 41.2% of the less successful often make a timetable for studying different topics for the examination as opposed to 36% of the successful students.

The findings from the interviews revealed that not a single participant reported ever making a timetable for examinations. What was found to be a common practice was making or using a timetable for everyday studying, not specifically for examinations. What seems to be happening, concerning preparation for exams, is that students just report studying a long time before the examination time and do not make a study timetable for examinations.

Two of the successful students reported that they do start reading some time before the examinations. For example, Lebohelang said,

> For tests I try to.....the strategy is to start reading textbooks that I have on time. I
> can't work under pressure at all, so I try to start at the beginning of the year or the
> month. Because I cannot manage to start during the exam time (interview, 04/05/10)

On the same issue another successful student gave this response,

> Eh, maybe I read eh... about two... two consecutive days then the information will go
> into my short term memory. And then read for the... skip a day and then read on the
> fourth day, then surely it will be in my long term memory and I won't forget it for
> the examinations (interview, Kulo, 05/05/10)

One of the less successful students also reported preparing for the examination but his preparation was different from the successful ones. He said, "When I am going to write an examination, I make sure that if I am going to write science tomorrow... I make sure I only concentrate on it" (interview, Letlama, 04/05/10).

The evidence from both the questionnaire and interviews is that the successful students tend to start studying far ahead of the examinations. But it also shows that they do not make examination time-tables as often as the less successful students.

Discussion

The evidence from both the questionnaire and the interviews supports the main assertion that successful students engage more in self-regulating strategies than their less successful counterparts. It shows that there are notable differences between successful and less successful students on the use of most self-regulatory activities. The successful students engaged more in such strategies as reviewing, self-evaluation and goal-setting. There are a few learning strategies which are used almost equally the two groups, such as keeping a file of past tests and exams, reading notes to prepare for tests, and making a time-table in preparing for an examination.

This means that the less successful students also engage in self-regulation, even if it is to a small extent, or engage in activities that do not require much mental activity, such as keeping files or reading notes over and over. A surprising finding was that the less successful students seem to seek assistance from family members or friends more often than the successful ones, and seldom from teachers. On the whole, the successful students seem to engage more in self regulation strategies. The extent to which these strategies are used by each group is summarised in Appendix C.

These findings are similar to those of many researchers which support the idea that successful students used more self regulatory strategies. For example, Martinez-Pons and Zimmerman (1986) investigated student use of self-regulated learning strategies. They

found that the high achievement group of students comparatively used more self-regulated learning strategies than the low achievement group. Similarly Purdie and Hattie (1996) also found that high achievers used more self-regulatory strategies as compared to the low achievers. They found that the high achievement group relied heavily on help seeking strategies such as the use of teachers, peers as well as parents or other adults.

In this study it was found that the less successful students are the ones who often use peers, family members and rarely teachers, while the successful ones rely more on teachers. This is similar to the findings of Young and Ley (2005), that lower achieving students prefer to seek assistance from other sources apart from their teachers. This may be the reason for their poor success as they use sources that are not experts in their particular subject.

Other researchers have also found that successful students report a higher use of self-regulated learning strategies than the less successful students. Livingston and VanZile-Tamsen (1999) carried out a study in which they examined differences between high achievers and low achievers in the use of self-regulated learning strategies. Kosnin (2007) also found that "high achievers were better users of self-regulated learning than low achievers" (p. 225).

Another study with similar findings was carried out by Ruban, Lilia, Reis and Sally (2006). They investigated the nature and individual patterns of self-regulatory strategy use and motivation for using self-regulated learning strategies among low-achieving and high-achieving college students. They found that low achievers engaged in low-level strategies such as routine memorisation while high-achievers engaged in deep processing strategies.

From the evidence obtained in this study and the findings of other studies it can be concluded that successful students engage more in self-regulatory strategies than the less successful students. According to Zimmerman (2002), it means that the successful students have a tendency of taking responsibility for their own learning. This maybe an indicator that they are self-efficacious students as they are more motivated to learn in a self-regulated manner. Some researchers (Pintrich, 1999; Sungur & Tekkava, 2006) found that students high in self-efficacy engaged more in cognitive and self-regulatory strategies. Therefore the findings from this study give an indication that the successful students are high in self-efficacy.

It can also be concluded that both groups use almost all the learning strategies but to different extents. It also seems that successful students are able to select the more effective learning strategies. For example, both groups may read notes but the less successful ones

just read them over and over whereas the successful memorise key words and write summaries. The successful students seem to use learning strategies more effectively.

4.4   WHAT INFLUENCES THEM TO BE SUCCESSFUL

Assertion 4:   Successful science students tend to do well because they have the support and influence of their families; they love science as a subject and have ambitions or goals.

The focus at this point is on factors that seem to influence the successful students to work the way they do in order to succeed. These influences or factors were not actually addressed by the questionnaire but they came out of the comments written on the questionnaire. Consequently they were included in the individual and focus group interview questions with a view to obtaining further information. It was through the analysis of these interviews and comments on the questionnaires that a few common themes were found to be more frequently reported. It seemed that the successful students attributed their success to the influence of their families, their teachers, their love of the subject and their ambitions or goals.

4.4.1   Family support
Successful science students seem to have the support and influence of their families.

The successful students seem to be encouraged to do well by either their parents or by their brothers or sisters whom they would not like to disappoint. The members of the families also provide support and encouragement. This came out during the interviews when the students were asked as to what influenced them to work hard and use the strategies that enabled them to be successful.

When the students were asked as to what drives them to work hard, most of them cited the influence that they get from their family members. This influence was a consequence of the motivating and encouraging words to do well and the support by providing additional learning resources. Moruti, who is one of the successful students in grade 11 responded in this manner:

Moruti:	Eh, the thing is that my sister, I may say she......her work at school.....she was doing well. Apart from that we have been competing since we were young.
Int.:	Oh!
Moruti:	Therefore I normally want.....but she......not that we were competing as such. But she was motivating me by telling me that when she was in school she was like this and like that.
Int.:	Hmm.
Moruti:	But she is working now and she is the person who is still motivating me even today.

(Moruti interview, 06/05/10)

Another participant who also gave as the reason for her motivation the support of her family is another successful grade 11 student, Lebohelang, who said, "I think I am motivated by many things. One of them is my parents. They really encourage me to study hard" (interview, 04/05/10). Kulo responded in the following manner, "My mother has helped me a lot in that. She... she made sure that I have a science syllabus and then after I completed everything I would have question papers and check my... how I have learned" (interview, 05/05/10).

The evidence that has been provided in this section does indicate that the role of the family members is a very important factor in influencing students to work hard. It shows that those students who are encouraged or motivated to work hard tend to do well in school.

4.4.2   Love of the subject
Successful science students do well because they love the subject.

One of the common comments from the students was that it makes it better for one to do well if he or she loves and enjoys the subject. Most of these came from the comments written on the questionnaire. But there were also three interviewees who expressed this idea. One example is from one of the successful grade 12 students who gave the following response when asked as to what drives him to work the way he does;

I don't know, it is just the love for the subject as it is. The subject as it is sir. You see the things that are related to it. You don't just hear from the book that a generator is like this but you actually go and see it where it is working. That is enough for you in order to understand it. (Lethola, interview, 05/05/10)

There were also many comments from the questionnaire in which the students pointed out that one should love and enjoy science in order to do well. The following are examples such comments; the first one was, "Science is a very interesting subject but to be more interested in it you have to love it and develop a positive attitude towards it". The second one was, "I learn to love being inquisitive and gaining knowledge in every subject, science being the best of them all" and the third comment was, "To study science one has to have an interest/inspiration/goal to do so. I want to take science not as a subject but as a career. Teachers should try to make science an exciting subject".

The students seemed to have a belief that the teacher should be responsible for making the subject more interesting and enjoyable. This became apparent in about 25% of the comments on the questionnaires and was a common view amongst the successful students. Some examples of such comments are the following: "Studying science is interesting, especially when I'm taught by a dedicated teacher"; "Studying science is very fun and interesting if you have a right teacher"; "Teachers should be flexible when teaching science. They should make learning fun like making a song out of a certain topic, so that it is easy to memorise such a topic, like my teacher does"; and lastly, "Teachers should be more fun and loosened and try to a funkier approach to science that will make science more enrapturing".

This evidence shows that the students feel that one should love the subject in order to do well in it. They also feel that one should develop a positive attitude and enjoy the science lessons. However, it is the role of the teacher to make science more interesting or exciting for the students.

4.4.3   Ambitions or goals
Successful science students are ambitious and have set goals for themselves.

The focus at this point is on what the students has set as targeted achievements. This involves such things as what they would like to be or study in future. The successful science students seem to have clear goals that they want to take careers which involve science. This is supported by evidence from interviews and comments from the questionnaires.

There were several comments from questionnaires such as the following; "science is the very good subject that needs one to study hard because it is the one that carries our future," or "I think it's wonderful that science is compulsory because there is a variety of

careers you can choose from," even "To study science one has to have an interest/ inspiration/ goal to do so. I want to take science not as a subject but as a career," and lastly, "Science is a subject which I like most and I realised that it is in a market and most of the science students at universities find job easily but I am getting little bit discouraged because it is not easy". In four out of eight interviews the students reported that one of the driving forces behind their success was their goals in life. This was put very clearly by one of the successful students from grade 12 who had this to say about his goal:

> I think my ultimate dream is to be a particle physicist. I know that I have to
> work hard to do that and I don't see why anything that could stop me from
> reading things that are ahead of where I am now. So even that desire to reach
> that stage, to know more about the course I want and actually I find myself
> knowing...I find that when I....I master a certain field in science, then I can
> master all the sciences and then all the subjects. (Kulo, interview, 05/05/10)

On the same issue another successful student from grade 11, Lebohelang, said that also wants to find herself doing the things that she likes which mostly involves science, "therefore when I remember this goal of mine, that I want to get somewhere with science I get motivated, I want to work hard, even when it is difficult I work" (interview, 04/05/10).

The assertion that successful students have ambitions or goals that they want to achieve has been addressed by the evidence provided in this section. It shows that they have personal goals or ambitions to attain certain careers or status in future and this makes them work hard.

Discussion

The findings from this study have shown that successful students appear to be influenced by several factors to work as they do in order to be successful. These factors range from the influence by family members, love of the subject and the goals that they set for themselves. The findings that the family is an influencing factor in this study are the same as those of Long (2002). The study was about the perceptions of academically achieving black adolescents on the impact of self, family and school on their achievement. It was found that the students attributed their achievement among others to family in terms of the encouragement and support as well as motivation.

Dass-Brailsford (2005) conducted a study in which she explored resiliency among disadvantaged black youth in South Africa. She also found that amongst other factors that students attribute for their academic success was the support of family. This support took

the form of encouragement and motivation as well as positive role models. Other researchers (e.g. Garrett et.al, 2010; Wilson, 2009) also obtained similar results from different studies. They found that the family plays an important role in influencing the students to do well in school. This could take the form of helping with homework or providing resources that can help and monitoring their children's school related activities. Apart from these, supportive family members offer encouragement and motivation. It has also been reported by Roman, Cuestas and Fenollar (2008) that family support influences "active engagement in learning activities such as deep processing strategies and effort" (p. 135).

The findings that successful students are influenced by their goals or aspirations are similar to those of Nota, Soresi and Zimmerman (2004). They carried out a study in which they investigated high school students' reports of using self-regulation strategies, their scholastic achievement, and their academic resilience (i.e., their intention to continue with higher education). Their findings revealed that the use of self-regulation strategies positively correlated with high academic achievement and resilience. Peterson (2000) also found that successful students are able to set goals or make early decisions about their future careers and this seems to enhance their academic achievement. This means that those students who have the ambition or aspiration to go further in their studies tend to do well in their studies.

The findings that successful students do well because they love the subject are similar to those of Ayayee and Sanders (1998). They found that high achievers exhibit positive attitudinal factors such as taking interest and enjoying the subject and this is what differentiate them from low achievers.

In the final chapter the findings are summarised and the limitations and implications of the study are discussed.

CHAPTER 5

SUMMARY, IMPLICATIONS AND CONCLUSIONS

The purpose of the present study was to explore the learning strategies that are used by the successful high school science students. The participants in the study were grade 10, 11, and 12 students in a high achieving school in Lesotho. It also explored the factors reported by the students as influencing them to work as they do. In order to best answer the research questions, given restraints in time and resources of the researcher, it was decided that the most appropriate approach was a mixed methods approach. This involved the collection of both quantitative and qualitative data which helped in corroborating each other. The research instruments chosen were the questionnaire for quantitative data and individual interviews and focus group interviews for qualitative data.

These instruments with the exception of the focus group were administered to both the successful and the less successful students. The focus group included only the successful students. The quantitative data was analysed descriptively producing frequency tables while the qualitative data was analysed inductively by identifying similar ideas and categorising them into different themes which addressed the research questions.
It has been revealed in this study that there are a number of different strategies that successful students tend to use more than their less successful counterparts. It has also been found that there are certain factors which influence them to work as they do in order to be successful.

5.1   SUMMARY OF FINDINGS

The data analysis led to the formulation of four main assertions that guided the responses to the research questions. The first assertion addressed the question of effort regulation, the second and third addressed the question of learning strategies that are used by successful students while the fourth assertion addressed the question of factors that influences the successful students.

The first assertion suggested that successful and less successful students deal with resource management such as effort regulation and study environment differently. This was divided into the following sub-assertions:

- Successful students apply more effort in carrying out difficult and uninteresting educational tasks.

- Successful students regulate and monitor the environment in which they learn and study more than the less successful students.

The findings of this study were in agreement with the first part of effort regulation but could not support the second part of environmental monitoring and regulation. The findings suggest that successful students do indeed apply more effort in dealing with difficult and boring tasks until they finish, much more than their less successful counterparts. The successful students also seem to deal with all the set tasks without leaving the difficult parts while the less successful students leave out difficult parts. But surprisingly it was found that it was the less successful students who engaged more in environmental structuring by finding places free from distractions when they are studying.

The second assertion suggested that successful students tended to use a variety of cognitive learning strategies. This had the following four sub-assertions:

- Successful students learn and study by memorising and practicing in order store information.

- Successful students do more in trying to understand what they are learning.

- Successful students tend to summarise and make connections between main ideas and relate what they are learning to what they already know.

- Successful students tend to be more involved in selecting, arranging and organising information of the material that they are learning than the less successful students.

The findings showed that generally the successful students reported that they used a variety of cognitive learning strategies. It was found that in most cases successful engaged more in these strategies but there were certain cognitive strategies which were used more by the less successful students. The successful students were found to engage more in almost all activities such as memorising key words, all the comprehension monitoring activities and elaboration activities. The less successful students seemed to rely more on repetition strategies or simple activities requiring less cognitive engagement which only foster surface learning. These involved reading notes over and over again as well as highlighting or marking sections in notes or textbooks.

The third assertion stated that successful exhibit characteristics of being in control of their own learning in terms of regulating and monitoring their learning activities. This was split into six sub-assertions;

- Successful students are more adept in acquiring information than the less successful students.
- Successful students tend to ask for help from different sources more than the less successful students.
- Successful students are the ones who more often evaluate their work and actions than the less successful students.
- Successful students tend to be more vigilant in keeping records than the less successful students.
- Successful students tend to prepare better for lessons and tests than the less successful students.
- Successful students prepare earlier for examinations than the less successful students.

In the case of this third assertion it was found that successful students reported that they tended to regulate and monitor their learning much more than the less successful students in most cases. They were found to engage more in self-regulatory activities than their less successful counterparts. This involves such activities as self-questioning, information-seeking and help-seeking. There were some self-regulatory activities in which there was very little difference between the successful and less successful students, such as keeping a file of past examinations, reading notes in preparing for tests or making a time-table for examinations. But there was also one particular activity in which the less successful students seem to be involved more than the successful students. This was seeking help from family members or from friends.

These findings from the use of learning strategies have revealed that the use of learning strategies is not a compartmentalised activity. The students may engage in certain activities which may reflect a certain strategy or several strategies. For example, one of the commonly reported activities is engaging in practising in order to understand. This involves such strategies as memorising, reviewing and comprehension monitoring. But there were still those strategies that were clearly the mostly used and trusted ones. For example all successful students used memorisation or rehearsal, they read widely to gather information, they seek help from knowledgeable people and keep on practicing.

The last assertion was in response to the factors that students report as influencing the successful students to work as they do. It stated that successful science students tend to do well because they have the support and influence of their families, they love science as a subject and have ambitions or goals. This gave rise to three sub-assertions;

- Successful science students seem to have the support and influence of their families.
- Successful science students do well because they love the subject.
- Successful science students are ambitious and have set goals for themselves.

It was found that the main factors seemed to be the influence of the family members in terms of providing encouragement and motivation. Secondly it was found that the successful students are ambitious and have already set themselves some goals that will lead them to their targeted careers. Lastly it was found that the successful students seem to have a love for and an interest in science. The students also mentioned the character of the teacher as an important factor in their learning of science.

5.2   LIMITATIONS

Given the fact that the masters research needs to be completed within a limited space of time and limited financial resources, it was not possible to be very exhaustive in data collection. As it has already been mentioned earlier, the school in which the study carried out is not a typical Lesotho school as it takes only the best students from the primary schools. It therefore means the setting has a big effect on the way these students learn which may be different from other students in other schools. This means therefore one cannot generalise the findings from this study.

It is therefore suggested that further research is necessary in which more students from a variety of schools in the country will be involved. It is also suggested that it may be more appropriate to start first by exploring their understanding of learning strategies and the specific learning strategies that they use. Then this could be incorporated into the data-collecting instrument. I am saying this because it seems that students may have a different opinion about what makes them learn better.

It should also be pointed out that this study depended on information that was given by students. It is assumed that they were truthful and sincere in providing this information. This is another limitation of this study and I feel that further study could improve this by gathering more concrete empirical evidence. This could involve classroom observations, parents and teachers' interviews as well as analysis of students' diaries and exercise books.

Such methods would allow for more detailed triangulation and perhaps give more reliable data on the learning strategies that the students actually use.

5.3   IMPLICATIONS TO TEACHING AND LEARNING

The findings of this study are in agreement with the findings of other research studies in that there is a strong positive relationship between the use of learning strategies and academic achievement. It has been shown that those students who have the tendency of using learning strategies are those that are academically more successful. While a causal relationship has not been established in this study, there does appear to be grounds for action given the findings of this study. The chances of many more students succeeding academically may be increased if the schools and teachers could adopt the following suggestions in relation to the findings of this study.

The first finding shows that the successful students reported that they tend to use learning strategies more often than their less successful counterparts. This implies that the use of learning strategies may be instrumental in their academic success. Therefore, one of the recommendations is that it may be advisable for schools to adopt a policy which requires that teachers should make sure that they equip the students with the knowledge and skills of how to use learning strategies. This could be made more successful if students can be shown that it is through their use of strategies that their academic performance might improve. According to Paris and Paris (2001), students tend to use effective strategies if they attribute their academic achievement to the employment of learning strategies. This means teachers can instil this practice in their students making them realise the benefits of using learning strategies. The importance of such a recommendation has been highlighted by many researchers such as (Rachal, Daigle and Rachal, 2007 and Zimmerman, 2008). They found that students' learning difficulties persist throughout their curriculum from matriculation to tertiary institutions. They therefore suggested students should be instructed in the use of learning strategies. This means that teachers themselves should be made aware of learning strategies and their importance in learning.

The second finding shows that one of the learning strategies that successful students reported using more often is information seeking. This implies that they require a variety of resources from which they can gather information. I have also realised that successful students read and get information from different sources, which, from my experience, many students fail to do perhaps because of a lack of resources. It is therefore suggested

that schools should try to make more resources available to the students and set tasks that teach learners to use a variety of resources. These resources could include a variety of up-to-date library books and internet services where possible. The need to use a variety of learning strategies could also be communicated to parents. It is therefore recommended that the school through its teachers, during the teacher-parent meetings, should make parents aware of different ways in which they can support their children apart from financial support. These would involve provision of resources such as a variety of books and appropriate place and time for studying at home. It has also been found that the successful students attribute their success to the support they get from the family members in the form of motivation or encouragement and assistance with school work. Therefore, the school should advise parents to show interest in their children's school work and monitor their daily activities.

An important finding is the one that revealed that even though the successful students reported seeking assistance from teachers, both groups confessed their reluctance to do so. This is a serious problem especially when teachers are the ones entrusted with the role of helping the students with the expertise that they have. It is therefore recommended that teachers should try to create an atmosphere in which students feel at ease to approach them in order to seek help. This is important due to the fact that teacher behaviour has been found to be one of the factors that influence the use of help-seeking strategies (Dembo & Martin, 2000).

5.4   CONCLUSIONS

The review of literature has revealed that the concept of learning strategies is very important in two ways. First, it was shown that the use of learning strategies enhances academic achievement. Secondly, it was shown that the use of learning strategies can lead to student independence. This means that their incorporation in the teaching and learning activities can result in learners who are in a position to monitor and regulate their learning.

What I found in conducting this study was that the successful students seem to know their strengths and weaknesses and have found ways or strategies that they use in order to succeed. But the less successful students seem to have few ideas and keep on using the same limited strategies even if they don't result in improving their academic achievement. Alternatively they might know of strategies but are not motivated to use them. Consequently, both strategy development and motivation to use them go together.

This is important in light of the fact that as teachers we are still following the traditional way of teaching where students depend on us. This handicaps their progress in higher institutions where there is no close teacher monitoring. It would therefore be beneficial to our students if they can be equipped with these strategies at the earliest possible stage. It was very impressive to find a student who could say "But when you start studying ahead, it is not often that you find that something is really hard." This gives an idea of a dedicated student who is in control of his own learning and knows that he or she has to seek information himself in order to succeed academically.

REFERENCES

Albaili, M. A. (1997). Differences among low-, average- and high-achieving college students on learning and study strategies. *Educational Psychology*, *17* (1&2), 171-177.

Alexander, P. A., & Murphy, K. P. (2006). *Understanding how students learn: a guide for instructional leaders.* London: Corwin Press.

Almeida, L. C. (2008). The effects of different learning strategies to facilitate achievement of different educational objectives. *TechTrends*, *52* (3), 32-45.

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: students' learning strategies and motivation process. *Journal of Educational Psychology*, *80* (3), 260-267.

Ashman, A. F., & Conway, R. F. (1987). *An introduction to cognitive education: theory and applications.* London: Routledge.

Ayayee, E., & Sanders, M. (1998). Factors considered necessary for academic success in first year biological sciences courses. In Ogude, A. And Bohlmann, C. (Eds.), *Proceedings of the Sixth Annual Meeting of   SAARMSE (pp.52-59). 14-17 January, 1998.* UNISA: Johannesburg.

Baker, L., & Lombardi, B. R. (1985). Students lecture notes and their relation to test performance. *Teaching of Psychology*, 28-32.

Bassey, M. (1999). *Case study research in educational settings.* Maidenhead: Open University Press.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: study design and implementation for novice researchers. *The Qualitative Report, 13(4)*, 544-559.

Bembenutty, H. (2009). Feeling-of-knowing judgement and self-regulation of learning. *Education , 129* (4), 589-598.

Bennett, J. (2003). *Teaching and learning science.* London: Continuum.

Bergman, M. M. (2010). On concepts and paradigms in mixed methods research. *Journal of Mixed Methods Research, 4* (3), 171-175.

Bothma, F., & Monteith, J. (2004). Self-regulated learning as a prerequisite for successful distance learning. *South African Journal of Education*, *24* (2), 141-147.

Britton, B. K., & Tesser, A. (1991). Effects of time management practices on college grades. *Journal of Educational Psychology*, *83* (3), 405-410.

Cantor, N. (1990). From thought to behaviour: having and doing in the study of personality and cognition. *American Psychologist*, *45* (6), 735-750.

Cao, L., & Nietfeld, J. L. (2007). Examining relationships between achievement goals, study strategies, and class performance in educational psychology. *Teaching Educational Psychology*, *2* (1), 1-20.

Carrier, L. M. (2003). College students' choice of study strategies. *Perceptual and Motor skills*, *96* (1), 54-56.

Carvalho, S., & White, H. (1997). *Combining the quantitative and qualitative approaches to poverty measurement and analysis: the practice and the potential.* New York: The World Bank.

Ceci, S. J., & Bronfenbrenner, U. (1985). "Don't forget to take the cupcakes out of the oven": prospective memory, strategic time-monitoring, and context. *Child Development*, *56* (1), 152-164.

Chen, C. S. (2002). Self-regulated learning strategies and achievement in an introduction to information systems course. *Information Technology, Learning, and Performance Journal*, *20* (1), 11-25.

Chen, H. T. (2006). A theory-driven evaluation perspective on mixed methods research. *Research in the Schools*, *13* (1), 75-83.

Cherryholmes, C. H. (1992). Notes on pragmatism and scientific realism. *Educational Researcher*, *21* (6), 13-17.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6[th]ed.) . New York: Routledge Taylor & Francis Group.

Coll, R. K., & Taylor, T. N. (2001). Using constructivism to inform tertiary chemistry pedagogy. *Chemistry Education: Research and Practice in Europe*, *2* (3), 215-226.

Conner, L., & Gunstone, R. (2004). Conscious knowledge of learning: accessing learning strategies in a final year high school biology class. *International Journal of Science Education*, *26* (12), 1427-1443.

Craik, F. I., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology; General*, *104* (4), 268-294.

Creswell, J. W. (1994). *Research design: Qualitative & quantitave approaches.* London: Sage Publications Ltd.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches* (2nd ed.). Thousand Oaks: Sage Publications.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice*, *39* (3), 124-130.

Creswell, J. W., Shope, R., Plano Clark, V. L., & Green, D. O. (2006). How interpretive qualitative research extends mixed methods research. *Research in the Schools*, *13* (1), 1-11.

Dahl, T. I., Bals, M., & Turi, A. L. (2005). Are students' beliefs about knowledge and learning associated with their reported use of learning strategies? *British Journal of Educational Psychology*, *75* (2), 257-273.

Daigle, S., Rachal, K. C., & Rachal, W. S. (2007). Learning problems reported by college students: are they using learning strategies? *Journal of Instructional Psychology*, *34* (4), 191-199.

Dass-Brailsford, P. (2005). Exploring resiliency: Academic achievement among disadvantaged black youth in South Africa. *South African Journal of Psychology*, *35* (3), 574-591.

Deloache, J. S., Cassidy, D. J., & Brown, A. L. (1985). Precursors of mnemonic strategies in very young children's memory. *Child Development*, *56* (1), 125-137.

Dembo, M. H., & Eaton, M. J. (2000). Self-regulation of academic learning in middle-level schools. *The Elementary School Journal*, *100* (5), 473-490.

Denscombe, M. (2008). Communities of practice: a research paradigm for the mixed methods approach. *Journal of Mixed Methods Research*, *2* (3), 270-283.

Douglas, G., Hattie, J., & Purdie, N. (1996). Student conception of learning and their use of self-regulated learning strategies: a cross-cultural comparison. *Journal of Educational Psychology*, *88* (1), 87-100.

Feilzer, M. Y. (2010). Doing mixed methods research pragmatically: implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed Methods Research*, *4* (1), 6-16.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: a new area of cognitive-developmental inquiry. *American Psychologist*, *34* (10), 906-911.

Flick, U. (2006). *An introduction to qualitative research.* London: Sage.

Fraenkel, J. R., & Wallen, N. E. (2008). *How to design and evaluate research in education (7th ed.).* Boston: McGraw-Hill.

Gallagher, J. J., & Tobin, K. (1991). Uses of interpretative research in science education. In J. J. Gallagher (Ed.), *Interpretive research in education: National Association for*

Research in Science Teaching (Vol. 4, pp. 85-95). Manhattan: Kansas State University.

Garner, R. (1990). When children and adults do not use learning strategies: towards a theory of settings. *Review of Educational Research*, *60* (4), 517-529.

Garrett, T., Antrop-Gonzalez, R., & Velez, W. (2010). Examining the success factors of high-achieving Puerto Rican male high-school students. *Roeper Review*, *32* (2), 106-115.

Gay, L. R., & Airasian, P. (2000). *Educational research: Competencies for analysis and application.* New Jersey: Merrill .

Gibbs, G., Morgan, A., & Taylor, E. (1984). The world of the learner. In F. Marton, D. Hounsell, & N. Entwistle, *The experience of learning* (pp. 165-188). Edinburgh: Scottish Academic Press.

Greig, A., MacKay, T., & Taylor, J. (2007). *Doing research with children (2nd ed.).* Los Angeles: SAGE Publications.

Heikkila, A., & Lonka, K. (2006). Studying in higher education: students' approaches to learning, self-regulation, and cognitive strategies. *Studies in Higher Education*, *31* (1), 99-117.

Henning, E. (2004). *Finding your way in qualitative research.* Paarl: Van Schaik Publishers.

Hong, E., Sas, M., & Sas, J. C. (2006). Test-taking strategies of high and low mathematics achievers. *The Journal of Educational Research*, *99* (3), 144155.

Jick, T. D. (1979). Mixing qualitative and quantitative methods: triangulation in action. *Administrative Science Quarterly*, *24*, 602-611.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: a research paradigm whose time has come. *Educational Researcher*, *33* (7), 14-26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1* (2), 112-133.

Kirby, J. R. (1988). Style, strategy, and skill in reading. In R. R. Schmeck (Ed.), *Learning strategies and learning styles* (pp. 230-271). New York: Plenum Press.

Kitsantas, A. (2002). Test preparation and test performance: a self-regulatory analysis. *Journal of Experimental Education*, *70* (2), 101-113.

Kitsantas, A., Winsler, A., & Huie, F. (2008). Self-regulation and ability predictors of academic success during college: a predictive validity study. *Journal of Advanced Academics*, *20* (1), 42-68.

Kosnin, A. M. (2007). Self-regulated learning and academic achievement in Malaysian undergraduates. *International Education Journal*, *8* (1), 221-228.

Krauss, S. E. (2005). Research paradigms and meaning making: a primer. *The Qualitative Report*, *10* (4), 758-770.

Kvale, S. (2002). The social construction of validity. In N. K. Denzin, & Y. Lincoln (Eds.), *The qualitative inquiry reader* (pp. 299-326). London: SAGE Publications.

Kvale, S. (2007). *Doing interviews.* Los Angeles: SAGE

Lai, P., & Chan, K. (2005). A structural model of conceptions of learning, achievement motivation and learning strategies of Hong Kong Teacher Education Students. *Paper presented at the Australian Association of Research in Education Parramatta Conference held at the University of Western Sydney*, Sydney, 28Nov-2Dec, 2005.

Levin, J. R. (1986). Four cognitive principles of learning-strategy instruction. *Educational Psychologist*, *21* (1&2), 3-7.

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2006). *Methods in educational research: from theory to practice.* San Francisco: Jossey-Bass.

Long, L. A. (2002). Academically achieving black adolescent students' perceptions of how self, family and school impact their achievement. *A thesis submitted for the degree of Doctor of Philosophy. University of Georgia.* Georgia.

Lubbe, E., Mentz, E., & Monteith, J. (2006). The relationship between keyboarding skills and self-regulated learning. *South African Journal of Education*, *26* (2), 281-293.

Lynch, D. J. (2006). Motivational factors,learning strategies and resource management as predictors of course grades. *College Student Journal*, *40* (2), 423-428.

Lynch, D. J. (2008). Confronting challenges: motivational beliefs and learning strategies in difficult college courses. *College Student Journal*, *42* (2), 416-421.

Mackenzie, M. A. (1994). Examination preparation, anxiety and examination performance in a group of adult students. *International Journal of Lifelong Education*, *13*, 373-388.

Mahuma, G. M. (1996). An analysis of the self-regulated learning abilities of standard 10 biology students in the Mankwe region. *A thesis submitted for the degree of Master of Science, Potchefstroom University for Christian Higher Education* . Potchefstroom.

Marshall, C., & Rossman, G. B. (2006). *Designing qualitative research 4th Edition* . London: Sage Publishers.

Mason, J. (2002). *Qualitative Researching 2nd edition.* London: Sage Publications.

Mayer, R. E., & Weinstein, C. E. (1986). The teaching of learning strategies. In M. C. Wittrock (Ed.), *Handbook of research on teaching 3rd Edition* (pp. 315-372). New York: Macmillan.

McEwan, E. K., & McEwan, P. J. (2003). *Making sense of research:What's good, what's not, and how to tell the difference.* Thousand Oaks, California: Corwin Press, Inc.

McMillan, J. H., & Schumacher, S. (2010). *Research in education: Evidence-based inquiry* (7 ed.). Boston: Rearson.

Merriam, S. B. (1998). *Qualitative research and case study applications in education.* San Fransisco: Jossey-Bass Publishers.

Nenty, J. H. (2010). Analysis of some factors that influence causal attribution of mathematics performance among secondary school students in Lesotho. *Journal of Social Science*, *22* (2), 93-99.

Nieuwenhuis, J. (2007). Introducing qualitative research. In K. Maree (Ed.), *First steps in research* (pp. 46-66). Paarl: Van Schik Publishers.

Nota, L., Soresi, S., & Zimmerman, B. J. (2004). Self-regulation and academic achievement and resilience: a longitudinal study. *International Journal of Educational Research*, *41* (3), 198-215.

Onwuegbuzie, A. J. (2002). Why can't we all get along? Towards a framework for unifying research paradigms. *Education*, *122* (3), 518-530.

Opie, C. (2004). Research procedures. In C. Opie (Ed.), *Doing educational research: a guide to first time researchers* (pp. 95-129). London: SAGE.

Paris, S. C., & Paris, A. H. (2001). Classroom applications of research on self-regulated learning. *Educational Psychologist*, *36* (2), 89-101.

Paterson, C. C. (1996). Self-regulated learning and academic achievement of senior biology students. *Australian Science Teachers Journal*, *42* (2), 48-52.

Patton, M. (2002). *Qualitative research & evaluation methods 3rd edition.* London: Sage Publications.

Peterson, J. S. (2000). A follow-up study of one group of achievers and underachievers four years after high school graduation. *Roeper Review*, *22*, 217-224.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research*, *31* (6), 459-470.

Pintrich, P. R. (2004). A conceptual framework for asssessing motivation and self-regulated learning in college students. *Educational Psychology Review*, *16* (4), 385-407.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82* (1), 33-40.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research, and application.* New Jersey: Prentice-Hall.

Pintrich, P. R., Smith, D. A., Garcia, T., & Mckeachie, W. J. (1991). *A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ).* Ann Arbor: The University of Michigan, National Centre for Research to Improve Postsecondary Teaching and Learning.

Postma, F. (1991). Variables that influence academic achievement in chemistry at university. *South African Journal of Education*, *11* (4), 236-240.

Purdie, N., & Hattie, J. (1996). Cultural differences in the use of strategies for self-regulated learning. *American Journal of Educational Research*, *33* (4), 845-871.

Risenberg, R., & Zimmerman, B. J. (1992). Self-regulated learning in gifted students. *Roeper Review*, *15* (2), 98-101.

Robson, C. (2002). *Real world research, (2nd ed.).* Oxford: Blackwell.

Robson, C. (2007). *How to do a research project: A guide for undergraduate students.* Victoria: Blackwell Publishing.

Roman, S., Cuestas, P. J., & Fenollar, P. (2008). An examination of the interrelationships between self-esteem, others' expectations' family support, learning approaches and academic achievement. *Studies in Higher Education*, *33* (2), 127-138.

Ruban, Lilia, Reis, & Sally, M. (2006). Patterns of self-regulatory strategy use among low-achieving and high-achieving university students. *Roeper Review*, *28* (3).

Salovaara, H. (2005). An exploration of students' strategy use in inquiry-based computer-supported collaborative learning. *Journal of Computer Assisted Learning*, *21*, 39-52.

Schmeck, R. R. (1988). Introduction to strategies and styles of learning. In R. R. Schmeck, *Learning strategies and learning styles* (pp. 3-18). New York: Plenium Press.

Schunk, D. H. (2000). *Learning theories: an educational perspective.* New Jersey: Prentice Hall.

Silverman, D. (2006). *Interpreting qualitative data: methods for analysing talk, text, and interaction.* London: Sage Publications.

Slavin, E. R. (2007). *Educational research:in an age of accountability.* Boston: Pearson Education, Inc.

Smyth, R. (2004). Exploring the usefulness of a conceptual framework as a research tool: a researcher's reflections. *Issues in Educational Research*, 168-180.

Soric, I., & Palekcic, M. (2009). The role of students' interests in self-regulated learning: the relationship between students' interests, learning strategies and causal attributions. *European Journal of Psychology of Education*, *XXIV* (4), 545-565.

Stipek, D., & Gralinski, J. H. (1996). Children's beliefs about intelligence and school perforformance. *Journal of Educational Psychology*, *88* (3), 397-407.

Sungur, S., & Tekkaya, S. (2006). Effects of problem-based learning and traditional instruction on self-regulated learning. *The Journal of Educational Research*, *99* (5), 307-317.

The University of Kansas Centre for Research on Learning. (2009). Retrieved June 10, 2009, from http://kucrl.org/sim.

Teddlie, C., & Tashakkori, A. (2006). A general typology of research designs featuring mixed methods. *Research in the Schools*, *13* (1), 12-28.

Trigwell, K., & Prosser, M. (1996). Changing approaches to teaching: a relational perspective. *Studies in Higher Education*, *21* (3), 275-284.

Tuckman, B. W. (2003). The effect of learning and motivation strategies on college students' achievement. *Journal of College Student Development*, *44* (3), 430-437.

University of Cincinnati. (2003). *Helping students become more strategic learners: University of Cincinnati Learning and Study Strategies Inventory (LASSI) user manual.* Cincinnati: Office of Educational Services, Learning Assistance Center (LAC).

VanZile-Tamsen, C., & Livingston, J. A. (1999). The differential impact of motivation on the self-regulated strategy use of high- and low-achieving college students. *Journal of College Student Development*, *40* (1), 54-60.

Vermunt, J. D., & Vermetten, Y. J. (2004). Patterns in student learning: relationships between learning strategies, conceptions of learning, and learning orientations. *Educational Psychology Review*, *16* (4), 359-384.

Weinstein, C. E. (1987). Fostering learning autonomy through the use of learning strategies. *Journal of Reading*, *30* (7), 590-595.

Wilkinson, D., & Birmingham, P. (2003). *Using research Instruments: A guide for researchers.* New York: RoutledgeFalmer.

Wilson, C. M. (2009). The relation among parental factors and achievement of African American urban youth. *Journal of Negro Education*, *78* (2), 102-113.

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser, *Metacognition in educational theory and practice* (pp. 227-304). New Jersey: Erlbaum.

Wolters, C. (1998). Self-regulated learning and college students' regulation of motivation. *Journal of Educational Psychology*, *90* (2), 224-235.

Yin, R. K. (2003). *Case study research: design and methods.* London: SAGE Publications.

Yip, M. C. (2007). Differences in learning and study strategies between high and low achieving university students: a Hong Kong study. *Educational Psychology*, *27* (5), 597-606.

Young, D., & Ley, K. (2005). Developmental college student self-regulation: results from two measures. *Journal of College Reading and Learning*, *36* (1), 60-80.

Young, S. F. (2008). Theoretical frameworks and models of learning: tools for developing conceptions of teaching and learning. *International Journal for Academic Development*, *13* (1), 41-49.

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: an overview. *Educational Psychologist*, *25* (1), 3-17.

Zimmerman, B. J. (2000). Attainment of self-regulation: a social cognitive perspective. In M. Boekaerts, P. Pintrich, & M. Zeidner, *Handbook of self-regulation, research, and applications* (pp. 13-39). San Diego, CA: Academic Press.

Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: an overview and analysis. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: theoretical perspectives* (pp. 1-37). Mahwah,NJ: Lawrence Erlbaum Associates.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: an overview. *Theory into Practice*, *41* (2), 64-70.

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: historical background, methodological developments, and future prospects. *American Research Journal*, *45* (1), 166-183.

Zimmerman, B. J., & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *23* (4), 614-628.

APPENDIX A   QUESTIONNAIRE

HOW DO YOU STUDY AND LEARN YOUR SCIENCE?

Your name _____ Are you a boy or girl? _____
Name of your science teacher _____   Your grade & class _____
Your mark for science at end of 2009 _____   How old are you in years? _____

	STATEMENT	Almost never	Very few	Some-times	Many times	Almost always
1.	I memorize key words in order to remind myself of what I have learned.	1	2	3	4	5
2.	I practice similar sorts of examples so that I can remember how to do similar ones in a test.	1	2	3	4	5
3.	I read my notes over and over again when studying.	1	2	3	4	5
4.	I put important ideas from notes and textbook into my own words.	1	2	3	4	5
5.	I write summaries of the main ideas from class notes and textbooks.	1	2	3	4	5
6.	I make notes when I am reading a topic in a textbook.	1	2	3	4	5
7.	I learn new ideas or concepts by imagining a situation in which they occur.	1	2	3	4	5
8.	I try to relate or link new information to what I already know.	1	2	3	4	5
9.	I go through my class notes and try to find the most important points.	1	2	3	4	5
10.	I make simple diagrams to help me organize and understand my ideas .	1	2	3	4	5
11.	I mark or highlight important sections in the textbook or notes given by teacher.	1	2	3	4	5
12.	I think about what I must do and make a plan before I answer test or examination questions.	1	2	3	4	5
13.	I prepare for each class by going through my notes and textbooks before class.	1	2	3	4	5
14.	I prepare for tests by going through all the assignments and tests that I have previously done.	1	2	3	4	5
15.	When preparing for a test, I read my notes.	1	2	3	4	5
16.	I ask myself questions to make sure I know and understand the subject information.	1	2	3	4	5
17.	I work on practice exercises and answer end of chapter questions.	1	2	3	4	5
18.	I ask someone to test me to see if I know and understand what I have been studying.	1	2	3	4	5
19.	I go over my work and check to see if I did it right.	1	2	3	4	5
20.	If I don't finish my work or study in time, I think about my actions and try to see why I did not finish.	1	2	3	4	5

	STATEMENT	Almost never	Very few	Some-times	Many times	Almost always
21.	I listen carefully during class discussions and take note of what is said.	1	2	3	4	5
22.	I keep a file of all my tests and examinations papers.	1	2	3	4	5
23.	I keep a record of questions which I got wrong.	1	2	3	4	5
24.	I read other books (not only my textbook) on the topic that is being done in class.	1	2	3	4	5
25	Before I write an assignment or project, I gather as much information as possible.	1	2	3	4	5
26.	I ask the teacher to help clarify things that I did not understand.	1	2	3	4	5
27	When confused, I ask my parents, brothers or sisters to help by explaining difficult things.	1	2	3	4	5
28.	If I encounter a problem, I ask a friend to help by explaining to me or helping with an assignment.	1	2	3	4	5
29.	I discuss my science schoolwork with my classmates.	1	2	3	4	5
30	I choose to work with other friends or students when doing some of my school assignments.	1	2	3	4	5
31.	I start studying before the examinations not just the day before and I pace myself.	1	2	3	4	5
32.	When doing homework or a test, I leave difficult questions until last, then I come back to them.	1	2	3	4	5
33.	As part of my exam preparation, I make a time-table showing when I must study different topics.	1	2	3	4	5
34.	I try to find a quiet place for studying which has no distractions.	1	2	3	4	5
35	I think about the praise I get for doing well in the tests and exams and that makes me work harder.	1	2	3	4	5
36.	Even when the topic is dull and not interesting, I still study hard until the work is finished.	1	2	3	4	5
37.	When the work is hard, I leave those parts out and study the easy parts.	1	2	3	4	5
38.	If I do well in my studies, I reward myself.	1	2	3	4	5
39.	I think about failing and that makes me want to work hard.	1	2	3	4	5

Do you have any comments to add about studying science?

_____

_____

_____

APPENDIX B   INTERVIEW SCHEDULE

The Interview Schedule for Learning Strategies Study

Name of school: **Name of interviewee**:
Name of interviewer: **Date of the interview**:

Introduction
My name is Phehlane Lebuso and I am currently a Masters of Education student at the University of Kwazulu-Natal. I requested you to grant me this interview in which I want to find out about the learning strategies that are used by successful science students. This research is a requirement for the completion of the Masters degree. This interview is confidential in that there will be no mention of your name or that of your school if you so require, in the research report. You are also free to withdraw from this interview at any time for whatever reason if you wish.
Do you have any questions concerning this research before we commence with our interview?

Interview questions
1.   There are people who feel that science is a very difficult subject while others feel it is not.
(a)   What is your opinion?
(b)   You were selected because you seem to be doing well in science. Can you describe how you manage to do so well?

2.   What are some of the difficulties that you encounter in learning science?
 (a) How do you manage to solve some of these problems?
 (b) How do you manage to absorb and remember the many facts that you learn in science?
3.   Can you describe the ways you use to extract information from written   material, passages or text book chapters?
4.   How do you make sure that you get all the important points or information from class discussions or 'lecture' that your teacher presents in class?
5.   In the case that you come across a very challenging topic, what do you do in order to master it?
6.   Many students seem to have problems in dealing with distractions from their studies such as watching TV, sports activities, parties, noisy classrooms etc.
      How do you cope with such problems?
7.   Can you describe some of the ways that you use to check whether you actually understand a scientific idea or topic or not?
8.   One of the concerns of teachers is that students are not interested in their studies. Do you think you fall under that category of students? If not, can you describe the activities that you engage in that are a reflection of your interest in your school work?

We have now come to the end of the interview. Is there any other information that you would like to add to what you have already said?

Thank you very much for your contribution in this research.

APPENDIX C   QUESTIONNAIRE SUMMARY

Summary of responses to the survey questionnaire giving the percentage of students reporting that they used a strategy often (many time + almost always)

	Category	Questionnaire survey Statements Reported use by learners % reported = "many times" plus "almost always" combined	SUCCESSFUL	LESS SUCCESSFUL	DIFFERENCE
		STRATEGIES REPORTEDLY USED MORE BY SUCCESSFUL STUDENTS			
8	Elaboration	I try to relate or link new information to what I already know	77.1%	43.1%	34%
21	Record-keeping	I listen carefully during class discussions and take note of what is said.	72.1%	56.8%	32.9%
4	Comprehension monitoring	I put important ideas from notes and textbook into my own words	50.8%	29.4%	21.4%
36	Effort regulation	Even when the topic is dull and not interesting, I still study hard until the work is finished.	60.6%	35.3%	25.3%
20	Self-evaluation	If I don't finish my work or study in time, I think about my actions and try to see why I did not finish.	60.7&	41.2%	19.5%
5	Elaboration	I write summaries of the main ideas from class notes and textbooks.	26.2%	7.9%	18.3%
17	Comprehension monitoring	I work on practice exercises and answer end of chapter questions.	37.7%	19.6%	18.1%
26	Help-seeking	I ask the teacher to help clarify things that I did not understand.	34.4%	17.6%	16.8%
13	Reviewing	I prepare for each class by going through my notes and textbooks before class.	27.9%	11.7%	16.2%
14	Reviewing	I prepare for tests by going through all the assignments and tests that I have previously done	57.3%	41.2%	16.1%
19	Self-evaluation	I go over my work and check to see if I did it right	72.1%	56.8%	15.3%
1	Rehearsal	I memorise key words in order to remind myself of what I have learned.	44.3%	29.4%	14.9%
23	Record-keeping	I keep a record of questions which I got wrong	34.4%	19.6%	14.8%
7	Elaboration	I learn new ideas or concepts by imagining a situation in which they occur.	45.9%	31.4%	14.5%
35	Self-consequences	I think about the praise I get for doing well in the tests and exams and that makes me work harder.	82%	68.6%	13.5%
6	Elaboration	I make notes when I am reading a topic in a textbook.	39.4%	27.5%	11.9%
25	Information-seeking	Before I write an assignment or project, I gather as much information as possible.	36%	25.5%	10.5%

	Category	Questionnaire survey **Statements** Reported use by learners % reported = "many times" plus "almost always" combined	SUCCESSFUL	LESS SUCCESSFUL	DIFFERENCE
STRATEGIES REPORTEDLY USED MORE BY THE LESS SUCCESSFUL STUDENTS					
37	Effort regulation	When the work is hard, I leave those parts out and study the easy parts.	18.6%	47%	28.4%
28	Help-seeking	If I encounter a problem, I ask a friend to help by explaining to me or helping with an assignment.	67.2%	90.2%	23%
11	Organising	I mark or highlight important sections in the textbook or notes given by teacher.	52.5%	70.6%	18.1%
34	Regulation of study environment	I try to find a quiet place for studying which has no distractions.	60.6%	78.4%	17.8%
30	Peer-learning	I choose to work with other friends or students when doing some of my school assignments.	29.6%	43.1	13.5%
27	Help-seeking	When confused, I ask my parents, brothers or sisters to help by explaining difficult things.	50.8%	63.1%	12.3%
3	Rehearsal	I read my notes over and over again when studying.	47.5%	58.9%	11.4%
38	Self-consequences	If I do well in my studies I reward myself.	34.4%	43.1%	8.7%
STRATEGIES REPORTEDLY USED ALMOST EQUALLY BY BOTH GROUPS					
31	Goal-setting and planning	I start studying before the examinations not just the day before and I pace myself.	62.3%	53%	9.3%
16	Comprehension monitoring	I ask myself questions to make sure I know and understand the subject information.	68.8%	60.8%	8.0%
24	Information-seeking	I read other books (not only my textbook) on the topic that is being done in class.	54.1%	47.1%	7.0%
9	Organisation	I go through my class notes and try to find the most important points.	65.6%	58.9%	6.7%
10	Organisation	I make simple diagrams to help me organize and understand my ideas	21.3%	15.7%	5.6%
12	Organisation	I think about what I must do and make a plan before I answer test or examination questions.	62.2%	56.8%	5.4%
33	Goal-setting and planning	As part of my exam preparation, I make a time-table showing when I must study different topics.	36%	41.6%	5.2%
15	Reviewing	When preparing for a test, I read my notes	96.8%	92.2%	4.6%
2	Rehearsal	I practice similar sorts of examples so that I can remember how to do similar ones in a test	57.4%	53%	4.4%
29	Peer-learning	I discuss my science schoolwork with my classmates.	39.3%	35.2%	4.1%
39	Self-consequences	I think about failing and that makes me want to work hard.	88.5%	92.1%	3.6%
22	Record-keeping	I keep a file of all my tests and examinations papers.	77.1%	80.4%	3.3%
18	Self-evaluation	I ask someone to test me to see if I know and understand the subject information.	32.8%	35.2%	2.5%

APPENDIX D   INFORMED CONSENT DOCUMENT

The learning strategies that are used by successful science students
Informed Consent Document

Dear parent,

I am a Masters of Education student at the University of KwaZulu-Natal. I am researching the understanding and use of learning strategies among science students. Your child has been selected to participate in this research activity in which he or she will be required to answer some questions in an interview. The selection was based on the knowledge that he or she is one of the science students in the school and therefore may be able to provide valuable information for this research. The interview session will take approximately twenty five minutes. The research is aimed finding out if science students are aware of different learning strategies and whether they do use them. Participation in this study is voluntary and the participant can withdraw from the study at any stage and for any reason. The decision not to participate will not result in any form of disadvantage. The participant's identity and the information provided will be treated as confidential. The information will be stored securely at the University of KwaZulu-Natal for a period of five years after which it will be shredded.

You are also free to contact my supervisor Professor Paul Hobden at the University of KwaZulu-Natal if you wish to get any further information.

Yours faithfully

Phehlane Lebuso (Mr)   Professor P. Hobden.

0790833383/58858431   (031) 2603447

lebuso2000@yahoo.com   hobden@ukzn.ac.za

You are therefore requested to complete the declaration attached to this letter.

I.. (Full   names)   hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to my child participating in the research project.

I understand that he or she is at liberty to withdraw from the project at any time, should he/she so desire.

Signature of parent... Date..

APPENDIX E   **REQUEST FOR PERMISION TO CONDUCT RESEARCH**

University of KwaZulu-Natal

Edgewood Campus

P/Bag X03

Ashwood

23rd November, 2009.

The District Education Officer

Maseru district

Lesotho.

Dear sir/Madam,

I am a M.Ed student at the University of KwaZulu-Natal. I humbly request permission from your office to carry out a research in two schools in your district (N.U.L. International School and Lesotho High School). The aim of the research is to find out the learning strategies that students use in the learning of science. This study is expected to take place early February in 2010.

If more information is required you can contact my supervisor Professor Paul Hobden at the University of KwaZulu-Natal.

Yours faithfully,

Phehlane Lebuso (Mr)

0790833383

lebuso2000@yahoo.com

Professor P. Hobden (Supervisor)

2603447

hobden@ukzn.ac.za

APPENDIX F   ETHICAL CLEARANCE CERTIFICATE