

*The relation between self-regulated learning, self-efficacy,
learning strategies and academic achievement*

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DECLARATION

I declare that the relation between self-regulated learning, self-efficacy, learning strategies and academic achievement is my own work. It is being submitted for the MAGISTER EDUCATIONIS degree to the Potchefstroomse Universiteit vir Christelike Hoër Onderwys, Potchefstroom. It was not submitted before, for any degree or examination in any other University.

MODUMO JONAS MOFOKENG

DEDICATION

In memory of my late beloved parents, **TELEKO** and **MAPULENG**
MOFOKENG

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Potchefstroom

OPSOMMING

DIE VERBAND TUSSEN SELF-GEREGULEERDE LEER, SELF-DOELTREFFENDHEID, LEERSTRATEGIEË EN AKADEMIESE PRESTASIE

Die doel van die studie was om deur middel van 'n literatuuroorsig en empiriese ondersoek vas te stel of selfgereguleerde leer, selfdoeltreffendheid en leerstrategieë 'n invloed uitoefen op die akademiese prestasie in Natuur- en Skeikunde van St. 10 leerlinge in Qwaqwa. Die literatuurstudie het aangedui dat daar 'n verband tussen self-gereguleerde leer, self-doeltreffendheid, leerstrategieë en akademiese prestasie bestaan.

Teorieë oor die verband tussen self-gereguleerde leer en akademiese prestasie beklemtoon hoe leerlinge kan selekteer, organiseer, en 'n positiewe leeromgewing vir hulself skep, asook hoe hulle die formaat (omvang) en hoeveelheid take kan beplan en beheer. Self-gereguleerde leerders kan onderskei word deur hulle sistematiese gebruik van metakognitiewe en motiveringstrategieë en die verskil in reaksie op terugvoer oor die effektiwiteit van hulle leerhandelinge, hul self-doeltreffendheidsortoelings en akademiese prestasie tussen hierdie en ander leerders.

Selfdoeltreffendheidsortoelings beïnvloed die leerlinge se keuse van aktiwiteite, die hoeveelheid energie wat aan leeraktiwiteite bestee word, en die uithouvermoë wat hulle openbaar wanneer hulle met negatiewe leerervarings gekonfronteer word. Leerlinge met negatiewe ortoelings oor hulle self-doeltreffendheid met betrekking tot die voltooiing van leertake mag take heeltemal probeer vermy, in teenstelling met leerlinge wat meer selfdoeltreffend voel, en gevolglik met meer oorgawe en entoesiasme aan opdragte gehoor gee en take uitvoer.

Die gebruik van effektiewe en doeltreffende leerstrategieë, fasiliteer die verwerwing, integrasie, organisasie en berging van inligting, en maak sodoende doeltreffende leer moontlik. Deeglik geselekteerde leerstrategieë kan daartoe bydra om kontinue leer te genereer en motiveer. Leerstrategieë help leerlinge om nuwe inligting meer sinvol te maak deur dit met die leerling se voorkennis te integreer.

Daar is aan die hand van 'n empiriese ondersoek aangedui dat daar 'n verband bestaan tussen self-gereguleerde leer, self-doeltreffendheid vir sosiale ondersteuning en akademiese prestasie in Natuur- en Skeikunde. Die verband tussen leerstrategieë en akademiese prestasie in Natuur- en Skeikunde kon nie vasgestel word nie, aangesien die verband nie ondersoek kon word nie.

SUMMARY

THE RELATION BETWEEN SELF-REGULATED LEARNING, SELF-EFFICACY, LEARNING STRATEGIES AND ACADEMIC ACHIEVEMENT

The purpose of this study was to determine by means of the review of the literature and an empirical investigation whether self-regulated learning, self-efficacy and learning strategies influence the academic achievement in Physical Science of Std. 10 Qwaqwa students. From the review of the literature, it was established that there is a relationship between self-regulated learning, self-efficacy, learning strategies and academic achievement.

Self-regulated learning theories of academic achievement lay emphasis on how students can select, organize, create advantageous learning environments for themselves and how they can plan and control the form and amount of their own instruction. Self-regulated learners are distinguished by their systematic use of metacognitive and motivational strategies, their responsiveness to feedback regarding the effectiveness of their learning and their self-efficacy for academic accomplishment from other learners.

Self-efficacy perceptions affect students' choice of activities, the effort they expend when learning and perseverance they exercise in the face of adverse experiences. Students that hold a low sense of self-efficacy for completing their tasks may avoid them completely, whereas those who feel more efficacious participate more eagerly.

The use of effective and efficient learning strategies facilitate acquisition, integration, organisation, storage of information and this makes learning possible. Properly selected learning strategies help in generating and maintaining motivation for continued learning. Learning strategies help students to make new information more meaningful and help them integrate new information with prior knowledge.

By means of an empirical investigation, it could be established that there is a relationship between self-regulated learning, self-efficacy for social support and academic achievement in Physical Science. The relationship between learning strategies and academic achievement in Physical Science could not be established as the relationship could not be investigated.

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TEXTUAL NOTE

To simplify grammatical construction, the masculine form is used throughout. It may be substituted by the feminine if so preferred.

CHAPTER 1

STATEMENT OF THE PROBLEM AND OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND STATEMENT OF THE PROBLEM

Considering the high failure rate and poor academic achievement of Standard Ten students in Qwaqwa secondary schools in Physical Science as reflected in the Standard Ten results over the years, one can assume that these students have difficulties in their learning. At the basis of this assumption lie problems such as an inability of students to self-regulate their learning, an inability to cope with task demands, failure to expend greater effort in task accomplishments, failure to sustain motivation for goal attainment, failure to plan and set goals, failure to persist longer when facing obstacles, as well as their inability to engage in behaviours and thoughts during learning that are intended to influence their encoding processes (Frieze & Weiner, 1974:69). For students to overcome these problems, they must learn to accept responsibility for their own learning and must have the will to self-regulate (Zimmerman, 1990:4). Students must also have the ability to use cognitive (i.e. learning) strategies to learn, study, remember, and understand learning material as well as developing positive judgements of what they can do with whatever skills they possess (Zimmerman, 1989a:329).

D.S. According to Tuckman (1990:291) tasks that students work on, particularly in Physical Science, require students to self-regulate their learning, make proper selection and use of learning strategies, and have the willingness to accept responsibility. Corno and Mandinach (1983:60) define self-regulated-learning as the highest form of cognitive engagement a student can use to learn in classrooms: it is an effort put forth by students "to deepen and manipulate the associative network in a particular area and to monitor and improve that deepening process". Schunk (1990b:71) reports that self-regulated learning occurs when students activate and sustain cognition and behaviours systematically oriented toward attainment of learning goals.

Zimmerman (1989a:329) reports that self-regulated learning processes involve goal-directed activities such as attending to instruction, processing and integrating information, rehearsing information to be remembered, developing and maintaining positive beliefs about learning capabilities and anticipated outcomes of actions that students instigate, modify and sustain. Self-regulated learners view acquisition as a

systematic and controllable process, and accept greater responsibility for their achievement outcomes (Zimmerman, 1990:4). Learners become aware of the strategic relations between regulatory processes and learning outcomes and their use of strategies to achieve their academic goals (Zimmerman, 1990:4). According to Bandura (1982:129), self-regulatory capabilities require tools of personal agency and self-assurance such as self-efficacy and learning strategies to improve academic achievement.

Zimmerman (1989a:329) reports that self-regulated learning involves the use of specific strategies to achieve academic goals on the basis of self-efficacy perceptions. Bandura (1977:193) defines self-efficacy as judgements of one's capability to organize and implement actions necessary to attain designated performances. Self-efficacy can therefore influence the choice of learning activities. Zimmerman (1989a:330) assumes that self-efficacy is a key variable affecting self-regulated learning. Students with high self-efficacy are believed to display better quality of learning strategies and more self-monitoring of their learning outcomes. Schunk (1990a:8) postulates that students who are more efficacious work harder and persist longer when facing obstacles than those who doubt their capabilities.

Schunk (1990a:3) advocates a direct relationship between self-efficacy and the nature of the strategies adopted for learning, because self-efficacy influences the student's use of learning strategies. Weinstein and Mayer (1986:315) define learning strategies as behaviours and thoughts that a learner engages in during learning that are intended to influence the learner's encoding processes. For example, Levin *et al.* (1982: quoted by Weinstein and Mayer, 1986:319) postulate that students who use the keyword method as a learning strategy when learning academic contents such as definitions, may recall these better than students not using this strategy. Students who underline sentences in a passage are able to recall substantially more information than students who simply read the passage without underlining (Rikards & August, 1975: quoted by Weinstein & Mayer, 1986:318). According to Bandura (1982: quoted by Schunk, 1985:215), strategy verbalisation leads to a greater increase in self-efficacy across all grades and promotes performances among all students.

It is against this background that this study therefore seeks to answer the following questions:

- * Does self-regulated learning have an influence on Standard Ten students' academic achievement in Physical Science?
- * Do learning strategies have an influence on Standard Ten students' academic achievement in Physical Science?

- * Does self-efficacy have an influence on Standard Ten students' academic achievement in Physical Science?

1.2 AIM OF THE STUDY

The aim of the research was:

- * to determine from a review of the literature whether self-regulated learning, learning strategies, and self-efficacy have an influence on the academic achievement of the Standard Ten Qwaqwa students in Physical Science,
- * to determine empirically the relationship between self-regulated learning, learning strategies, self-efficacy and academic achievement of the Standard Ten Qwaqwa students in Physical Science.

1.3 RESEARCH HYPOTHESIS

To achieve the aim as set in paragraph 1.2, the following hypotheses were postulated:

*** Hypothesis 1**

There is a relationship between self-regulated learning and the academic achievement of Standard Ten Qwaqwa students in Physical Science.

*** Hypothesis 2**

There is a relationship between learning strategies and the academic achievement of Standard Ten Qwaqwa students in Physical Science.

*** Hypothesis 3**

There is a relationship between self-efficacy and the academic achievement of Standard Ten Qwaqwa students in Physical Science.

1.4 METHOD OF RESEARCH

The research fell into two sections: a literature study and an empirical investigation. Literature in the field concerned was studied from theses, journals and other primary and secondary sources of information related to the study. A DIALOG-search was conducted based on the following keywords: self-regulation, learning strategies, self-efficacy, and academic achievement.

An empirical investigation was undertaken to determine whether self-regulated learning, learning strategies, and self-efficacy, influence academic achievement in Physical Science.

1.5 PROCEDURE AND OVERVIEW OF THE STUDY

The aim of this study as outlined in paragraph 1.2, was to determine whether self-regulation, learning strategies, and self-efficacy influence academic achievement in Physical Science. To achieve this aim, it was necessary to review related literature on the variables that influence achievement in Physical Science. In Chapter Two self-regulated learning and its influence on academic achievement is discussed, while Chapter Three traces the influence of learning strategies and self-efficacy as variables influencing academic achievement.

To determine what specific role self-regulation, learning strategies, and self-efficacy play in influencing academic achievement in Physical Science, an empirical investigation was done of which the method is discussed in Chapter Four. In Chapter Five, the results are presented, analysed, and interpreted. Chapter Six gives a summary, the implications, limitations, and recommendations of the research project.

CHAPTER 2

SELF-REGULATED LEARNING AND ACADEMIC ACHIEVEMENT

2.1 INTRODUCTION

Self-regulated learning has recently received increased attention as an approach towards improving students' academic achievement (Zimmerman, 1990:3). Measures such as students' ability, quality of teaching, quality of school, and the quality of the environment were previously used as major criteria in the analysis of academic achievement (Zimmerman, 1986:307). In contrast with this approach, self-regulation theory focuses attention on how students personally activate, alter, and sustain their learning activities in specific contexts (Zimmerman, 1990:307). For example, self-regulated learners are assumed to be proactive in seeking out information and taking the necessary steps to process such information (Zimmerman, 1990:4; Ridley, Schutz, Glanz & Weinstein, 1992:293). Self-regulated learners are able to plan, set goals, keep records, seek social assistance, structure the environment, and review their study materials during the process of learning (Zimmerman & Martinez-Pons, 1988:284).

A self-regulated learning perspective on students' learning and academic achievement shifts the focus of educational analysis from the students' learning abilities and environments as fixed entities to their personally initiated processes and responses to improve their abilities and environments for learning (Zimmerman, 1990:4).

The aim of this chapter is to give a broad outline of self-regulated learning to create a theoretical background for this study. Self-regulated learning will first be defined (see par. 2.2), after which the assumptions underlying self-regulation (see par. 2.3), determinants of self-regulated learning (see par. 2.4), and self-regulated learning strategies (see par. 2.5) will be discussed.

2.2 DEFINITION OF SELF-REGULATED LEARNING

Social cognitive theorists view self-regulated learners as metacognitively, motivationally, and behaviourally active participants in their own learning process (Zimmerman, 1986:308; Zimmerman, Bandura & Martinez-Pons, 1992:664). Metacognitive processes determine the students' approach to learning. Through these processes, a learner can plan, organize, self-monitor, set goals, and evaluate at various stages during the process

of knowledge acquisition (Zimmerman, 1986:308; 1989b:4). Motivationally, self-regulated learners report high self-efficacy, intrinsic task interest, perceive themselves as competent and autonomous learners. Self-regulated learners are self-starters who display extraordinary effort and persistence during learning (Zimmerman, 1986:308; 1989b:4).

Zimmerman (1990:5) discusses several features that characterise definitions of self-regulated learning, arguing that it is important to distinguish between self-regulation processes (e.g. self-efficacy perceptions) and strategies designed to optimize these processes (e.g. goal-setting) when defining self-regulated learning. This distinction forms the first feature in the definition of self-regulated learning. Self-regulated learning strategies refer to processes directed at the acquisition of information or skills that involve agency and purpose, whereas self-regulation processes involve students' awareness of strategic relations between regulatory processes and learning outcomes as well as their use of these strategies to achieve their academic goals (Zimmerman, 1989a:329; 1990:5).

Zimmerman (1990:5) asserts that a second defining feature of self-regulated learning is a self-oriented feedback loop. A self-oriented feedback loop serves as one of the controlling principles of self-regulated learning (Carver & Scheier, 1985:238). The feedback loop forms the basic unit of cybernetic control in behavioural self-regulation (Scheier & Carver, 1982:159). This unit of cybernetic control (which is called a negative feedback loop) entails a cyclic process in which students monitor the effectiveness of their learning strategies and react to this feedback in a variety of ways (Scheier & Carver, 1982:152). The cybernetic feedback loop involves the process of behavioural self-regulation implemented through the use of strategies to acquire knowledge and skill, which is also true of personal and environmental self-regulation (Carver and Scheier, 1985:238).

The function of this negative feedback loop is to minimize the students' awareness of the difference between a present level of goal attainment or academic achievement, and the goal which was set that serves as a standard against which a present level of achievement is compared (Scheier & Carver, 1982:152). If a discrepancy is sensed (i.e. self-judgement) between the attained level of achievement and the goal set, the self-regulated learner would take steps (i.e. self-react) to reduce this discrepancy (Scheier & Carver, 1982:152). For example, if a student fails to achieve his¹ goal when using a certain

1 To simplify grammatical construction, the masculine form is used throughout. It may be subscribed by the feminine if preferred.

strategy he may put more effort into learning or he may replace a learning strategy by a more suitable one to match the standard of comparison.

It is important to note that Bandura (1989: quoted by Zimmerman, 1990:5) warns against viewing the feedback loop only in terms of negative aspects as it can also be positive. For example, a student may continue using a strategy that brings him positive outcomes. Positive feedback enables students to raise their level of goal attainment, as well as match the standards against which their goals are measured (Zimmerman, 1990:5).

An indication of how and why students choose to use a particular strategy is another feature of self-regulated learning (Zimmerman, 1989b:4; 1990:5). Proactive use of selected strategies for the completion of designated tasks by students require time, effort, and vigilance (Zimmerman, 1990:6). When students use strategies to attain their goals, they will become motivated. Students' learning and motivation are therefore treated as interdependent processes because they cannot be understood fully when set apart from each other (Zimmerman, 1990:6).

2.3 ASSUMPTIONS UNDERLYING SELF-REGULATED LEARNING

Zimmerman (1989a:331) asserts that there are four basic assumptions that underly self-regulated learning, viz. triadic reciprocity, self-efficacy, the sub-processes for self-regulation, and the state of self-regulation.

2.3.1 Triadic reciprocity

Reciprocal influence

Social cognitive theorists view students' self-regulated learning as the result of the reciprocal influence among personal, environmental, and behavioural processes (see Figure 2.1; Zimmerman, 1988:5; 1989a:330). Students' personal processes (see par. 2.4.1) are assumed to be influenced by both behavioural and environmental events in a reciprocal way during learning (Zimmerman, 1989a:330). For example, a student may isolate himself from anything that may distract his concentration and arrange a suitable study area by eliminating noise while studying for an examination (an environmental process). While preparing himself for a maths test, a student may rehearse or memorise (a behavioural process) a formula to check his progress (a personal process).

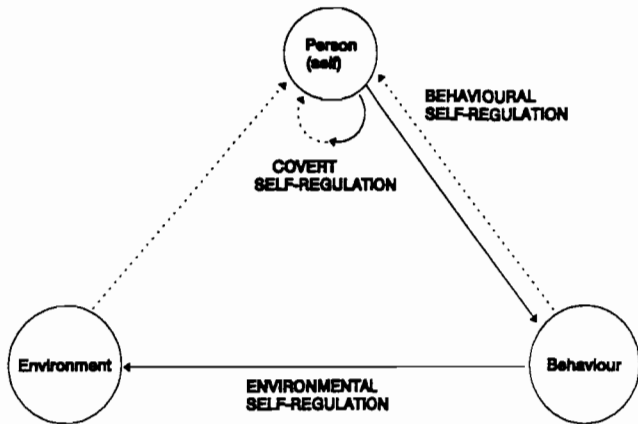


Figure 2.1: A triadic analysis of self-regulated functioning (Zimmerman, 1989a:330).

2.3.2 Self-efficacy

Self-regulated learning depends upon students' self-efficacy beliefs. Self-efficacy conveys information to learners that they are capable of planning and setting goals during the process of learning. Bandura (1977:193) postulates that self-efficacy refers to a student's expectations that he is capable of performing the behaviour that will produce desired outcomes in a particular situation (see par. 3.4 for a complete discussion of self-efficacy). Schunk (1988:4) asserts that a sense of self-efficacy for learning can help explain student's self-regulated learning efforts. Schunk (1991b:121) postulates that high self-efficacy stimulates effort and persistence when problems are encountered, while low self-efficacy leads to doubts, avoidance techniques and lack of effort. For example, low achievers will avoid subjects such as maths and science because they appear difficult to them, while those who are efficacious will view them as a challenge (Schunk, 1988:8). Students with a low sense of efficacy become discouraged when they are faced with new material because it is in such instances where they are more uncertain of their capabilities (Bandura, 1986:394). Students with strong beliefs in their self-efficacy intensify and sustain their effort needed to realise difficult performances which cannot be attained by those who are doubt-ridden (Bandura, 1986:394). Students who regard themselves as

highly efficacious have a higher level of thinking and take a more active part in classroom activities than those who perceive themselves inefficacious (Bandura, 1986:395).

Information about an individual's self-efficacy for completing tasks is basically acquired through performance accomplishments or enactive experiences, vicarious experiences, forms of persuasion, and physiological indexes (see par. 3.4.2).

Students' enactive learning experiences refer to learning that results from the consequences of an individual's own actions (Schunk, 1991b:87; see par. 3.4.2.1). Students engage themselves in numerous tasks in the classroom, which differ in the procedures, organisations, and products they require (Blumenfeld, Mergendoller, & Swarthout, 1987:138). Successful performances in these tasks raise students' self-efficacy, whereas repeated failure lowers it.

Vicarious learning refers to information that students acquire through observing models or other students performing and successfully attaining their desired expectations (Schunk, 1984:45; see par. 3.4.2.2). Vicarious learning is characterised by observing or listening to others (i.e. live on television, videotapes, or slides) and reading (Schunk, 1991a:103). For example, students learn that poisonous snakes are deadly by reading books rather than experiencing the unpleasant consequences of their bites (Bandura, 1986:399).

Verbal persuasion refers to all information given to students in the form of suggestions or encouragements to make them believe that they possess the capabilities to achieve their goals (Schunk, 1989:15; see par. 3.4.2.3). When students are persuaded that they possess capabilities to master assigned tasks, they may expend greater effort when completing such tasks than when they harbour doubts (Bandura, 1986:400). For example, if learners can be made to believe that they have the potential of working out five mathematical problems in ten minutes and successfully do it, their self-efficacy will be enhanced for continued learning.

Physiological indexes involve body symptoms such as sweating or heart rate in judging one's capabilities (Bandura, 1986:401; Schunk, 1989:15; see par. 3.4.2.4). When a learner is harassed persistently by aversive experiences, he expects no success. If learners experience a sense of inefficaciousness, they stop from trying to complete tasks or avoid them completely (Schunk, 1989:15). For example, trembling or sweating are emotional symptoms that can be interpreted as student's inability to do well in an examination. According to Bandura (1977:200) an increase in physical relaxation can

develop students' self-confidence and thereby increase their self-efficacy for better performance.

2.3.3 Sub-processes in self-regulation

Self-regulation involves a set of sub-functions or sub-processes that must be developed and mobilised for self-directed change in behaviour (Bandura, 1986:336). To self-regulate his learning a student has to observe the progress he makes towards his learning goal, evaluate his progress, and if necessary adjust his learning (Bandura, 1986:336). The student therefore has to self-observe, self-judge, and self-react to bring about change in his behaviour (Bandura, 1986:336).

Self-regulated learning thus depends on three component processes operating in a reciprocal manner, viz. self-observation, self-judgement, and self-reaction (Bandura, 1986:336; Zimmerman, 1989a:331).

2.3.3.1 Self-observation

Self-observation involves self-directed attention to one's own performance (Bandura, 1986:336; Schunk, 1990b:74). Self-observation serves the important self-regulatory function of providing information to individuals about what they do, which is then used to set goals and evaluate progress towards goal attainment (Bandura, 1986:337). Systematic self-observation provides a self-diagnostic device for gaining a better sense of what conditions lead one to behave in a certain way (Bandura, 1986:338). Students cannot regulate their actions if they are not fully aware of them (Schunk, 1991b:88). Information provided through self-observation enables learners to establish a programme of change in behaviour (see par. 2.3.3.3; Schunk, 1991b:88).

Self-observation serves two functions in the process of self-regulation. Firstly, it provides information necessary for setting realistic performance standards and for evaluating ongoing changes in behaviour (see par. 2.3.3.2). Secondly, it enlists self-reactive influences (see par. 2.3.3.3). For example, a student can videotape himself performing an action of a part he plays in the school drama. During the replay he will be able to identify deficiencies and can correct them (i.e. self-reaction) before appearing on stage. Assessment of this nature helps students to improve their performance on learning tasks by timeously selecting relevant materials, assessing their complexity, as well as evaluating clarity.

In the event of personal, behavioural, and environmental processes, factors such as regularity, consistency, and proximity of self-monitoring affect accuracy and the effects of self-evaluation (Bandura, 1986:336/7). Regularity of observation refers to instances where behaviour is monitored on a continuous basis (also see par. 2.4.1.2). Regular observations provide valid results for continued learning because students can immediately correct actions that will lead to unsatisfactory results (Schunk, 1991a:88).

Proximal self-observation refers to behavioural observations that take place shortly after their occurrences, rather than long after them (Schunk, 1991a:88). Proximal observations which provide information to the student that serves as the best influence on behaviour because it attracts attention while the action is still in progress (Bandura, 1986:338).

2.3.3.2 Self-judgement

Self-observation of one's performance alone does not provide a sufficient basis for regulating one's behaviour (Bandura, 1986:340). One's performance must be judged or evaluated as well, i.e. self-judgement.

Self-judgement refers to a systematic comparison of one's performance level with a standard against which it is measured (Bandura, 1986:340). Standards provide information to students on how they perform (Schunk, 1991b:89). For example, a student who is able to solve five maths problems in seven minutes instead of ten, realises that he has completed his work in less than the time stipulated and may evaluate goal progress as positive. The progress made by such an individual enhances his self-efficacy and sustains his motivation (Schunk, 1991b:89).

Standards against which one's actions are judged have both absolute and normative values (Schunk, 1991b:89). Absolute standards are fixed. For example, a student whose goal is to complete or solve five maths problems in ten minutes, can gauge his progress against this absolute standard. According to Bandura (1986:346), normative standards are based on the performance of others and can be acquired by observing models (see par. 2.3.2 & 3.4.2.2). Social comparison of performance virtually determines appropriateness of behaviour and thus make observation possible (Schunk, 1991b:89). For example, when students are given a fixed time to complete as many maths problems as possible, they may compare their progress with others in the class and see how their performance (i.e. completion of number of problems) compares with others. Competitive classroom conditions lead students to focus their attention on how they perform in comparison with their peers. Such conditions encourage students to improve their performance over time (Schunk, 1991b:89).

2.3.3.3 Self-reaction

Students' self-reactions depend largely on their evaluative standards and judgemental skills (Bandura, 1986:350). A student's self-reactive influence is achieved through creating incentives for his own actions and by responding evaluatively to his own behaviour which is measured against internal standards through strategy use (Bandura, 1986:340). Self-reaction thus occurs when a student judges that the learning strategy that is being used is not going to enable him to attain his goal or the standard which is required and decides to use another learning strategy which may be more suitable for goal achievement. Goal progress motivates the student and the anticipated satisfaction of goal accomplishment raises self-efficacy for continued improvement (Schunk, 1991b:90).

Self-reaction refers to a range of interactive processes that involve goal-setting, self-efficacy perceptions, strategy choice, as well as behavioural processes such as actual strategy use (Zimmerman, 1988:19; 1989a:334). For example, if students believe they have not worked hard to accomplish their goals, and that enhanced effort will promote progress, they may feel efficacious and work harder. If they feel they have been using an ineffective strategy, they may adopt a new approach to the task (Schunk, 1991b:91). However, students' motivation will not improve if they believe that they lack the ability to succeed and that increased effort, or a new way that they adopt when working on a task will not help (Schunk, 1991b:91).

2.3.3.4 The relationship between self-observation, self-judgement and self-reaction

Bandura (1986:340) and Zimmerman (1989a:331) clearly point out that there is a direct relationship between self-observation, self-judgement and self-reaction. Bandura (1986:340) points out that self-observation of one's performance alone does not provide a sufficient basis for regulating one's behaviour as it also requires judging or evaluating progress towards attaining the goal set. These processes (i.e. self-observation, self-judgement and self-reaction) interact with each other reciprocally to bring about change in a learner's behaviour (Bandura, 1986:340). Change in a learner's behaviour is subject to the progress he makes towards achieving academic goals by observing aspects of his own behaviour and judging them against standards and reacting positively to achieve set goals (Schunk, 1991b:88).

At the start of a learning activity students may have goals such as acquiring skills and knowledge as well as ways and means of accomplishing a task. Such a learning activity will require them to observe, judge, and react during that activity (Bandura, 1986:340).

According to Bandura (1986:340), students may, for example, observe their progress towards learning goals, judge their progress against standards, and find out that the learning strategies used are ineffective and cannot ensure successful attainment of their goals, leading them exchange their present learning strategies for more effective ones. If students judge that their strategies are effective and will ensure successful attainment of their goals, they will continue using them.

Students react positively on the outcomes of their self-judgement when they believe they are capable of improvement and set higher goals that require greater effort and persistence (Schunk, 1991b:91). Students may as well react negatively on the outcome of self-judgement when they are less motivated and believe that they are incapable of improving. Students' enhanced effort promotes progress and feeling of efficaciousness that will sustain their motivation for continued learning (Bandura, 1986:395).

2.3.4 Self-regulation is never an absolute state

Social cognitive theorists assume that self-regulation is never absolute in its state of functioning, but varies in degree, depending on the social and physical contexts (Zimmerman, 1988:6; 1989a:330). Zimmerman (1989a:330) asserts that the reciprocity between behavioural, personal, and environmental influences does not mean that these processes have the same qualities, or that they are equal in strength. For example, when preparing for an examination, it may happen that an environmental influence (i.e. noise or inadequate lighting) overrides both personal and behavioural processes in certain contexts or at certain points, and thus will affect students' goal achievement negatively. If one or more of these processes dominate the others, the progress of self-regulated learning will be retarded (Zimmerman, 1989a:332). Students must therefore have full strategic control over all three types of influences to regulate their learning properly (Zimmerman, 1988:6; 1989a:330).

2.4 DETERMINANTS OF SELF-REGULATED LEARNING

Self-regulated learning is dependent on the interaction between personal, behavioural and environmental influences or determinants. In accordance with the social cognitive view of self-regulated learning, these influences are assumed to be interdependent.

2.4.1 Personal influences

In accordance with the social cognitive view of self-regulated learning, self-efficacy is considered to be a key variable that influences students' self-regulated learning (Zimmerman, 1989a:332). Self-efficacy depends in part on four types of personal influences, viz. students' knowledge (e.g. declarative or propositional knowledge and self-regulative knowledge, or procedural and conditional knowledge), metacognitive processes, goals and affect. The interaction between students' self-efficacy perceptions and their personal processes offers a view of students' self-regulative knowledge that serves as a base for their self-regulation (Zimmerman, 1989a:332).

2.4.1.1 Declarative knowledge

Declarative knowledge refers to factual information that includes beliefs, opinions, theories, and events (Alexander, Schallert & Hare, 1991:322; Schunk, 1989b:164). Flavell (1979:907) asserts that declarative knowledge relates to the concept of metacognitive knowledge which consists primarily of knowledge that affects the outcome of cognitive activities. Flavell (1979:907) identified knowledge of personal variables, knowledge of task variables, and knowledge of strategies that influence students' learning (see par. 3.3.5). Personal knowledge includes everything that students know and believe about themselves as learners (see par. 3.3.5.1; Flavell, 1979:907), providing information to students about how they compare with others, knowing what and how they learn best, and what type of tasks they are good at. The task category concerns knowledge that students need to complete their tasks (see par. 3.3.5.2; Flavell, 1979:907). Students must be able to assess whether the sources of reference will give them sufficient information they need for completing their tasks (Pressley, 1986:140). The strategy category is concerned with the knowledge of learning strategies that students need to complete their tasks or solve problems successfully (see par. 3.3.5.3; Flavell, 1979:907; Pressley, 1986:140).

2.4.1.2 Self-regulative knowledge

Self-regulative knowledge has the qualities of both procedural and conditional knowledge (Zimmerman, 1989a:332). Procedural knowledge refers to knowing how to use declarative and conditional knowledge (Schunk, 1991a:175). Students display procedural knowledge when they summarize, take notes, and underline passages to find main ideas while reading (Schunk, 1991a:175). Procedural knowledge is interdependent from other forms of knowledge. Knowledge of where and when to use declarative and

procedural knowledge is of paramount importance. Such knowledge is referred to as "conditional" (Schunk, 1991a:182). Conditional knowledge addresses the conditions under which a learner may strategically learn best (Schunk, 1991a:182). Conditional knowledge enables a learner to select and employ declarative and procedural knowledge when completing tasks (Schunk, 1991a:182). The systematic application of declarative, procedural, and conditional forms of knowledge in task completion reflects metacognitive activities. Metacognitive processes thus form an integral part of self-regulated learning.

2.4.1.3 Metacognitive processes

According to Zimmerman (1989a:332) students' use of self-regulated learning strategies depends on metacognitive processes and achievement outcomes. Self-regulated learners may display their knowledge of metacognitive decision making by carefully analysing a task before completing it (Zimmerman, 1989a:332).

Metacognitive control forms the self-management component of metacognition (Pintrich, 1989:132). Self-management involves planning, monitoring, and regulation of learning activities (Pintrich, 1989:132). Planning involves activities such as setting goals for study, generating questions on the text to be read, and doing a task analysis before tackling it (Zimmerman, 1989a:332; Pintrich,1989:132). Good learners engage themselves in more planning activities than poor learners. Monitoring activities (see self-judgement, par.2.3.3.2) involve self-testing while reading the text to ensure comprehension of material, and tracking of attention as one reads for the proper understanding of the material and integrating it with prior knowledge (Pintrich, 1989:133). Regulation activities (see self-reaction, par. 2.3.3.3) forms a close link with monitoring activities. Regulation involves one's ability to follow a chosen plan and monitoring its effectiveness (Paris, Cross & Lipson, 1984:1241). For example, rereading certain portions of the text ensures comprehension and improves performance by assisting students in checking and correcting their behaviours while learning is still in progress (Pintrich, 1989:133).

2.4.1.4 Goals

According to Schunk (1989:29), goals have a regulatory power over behaviour. Goals refer to purposive objectives that individuals set to attain during learning and involve the quality, quantity, and rate of task performance (Schunk, 1991a:118; 1991b:91; see par. 3.4.2.6). Students can set themselves goals to attain or goals can be established for them

by their peers, teachers, or parents (Schunk, 1991a:118; 1991b:91). Goals are differentiated into proximal and distant goals depending on how far they project into the future (Bandura, 1986:474). Proximal goals determine the student's immediate choice of learning activities and how hard and self-regulated he will work on them, while distant goals serve a general directive function (Schunk, 1991a:119).

Proximal goals convey reliable information about one's capabilities (Schunk, 1991b:92). When students, for example, perceive that they are making progress towards a proximal goal, they are apt to feel efficacious and maintain their motivation for continued learning. Progress towards a distant goal is more difficult to gauge and too far to provide sufficient information of progress (Schunk, 1991b:92). The effects of proximal goals are impressive and enhance higher self-efficacy in comparison with distant goals (Zimmerman, 1989a:333).

Goals are also characterized by their specificity and difficulty level. Goal difficulty refers to an individual's perception about the level of the task as assessed against a standard (Schunk, 1991a:120; 1991b:92). The level at which the goal is set establishes the amount of effort students must expend to attain it. High levelled (i.e. difficult) goals require that students must expend greater effort than low levelled ones. Students beliefs of their capabilities are important as well (Schunk, 1991a:120; Ridley *et al.*, 1992:294). Students who believe that they possess capabilities necessary to reach difficult goals, develop a strong sense of efficacy because progress ensures that they possess the skills necessary to overcome obstacles.

Goals that include specific performance standards are more valuable than non-specific or general goals (Schunk, 1991b:92). It is not always easy to evaluate progress towards explicit goals, as such goals also specify the amount of time and effort required for success. For example, when students are given thirty minutes to read ten pages from their set book and successfully complete the assigned task within the specified time, they get the self-satisfaction from the anticipated outcome or accomplishment. An explicit goal of this nature promotes self-efficacy within the learner because progress is easy to gauge (Schunk, 1991b:92).

Goals set for or set by learners should be realistic, challenging, and attainable to facilitate learning (Schunk, 1991b:93). Goal attainment serves as an incentive towards enhancing students' self-regulation. For example, in the early stages of skills acquisition, teachers may give students easier goals so that they might experience and develop a sense of self-efficacy for further learning.

2.4.1.5 Affect

According to Zimmerman (1989a:333) students' long-term goals and use of metacognitive processes are dependent on self-efficacy perceptions, self-regulatory knowledge and affect. Affect refers to factors that are internal or external to the learner that impede control in metacognitive processes (Zimmerman, 1989a:333). For example, a student may fail to perform well in a test when he harbours failure as a result of anxiety or low self-efficacy. Bandura (1985:277) however, cautions that anxiety felt by people before performing any activity may sometimes raise their self-efficacy beliefs. For example, the anxiety, fear, and uncertainty that students feel during the last days before sitting for their examination, may motivate them to work harder to ensure that they perform well.

2.4.2 Behavioural influences

Zimmerman (1989a:333) postulates that self-observation, self-judgement, and self-reaction (see par. 2.3.3.1) are behavioural influences that determine self-regulated learning. Because each of these influences is observable, trainable and interactive, they provides students with information on goal progress (Zimmerman, 1989a:334).

2.4.2.1 Self-observation

Self-regulated learning is influenced by behavioural processes such as verbal or written reporting and quantitative recording of the individual's actions and reactions (Zimmerman, 1989a:333). Students can, for example, observe their progress by recording the number of maths problems they have completed in thirty minutes. Students can also put on record their daily activities to develop a study schedule for effective learning. Systematic self-observation enables students to set realistic performance standards for evaluating their own learning progress (Zimmerman, 1989a:333).

2.4.2.2 Self-judgement

Self-judgement (also see par. 2.3.3.2) involves systematic comparison of one's performance with a standard (Schunk, 1991b:89). The goal one has set becomes a standard which is used as a criterion to determine whether the student is making progress or not. The discrepancy sensed between the level of achievement and the goal set gives

an indication whether or not progress has been made, how much progress has been made, or what should be done to make progress.

Self-judgement helps students assess their goal progress through self-evaluation for continued learning. For example, students can do self-evaluation by checking the quality of their academic work while writing an essay, i.e. whether they have stated important ideas, integrated ideas, or have reached the required length, and so forth.

2.4.2.3 Self-reaction

Self-reactive (also see par. 2.3.3.3) responses arise from self-observation and self-judgement processes. When a student judges that no progress has been made because of an unsuitable learning strategy, such as rehearsal when an organizational strategy should have been used, the student would self-react by changing to the organizational strategy (Bandura, 1986:340; Schunk, 1990b:73). Self-reaction involves a range of interactive processes such as goal-setting, self-efficacy metacognitive planning, as well as behavioural outcomes (Zimmerman, 1988:18; 1989a:334; also see par. 2.4.2.2).

Self-reaction strategies are represented in the following three categories: behavioural self-reaction, personal self-reaction, and environmental self-reaction strategies (Zimmerman, 1988:19; 1989a:334). Behaviourally, students seek to optimize their learning outcomes through positive self-evaluations and avoid use of strategies that involve self-administered praise or criticism (Zimmerman, 1988:19; 1989a:334). With personal self-reaction, students seek to enhance their progress during learning through goal setting. For example, a student may break down distant meaningless goals into proximal meaningful goals. Environmentally, students seek to improve their learning through structuring their environments (also see par. 3.3.3.3.2) and by asking assistance from their peers, teachers, or parents (also see par. 3.3.3.3.3; Zimmerman, 1988:19; 1989a:334).

2.4.3 Environmental influences

Environmental influences refer to the influence of the social and physical context on students' behaviour (Zimmerman, (1989a:334).

2.4.3.1 Social context

Social cognitive theorists view learning as a social event influenced by people such as parents, teachers, other adults, peers, brothers and sisters (Zimmerman, 1988:20;

1989a:335). Zimmerman (1989a:335) distinguishes between enactive and vicarious social influences. Learning that results from enactive experiences involve learning from the consequences of one's own actions (Schunk, 1991b:87). Behavioural consequences inform and motivate students about which behaviours are likely to produce positive outcomes. Students retain actions that result in successful consequences and discard those that lead to failure (Schunk, 1991a:103). For example, when a student is preparing himself for a test, he may use a strategy that helped him to perform effectively in his previous tests and will discard those that do not improve his learning.

Students acquire much of their learning vicariously by observing models perform (Schunk, 1991b:87; Zimmerman, 1988; 1989a:335). Modelled behaviours inform and motivate students as observers to achieve academic goals. As is the case with enactive learning, learners are apt to try to learn those behaviours that lead to successful outcomes rather than those that result in failure (Schunk, 1991b:89).

Schunk (1991a:105) distinguishes between live and symbolic models. Live models appear in person (e.g. a peer, or a teacher; also see par. 3.4.2.2), whereas symbolic models are represented by pictures on television, films, or videotapes. Actions performed successfully by others inform and motivate students for continued learning (Bandura, 1986:406). For example, modelled behaviours that are rewarded for successful performances increase students' tendency to behave in similar fashion, whereas punishing behaviours decreases such a tendency. Students judge their capabilities by comparing their performances with those of others (Bandura, 1986:400). Comparison with people who are of similar or slightly higher ability provides the most informative information for gauging one's own capabilities because such information may act as a standard for self-improvement of abilities (Bandura, 1986:400).

Verbal persuasion forms another aspect of social experiences that can be used to talk learners into believing that they possess capabilities that will enable them to perform particular learning tasks (also see par. 3.4.2.3; Bandura, 1986:405; Zimmerman, 1989a:335). Verbal persuasion has been found to be a significantly powerful medium through which students can learn academic skills when it is coupled with modelling (Zimmerman, 1989a:335). In a study conducted by Zimmerman (1989a:335) on an active talking model, it was found that learners who were exposed to such behaviours did better when completing their learning tasks than their counterparts who were only exposed to a silent non-enactive model.

Social assistance is another important aspect of vicarious learning and refers to the help that students receive from their peers, their teachers, or their parents (Schunk, 1991b:87;

Zimmerman & Martinez-Pons, 1986:625). Students' social support is represented by literary and symbolic forms of information such as diagrammes, pictures, and formulas (Zimmerman, 1989a:336). Students that report a high sense of efficacy and motivation, rely on the social sources of assistance than inefficacious ones (Bandura, 1986:400). In the study on symbolic, social and physical aids conducted by Zimmerman (1989a:336) referred to earlier, it was found that aids give an extensive support towards students' self-regulated learning because of their effectiveness in an external and internal dimension.

2.4.3.2 The structure of the learning context

The structure of the learning context refers to the elements such as the physical setting of the environment and the academic task accomplishments (Zimmerman, 1989a:336; 1988:23). Students' capabilities to change the academic task to decrease the level of difficulty (i.e. breaking long-term goals into manageable and comprehensive sub-goals), or changing the academic setting from a noisy to a more quiet one (i.e. where learning can occur readily) report the ability to self-regulate their learning (Zimmerman, 1989a:336). For example, students who hold a strong sense of efficacy are capable of adjusting the environmental stimulus to suit their needs and enable them to accomplish their tasks successfully without distractions.

2.5 SELF-REGULATED LEARNING STRATEGIES

According to Weinstein, Meyer and Van Mater Stone (1994:362), a core component of self-regulated learning is a student's repertoire of learning strategies. Learning strategies are deliberate, planned, and consciously engaged-in activities that are intended to attain a goal or to complete a task (also see par. 3.3.1; Garner, 1988:64), and include behaviours that facilitate studying, understanding, and knowledge acquisition (Shute, 1994:3325).

Learning strategies help learners to use executive control processes to monitor their progress, set or modify their learning goals, create plans and use them to attain their goals (Shute, 1994:3325). Zimmerman (1989a:337) identified fourteen types of self-regulated learning strategies such as self-evaluation, organizing and monitoring, environmental structuring, self-consequating, rehearsing or memorizing, seeking social assistance, and reviewing records. For example, help-seeking strategies (also see par. 3.3.3.3.3), information-seeking strategies such as reading, as well as environmental structuring strategies seek to optimise the students' learning environment. Goal-setting

and planning, organising and transforming, rehearsing or memorising strategies seek to optimise students' personal self-regulation. Self-evaluation and self-consequating strategies seek to enhance students' behavioural self-regulation (Zimmerman, 1989a:337).

According to Weinstein (1987:590), strategies provide students with a sound knowledge base for regulating their cognition, the ability to exercise control over learning and thinking processes, as well as the fluency and flexibility of thought.

2.6 CONCLUSION

In this chapter the focus was on the relationship between self-regulated learning and academic achievement. The survey of the literature revealed that there is a definite relationship between self-regulated learning and academic achievement. Self-regulated learners are metacognitively, motivationally, and behaviourally active participants in their learning process (Zimmerman, 1989a:329). Self-regulated learners can plan, set goals, organize, self-instruct, self-monitor, and self-evaluate at various stages during the process of learning (Zimmerman & Martinez-Pons, 1988:284).

Self-regulated learning is determined by personal, behavioural, and environmental influences that interact reciprocally. This overview of the literature has revealed that these processes help students to be proactive in seeking out information and to take necessary steps to process such information during learning (Zimmerman, 1990:4).

CHAPTER 3

LEARNING STRATEGIES, SELF-EFFICACY, AND ACADEMIC ACHIEVEMENT

3.1 INTRODUCTION

The aim of this chapter is to view the relationship between learning strategies, self-efficacy, and academic achievement. Learning strategies are behaviours that are aimed at helping students to acquire new information and evaluate their learning tasks (Weinstein & Meyer, 1991:17). A sense of self-efficacy for learning can stimulate students' effort and persistence when problems are encountered during learning (Schunk, 1991a:121). Learning strategies will first be defined in paragraph (3.3.1) followed by an analysis of their relationship with academic achievement in paragraph (3.3.4). The relationship between self-efficacy and academic achievement will be discussed in paragraph (3.4).

3.2 LEARNING

3.2.1 Definition of learning

According to Shuell (1988:412) and Gagne' (1985:2), learning is an enduring change in an individual's behaviour or ability to do something which results from practice or other forms of experience. The kind of change exhibited must have more than a momentary quality and must be capable of being retained over a period of time (Gagne', 1985:2). The change must be distinguishable from the kind of change that is attributable to growth, such as change in height, or the development of muscles through exercise (Gagne', 1985:3; Shuell, 1990b:531).

Cognitive theorists view learning as an active, constructive, cumulative and goal-oriented process (Shuell, 1988:277; 1990a:3). Because learning is an active, constructive, cumulative, and goal-oriented process, it implies that the student has to process information actively. The active nature of learning involves students' engagement in activities such as planning, goal-setting, and organization of material, while processing incoming information in order to learn material in a meaningful way. Learning is constructive in that new information must be elaborated and related to other information in order for the student to retain simple information and understand complex material.

Learning is cumulative in that new learning builds upon the learner's prior knowledge in ways that determine what and how much is learned (Shuell, 1988:278). The goal-oriented nature of learning refers to the learner's awareness of the goal towards which he is working (Shuell, 1990a:4).

A cognitive view of learning requires a process-oriented approach that stresses the actual nature of learning as opposed to a product oriented approach to learning that focuses only on the end product of learning (Shuell, 1986:415). With a process-oriented approach, the focus is on the personal involvement and commitment of the student during learning. A process-oriented approach to learning assigns certain responsibilities to both the teacher and the learners. The role of the teacher changes from that of a transmitter of knowledge to that of a facilitator who presents students with opportunities to process information into knowledge (Shuell, 1986:415).

Since learning is viewed as an active, constructive, cumulative, and goal-oriented process, the role of a student changes from that of a passive recipient and memorizer of information to that of an active processor of information. To understand how the student processes information, it is necessary to briefly discuss the information processing approach to learning and the structure of the memory system.

3.2.2 The information processing model

The information processing model of learning postulates the existence of three memory stores, viz. a sensory memory or register, a short-term memory, and a long-term memory (Mayer, 1988:14). Control processes determine the quality of processing and the quality of information that the learner stores in memory and recalls when the need arises (Woolfolk, 1990:230; Biehler & Snowman, 1993:382).

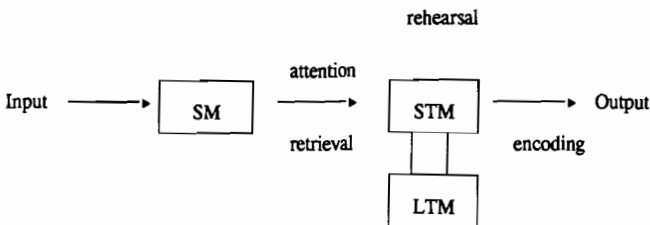


Figure 3.1: A schematic representation of a typical information processing model (Mayer, 1988:15).

3.2.2.1 The sensory register

From the environment a learner receives information that activate receptors (i.e. sense organs) in the form of visual, auditory, tactile, olfactory, and gustatory information (Woolfolk, 1990:242; Biehler & Snowman, 1993:328). This information is held in the sensory register for a brief moment, that is, half a second to perhaps four seconds for recognition (Sprinthall & Sprinthall, 1994:287). The sensory register is like an unending series of instant-camera snapshots or videotape segments which, when displayed, last for a short duration before fading away, but if recognised can be passed on into the short term memory for attention (Biehler & Snowman, 1993:382). Information which is relevant is selected through a process of selective attention and transferred to the short-term memory where it is held long enough for further attention (Woolfolk, 1990:242).

3.2.2.2 The short-term memory

Once information is attended to in the sensory register, it is transferred to the short-term memory for further processing (Gagne', 1985:72; Williams, 1985:3303). Information lasts for only about twenty seconds in this memory store (Woolfolk, 1990:236; Biehler & Snowman, 1993:384). To prevent an immediate loss of this information, it has to be rehearsed to keep it longer in the short-term memory to provide opportunity for integration with prior knowledge (Gagne', 1985:72; Parker, 1993:10).

The short-term memory has a limited capacity. The capacity of the short-term memory is said to be seven plus or minus two (i.e. $7+$ or -2) items at a time (Williams, 1985:3303; Woolfolk, 1990:237). The capacity of the short-term memory is determined by the complexity of the learning task or information to be processed. If the task is easy, the short-term memory increases its accommodation capacity, and if the task appears to be difficult, it decreases its accommodation capacity (Williams, 1985:3303; Woolfolk, 1990:237).

The short-term memory is often referred to as the working memory because it holds information that individuals think about at any given moment (Williams, 1985:3303; Woolfolk, 1990:237). Cognitive psychologists equate short-term memory with consciousness (Woolfolk, 1990:237). Information is kept active in the short-term memory for further processing through rehearsal and is organized through chunking to accommodate large amounts of information without exceeding the capacity of the short-term memory.

3.2.2.2.1 Rehearsal

Rehearsal involves the repetition of information to oneself, either silently or out loud (Biehler & Snowman, 1993:384). The purpose of rehearsal is to provide time for processing or encoding information for immediate or later use (Williams, 1985:3303). Cognitive psychologists distinguish between maintenance and elaborative rehearsal (Biehler & Snowman, 1993:384).

Maintenance rehearsal refers to the rote rehearsal or repetition of information to hold the information in the short-term memory for immediate use (Biehler & Snowman, 1993:384; Shuell, 1990a:12). For example, when a student wishes to phone a friend, he may look for a number in the directory and repeat it a number of times until the number is dialed. Maintenance rehearsal will help a student remember the number just long enough to dial it.

Elaborative rehearsal or elaborative encoding is a process that consciously relates new information to the knowledge already stored in the long-term memory (Biehler & Snowman, 1993:384). Elaborative rehearsal is aimed at facilitating both the transfer of information to the long-term memory and its maintenance in the short-term memory (Biehler & Snowman, 1993:384). For example, if a student wants to learn lines for a part he performs in a drama, he may try to relate the dialogue and behaviour of his character to similar personal experiences he remembers, and as he strives to memorize lines and actions, his mental elaborations will help him store the knowledge of his part in the long-term memory so that he can retrieve it later when he has to perform.

3.2.2.2.2 Chunking

Since the short-term memory can hold only seven plus or minus two items at once, individual bits of information are combined or organized through a process called chunking to create more room for large amounts of information without exceeding the capacity of the short-term memory (Williams, 1985:3303; Woolfolk, 1990:237). For example, if a student is given six digits to learn in preparation for balancing equations (i.e. 3 7 5 8 2 9), he may put them into chunks of three digits each (e.g. 375; 829), or into three chunks of two digits each (e.g. 37; 58; 29) to make it much easier for him to recall. This is a strategic process that helps to increase a students' capacity to recall learned material and enhances his academic performance during testing and examinations.

3.2.2.3 The long-term memory

Selected information that represents meaningful concepts (i.e. visual images or verbal units) is transferred from the short-term to the long-term memory through encoding processes (Gagne', 1985:72; Woolfolk, 1990:238). Once information is securely stored in the long-term memory, it apparently remains there permanently. Storing information in the long-term memory requires an integration of the newly learned material with information already stored in the long-term memory (Woolfolk, 1990:238). Storing information involves how it is represented (i.e. through visual images) and how it is organized (e.g. through verbal units; Woolfolk, 1990:238).

3.2.2.3.1 Encoding of information

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Encoding of information involves the addition of personal meaning to the new material to reflect the underlying relationship between new incoming information and already processed or prior knowledge (Shuell, 1988:288; Gagne', 1985:82). The encoding process can either be visual (i.e. how information is represented), or verbal (i.e. how information is organized; Shuell, 1988:289; Woolfolk, 1990:238). The manner in which new information is encoded not only determines what information is to be stored in memory, but also how it should be accessible for use as well (Shuell, 1988:289).

3.2.2.3.2 Retrieval of information

Retrieval of information refers to a process that requires cues to locate stored information which, after recognition, will be recalled into working memory as accessible information which will then be integrated with new information to form new knowledge structures (Williams, 1985:3305). Cognitive theorists believe that learning occurs when knowledge is retrieved from the long-term memory into the working memory to match what is learned with the newly presented information (Gagne', 1985:73).

3.2.3 Levels of information processing

Different levels of information processing can be distinguished. Houston (1981:183) defines levels of information processing as the idea that durability of learning depends on how information is processed. Durability of information is determined by the depth at which information is processed. If the processing is deep (i.e. when semantic properties are attended to), the recall of information will be more durable, whereas when the structural properties (i.e. what it looks like) are attended to, processing will be relatively

shallow and the recall of information will be weak (Houston, 1981:354; Miller, Alway, & Mckinley, 1987:399).

In this paragraph approaches to learning will be discussed from the context of everyday studying. According to Schmeck (1988:320), an approach to learning involves the learning process that emerge from students' perceptions of the academic tasks as influenced by their personal characteristics such as use of learning strategies, learning styles, and metacognitive knowledge. An approach to learning stems from an interaction between the general orientations that an individual displays across a particular learning situation and over time on one hand, and the current task and situational demands on the other (Miller *et al.*, 1987:399; Alexander & Judy, 1988:375).

The best approach to learning is aimed at helping students to add meaning and organization to what they are trying to learn (Entwistle & Waterson, 1988:258; Hattie & Watkins, 1988:345). Students must be made aware of their own way of approaching learning tasks and understanding their contents for their improved performance (Marton, 1988:80). For example, if learners can be made aware of how to summarize, create analogies, use inferential processes, create organizational schemes and outline texts, learning to learn in a genuine sense of the word can be enhanced. Two basic approaches to learning are those distinguished as the surface and deep approaches (Marton, 1988:65; Entwistle, 1988:24).

3.2.3.1 A surface approach

Surface or shallow processing of information involves rehearsal designed to hold information in memory for immediate use, and not to process it so deeply that it may become part of the permanent store of information (Houston, 1981:185; Hattie & Watkins, 1988:345). For example, when someone is given a number to dial, he may rehearse it verbally so that he will not forget it while searching for a pen and paper to have it written somewhere.

With a surface approach, there is little or no personal engagement in the act of learning (Entwistle, 1988:24; Entwistle & Waterson, 1988:259). Individuals with a surface approach fail to recognise the relationship between bits and pieces of a whole that are to be integrated to produce meaning (Ausubel, 1968:42; Shuell & Moran, 1994:3341). Learners with a surface approach regard information presented as not having personal significance to them, because they are more concerned with task completion than with improving their knowledge and skills (Entwistle, 1988:24; Hattie & Watkins, 1988:345; also see par. 3.3.3.1.1).

Students with a surface approach adopt an atomistic or sequential process of learning, or in other words, focus on the sequence of the text and lack orientation towards information as a whole (Entwistle, 1988:25). An atomistic or sequential process of learning fails to include the crucial stage of reorganization and reinterpretation and the outcome becomes a complete reproduction of the text (Entwistle, 1988:25).

Since students with a surface approach employ strategies that lead to rote memorization, they fail to distinguish between essential points and incidental facts or between principles and examples (Entwistle, 1988:25; Hattie & Watkins, 1988:346). Students with a surface approach are therefore unlikely to establish relationships between evidence and conclusions, or examine an argument in a critical way because they fail to build up an overview of what is learned (i.e. comprehension learning; Entwistle & Waterson, 1988:259; Entwistle, 1988:26).

3.2.3.2 A deep approach

Deep processing of information is concerned with the level of learning that prepares information for future use (Houston, 1981:185). Deep processing results in better and more durable learning (Entwistle & Waterson, 1988:259; Miller *et al.*, 1987:399). For example, when a student processes a list of words on a semantic level (i.e. a level of processing that involves the meaning of the word), his learning is likely to result in deep processing. Once the level of processing is deep, the recall of information is more rapid (Houston, 1981:183; Miller *et al.*, 1987:401). In an experiment on levels of information processing conducted by Craik and Tulving (1975; quoted by Houston, 1981:181), subjects were shown a long series of words for very brief periods of time, it was found that items in a semantic condition (i.e. deep processed items) were recalled more accurately than items in a structural condition (i.e. shallow processed items) during recall tests. Information that is processed in depth is believed to be retained more accurately than information processed in a shallow fashion (Houston, 1981:184; Miller *et al.*, 1987:401).

In a deep approach to learning students start with an intention to extract personal meaning from the text, a process that leads to active learning (see par. 3.2.1) in which students challenge ideas, evidence, and arguments presented to them (Ausubel, 1968:108; Entwistle, 1988:24). A deep approach to learning enables students to see the relationships among ideas presented and link them with their personal experiences (Entwistle, 1988:24).

Students with a deep approach to learning adopt a holistic (i.e. global) approach in integrating (see par. 3.2.2.3.1) information into memory with an intention to establish a network of meaningful connections between new information and previously established ideas, concepts, and factual experiences which result into meaningful learning (Miller *et al.*, 1987:399). In order for the information to be meaningful and capable of being understood, it must be structured and be organized (Shuell & Moran, 1994:3341). Learners can, for example, use organizational strategies (see par. 3.3.3.1.3) to organize information. By using such strategies, learners can internalize large quantities of new word meanings, concepts, and propositions with relatively little effort and few repetitions (Ausubel, 1968:58; Shuell & Moran, 1994:3341). Individuals with a deep approach to learning are reported to be independent, have an internal locus of control, and a high sense of self-efficacy (Shuell & Moran, 1994:3341).

3.5 LEARNING STRATEGIES

The aim of this paragraph is to give an overview of how learning strategies can help influence the ways in which students study new material, process information and improve the planning, execution, and organization of their learning tasks for better performance. Knowledge that students acquire about learning strategies can help them become strategic learners who can take significant responsibility for their own learning in order to become self-regulated learners (Weinstein & Meyer, 1991:17; Weinstein, 1987:591).

3.3.1 Definition of learning strategies

Learning strategies can be defined as the behaviours and thoughts that learners engage in during learning and which are intended to facilitate understanding, knowledge and skills acquisition (Klauer, 1988:355; Bjorklund, Mulr-Broadus & Schneider, 1990:93). Directing attention to important aspects of a learning task and organizing, processing and storing information in memory are examples of such thoughts and actions (Weinstein, 1988:291). Learning strategies are further defined as goal-oriented procedures that students can use either prior to, or during task accomplishment. These strategies are aimed at helping students to acquire new information, retrieve stored information during task accomplishment, regulate, execute or evaluate learning tasks (Mayer, 1988:11).

3.3.2 General characteristics of learning strategies

Learning strategies are goal-directed in nature in that they help students to reach the standard of performance required to attain a learning goal (Alexander & Judy, 1988:376; Pressley, 1986:139). When students are given a passage to identify and recall a set of main ideas (i.e. standard of performance), they may use an organizational strategy such as networking to identify the main internal connections from the passage that will enable them to recall (i.e. learning goal) the main ideas with ease.

Learning strategies are effortful processes that require time and often involve the use of highly interactive steps to accomplish learning tasks (Bjorklund *et al.*, 1990:97; Weinstein & Meyer, 1991:17). For example, when a student is listening to a lecture, he may use a note taking strategy (i.e. a form of complex rehearsal strategy) that involves paraphrasing in his own words, abbreviating words, and making distinctions between superordinate and subordinate information for better understanding of the learning task.

Learning strategies are situation specific in that no single strategy or set of strategies can meet all learning demands (Weinstein, Meyer & Van Mater Stone, 1994:359; Weinstein & Meyer, 1991:17). Students must also understand under what conditions or circumstances a given strategy is or is not appropriate to select or use (Shute, 1994:3327; Campione & Armbruster, 1985:331; see par. 3.3.5.3).

3.3.3 Taxonomies of learning strategies

Taxonomies of learning strategies refer to the organizational schemes used for classifying learning strategies (Weinstein, 1987:592; Pintrich, 1989:130). Learning strategies can be grouped into three main categories, viz. cognitive, metacognitive, and resource management strategies (Pintrich, 1989:130; Pintrich & Schrauben, 1991:159). The cognitive category (par. 3.3.3.1) includes strategies related to the students' learning or encoding of information as well as strategies that help in facilitating retrieval of information (Pintrich, 1989:130; Gagne', 1986:124).

Metacognitive or comprehension monitoring strategies (par. 3.3.3.2) are concerned with the individual's knowledge about his cognitive processes as well as his ability to control such processes through planning, monitoring, regulating, and modifying them as a function of learning outcomes (Weinstein, 1987:592; Weinstein & Rogers, 1984:4).

Resource management strategies (par. 3.3.3.3) are concerned with resources that students can use to facilitate their learning (Thomas & Rohwer, 1986:25; Pintrich & Schrauben, 1991:162).

3.3.3.1 Cognitive strategies

Cognitive strategies involve plans or techniques that learners employ to generate connections between the information that they are trying to learn, and knowledge already organized in their memory in order to reach their learning goals (Weinstein & Meyer, 1991:17; Pintrich, 1989:130). The more connections that can be generated during learning, the more meaning will be created for the new information, thus the deeper the level of processing, the easier it will be to hold the information or knowledge for future use. For example, concepts from an introductory course may be difficult to learn because there is little or no prior knowledge about the topic or field which may aid the generation of connections between new information and prior knowledge. The absence of prior knowledge may also force students to rote learn new information. In an advanced course where the student has established a rich set of prior knowledge which is well organized and integrated into rich knowledge structures, it is easier for a student to generate connections and to make sense out of new information he learns (Weinstein, 1988:293).

Students' cognitive strategies for learning include strategies such as rehearsal, elaboration, and organization (Weinstein & Meyer, 1991:19; Weinstein, 1988:293).

3.3.3.1.1 Rehearsal strategies

Rehearsal strategies require or refer to repetition in various forms ranging from simple repetition of concepts to underlining important sections of the material studied (Weinstein, 1987:592; 1988:293). As rehearsal strategies are designed to facilitate verbatim recall of information, they are ineffective in helping students to process information at a deep level of understanding because they operate on a surface level of information processing (Weinstein, 1987:592; 1988:293; see par. 3.2.3).

Rehearsal strategies are assumed to help students attend to and select important information from texts and keep this information active in the working memory for further processing (Weinstein, 1987:592; Pintrich & Shrauben, 1991:160).

Rehearsal strategies are found to be more effective in introductory courses that require simple recall, and in training programmes of basic knowledge because the acquisition of such knowledge is often the first step in the creation of a more extensive and integrated knowledge base in an area (Weinstein, 1988:293).

Because of the complexity of learning material, rehearsal strategies for basic learning tasks and rehearsal strategies for complex learning tasks are distinguished (Weinstein & Mayer, 1986:316; Weinstein, 1988:293).

*** Rehearsal strategies for basic learning tasks**

Rehearsal strategies for basic learning tasks refer to instances where a learner has to recite (e.g. a poem) or actively saying the presented material or information during learning (Weinstein & Mayer, 1986:317; Weinstein, 1988:293). Rehearsal strategies for basic learning tasks are aimed at selecting and acquiring simple information units to be transferred to the working memory for further processing (Weinstein & Mayer, 1986:317; Pintrich, 1989:130). For example, learners may use a rehearsal strategy such as repeating the names of mountains and rivers of the world in order to memorise them for future verbatim recall.

In a study conducted by Flavell, Friedrichs and Hoyt (1970: quoted by Weinstein and Mayer, 1986:317), it was found that the use of rehearsal strategies increases with age. Younger children are less likely to spontaneously use rehearsal strategies than older children because they have limited knowledge resources. Evidence on developmental changes in efficiency of strategy execution comes from a study conducted by Bjorklund *et al.* (1990:93), who found that older children and adults are better able to take advantage of the greater efficiency that a strategy affords than younger children because they already have sufficient knowledge resources available to apply the strategy.

*** Rehearsal strategies for complex learning tasks**

Rehearsal strategies for complex learning tasks involve learners actively copying the information over into a notebook, or taking notes while reading and selecting important sections (i.e. underlining) of the information during learning to facilitate recall (Weinstein & Mayer, 1986:318; Pintrich, 1989:130). In a study conducted by Rickard and August (1975: quoted by Weinstein and Mayer, 1986:318) on copying or underlining important aspects of a learning tasks, it was found that students who underlined sentences in a passage did better in recalling information than students who just read the passage without underlining.

3.3.3.1.2 Elaboration strategies

Elaboration strategies involve adding meaningful connections to what the students are trying to learn in an attempt to make the information more meaningful (Weinstein, 1987:592; Weinstein, 1988:293). Such meaningful connections which may be imaginal

or verbal, help students to store information in the long-term memory by building internal connections between new information and prior knowledge (Weinstein & Mayer, 1986:319; Weinstein, 1988:293).

Elaboration strategies are concerned with a relatively deeper level of information processing than rehearsal strategies (Pintrich & Schrauben, 1991:160). Elaboration strategies therefore enable students to gain a deeper level of understanding and help them incorporate new information into existing prior knowledge through networking (i.e. a technique used in breaking down a passage into parts and identifying linking relations between parts; Pintrich & Schrauben 1991:160; Dansereau, 1985:221).

Weinstein and Mayer (1986:316) distinguish between elaboration strategies for basic learning tasks and elaboration strategies for complex learning tasks.

*** Elaboration strategies for basic learning tasks**

Elaboration strategies for basic learning tasks are aimed at building connections or ideas between two or more items in the to-be learned material (Weinstein & Mayer, 1986:319; Weinstein & Meyer, 1991:20). Elaboration strategies for basic learning tasks include forming a mental image or generating a sentence that connects two or more items to make what students are trying to learn more meaningful (Weinstein & Mayer, 1986:319; Weinstein, 1988:293). For example, when students are presented with an unfamiliar concept (e.g. an unfamiliar animal such as a leopard) they may arbitrarily assign it to a category of familiar concepts (e.g. cat family) because of its similarities to familiar material for which context cues are available. When a student creates an analogy between known concepts and the to-be learned material, he compares and contrasts new information and prior knowledge to try make sense of the new material he has to learn. The process of comparing and contrasting helps students to build connections between new information and prior knowledge so that this new information can easily be transferred to the long-term memory (Weinstein & Meyer, 1991:20).

Levin *et al.*, (1982: quoted by Weinstein & Mayer, 1986:319) report that learners who use key words to learn definitions of certain concepts, do better than learners without any such support mechanism in memory-related tasks and can generalize the use of this strategy in their everyday school related tasks. For example, a keyword such as "purse" can be used to learn the definition of the verb "persuade". Students can be shown a picture indicating an interaction of the keyword with the definition of the concept such as a woman being persuaded to buy a purse. The use of such a mental imagery strategy helps students form relations of the action sequence through interactive images that may facilitate recall (Willoughby, Wood & Khan, 1994:281).

* **Elaboration strategies for complex learning tasks**

Elaboration strategies for complex learning tasks focus attention on improving students' understanding and task performance by integrating presented material with prior knowledge (Willoughby *et al.*, 1994:279; Dempster, 1988:254).

Elaboration strategies for complex learning tasks include activities such as paraphrasing (i.e. changing the study material into one's own words), summarizing (i.e. writing down important ideas while reading) creating analogies (i.e. finding out connections between what is studied and one's own experiences), generative note taking (i.e. being able to draw distinctions between more important and less important information), and question answering (i.e. self-evaluation; Weinstein & Mayer, 1986:320; Pintrich, 1989:131). These activities help students to integrate and connect new information with prior knowledge. By paraphrasing what they are reading, students may, for example, actively connect the new text information with their prior knowledge (Pintrich, 1989:131).

3.3.3.1.3 **Organizational strategies**

Organizational strategies are used to help learners transform information into another format that is easier to understand and thus result in deep processing and meaningful learning (Weinstein, 1987:592; Weinstein, 1988:294;). Organizational strategies help in creating meaning for the presented information so that it can incorporate new information into existing prior knowledge through networking (Bjorklund *et al.*, 1990:103; Weinstein & Meyer, 1991:221). Organized information makes recall easier than unorganized and unstructured information.

Weinstein and Mayer (1986:316) distinguish between organizational strategies for basic learning tasks and organizational strategies for complex learning tasks.

* **Organizational strategies for basic learning tasks**

Organizational strategies for basic learning tasks involve sorting items into different main categories to make it easier to understand and construct connections among them (Pintrich, 1989:294). If students are supplied with a list of words such as table, van, desk, truck, sofa, and bus to organize, they may separate the items such as table, sofa and desk (i.e. furniture) from the items bus, van and truck (i.e. modes of transport) on the basis of their shared characteristics.

Younger children are assumed to have problems in using organizational strategies compared to older ones because though they possess the appropriate skills, they fail to

use these spontaneously during learning. This is what is called a production deficiency, that is, they do very little to monitor their own memory, comprehension, and other cognitive processes (Weinstein & Mayer, 1986:321; Flavell, 1979:906). In a study conducted by Moely (1969: quoted by Weinstein & Mayer, 1986:321) on children's failure to use organizational strategies, it was found that after children were taught how to apply an organizing strategy to list learning items, they were able to do so and their recall performance increased.

*** Organizational strategies for complex learning tasks**

Organizational strategies for complex learning tasks involve the students' organising the information necessary to learn by for example, outlining main events and characters in a story (Weinstein & Mayer, 1986:322; Weinstein, 1988:294). Organizational strategies for complex learning tasks are aimed at facilitating the encoding and recalling processes through outlining and organizing material in order to differentiate between the main ideas and supporting details (Weinstein & Mayer, 1986:322; Pintrich, 1989:131).

In a study conducted by Holly *et al.* (1979: quoted by Weinstein & Mayer, 1986:322) on strategies used to train students to identify main internal connections in a passage through networking (see par. 3.3.3.1.2), it was found that subjects trained in identifying main internal connections did better in recalling main ideas than untrained ones.

3.3.3.2 Metacognitive or comprehension monitoring strategies

Metacognitive or comprehension monitoring strategies are concerned with students' knowledge about their cognitive processes as well as their abilities to control such processes through planning, monitoring, regulating, and modifying them as a function of learning outcomes (Pintrich, 1989:130; Pressley, 1986:140).

Planning refers to cognitive processes such as goal-setting, generating questions and doing task analysis of the problem to be solved or the task to be completed (Jacobs & Paris, 1987:259; Schmitt & Newby, 1986:30). These activities help students plan their use of strategies to facilitate the processing of information and activate relevant aspects of prior knowledge that make organizing and comprehending the material easier (Schmitt & Newby, 1986:30; Jacobs & Paris, 1987:259). Effective and competent learners are believed to engage themselves in more planning and more metacognitive activities than poor learners (Pintrich, 1989:132).

Monitoring or evaluation (see par. 2.3.3.2) involves steps or measures that learners take to evaluate their own understanding or progress towards goal attainment (Jacobs & Paris,

1987:259; Schmitt & Newby, 1986:30). Evaluation activities include tracking of one's attention as one reads, self-testing while reading a text to ensure comprehension of the material, and monitoring comprehension of a lecture (Pintrich, 1989:133; Schmitt & Newby, 1986:30). These various activities help students in understanding and integrating new information with prior knowledge.

Pintrich (1989:133) postulates that self-regulation activities are related to evaluation or monitoring activities because as learners monitor their comprehension of the text, they can regulate their reading speed to adjust to the difficulty of the material. Adjustments and fine-tuning of cognition are important components of metacognition that improve performance. Self-regulation includes behaviours such as reading, reviewing material, and test taking strategies such as skipping questions and coming back to them later in the examination (Schmitt & Newby, 1986:31; Jacobs & Paris, 1987:259).

3.3.3.3 Resource management strategies

Resource management refers to all the sources that students can use to make learning easier. Resource management strategies are designed to assist students in managing these resources in terms of effort and persistence and are aimed at helping students to manage time and their study environment, to seek help and to manage their effort as they attempt different academic tasks (Andrich, 1985:5265; White, 1994:5545). Resources that students use for learning include the physical setting of their environment, social assistance, effort, and the time available for studying (Pintrich, 1989:133; Thomas & Rohwer, 1986:25).

3.3.3.3.1 Time management

Time management is an important self-management activity in studying (Pintrich, 1989:133; White, 1994:5545). Time that students make available for their studies varies from monthly and weekly scheduling to the daily management of studies (Pintrich, 1989:133; Andrich, 1985:5265). Students need to have a weekly schedule for studying that will help them to organize their study time properly. A student may, for example, set aside three hours for efficient studying every evening, but if the three hours are not possible, then he can reduce these to two, or increase the amount of time spent on studying to four hours.

Because of the potential complexity of study events, students must plan the time they are likely to take to accomplish their learning tasks. Time management needs to be flexible enough to give students enough chance for example, to prepare themselves for mid-term

and final examinations without losing sight of other activities which are still to be carried out before the examination (Pintrich, 1989:133; Weinstein, 1988:309). Students may, for example, employ a workbook to specify their long- and short-term goals, and schedule their time appropriately, then monitor their progress in achieving those goals.

Time regulation also involves time that students may assign to review their study material to achieve their learning goals or to prepare for tests and examinations. Review sessions involved in time regulation offers an immediate feedback on the strengths and weaknesses of learning activities, thereby giving students an opportunity to alter their learning and study strategies if those employed do not bring any success. Time regulation allows continuous monitoring of learning events and thus produces higher levels of achievement because it conveys information about how instructional events occur (Thomas & Rohwer, 1986:25; Andrich, 1985:5265).

3.3.3.3.2 The study environment

The study environment refers to the students' defined area for studying which may include a variety of settings which need proper management to enhance learning (Pintrich, 1989:134; Zimmerman, 1988:7). Management of these settings involves adequate lighting, enough space for every one to study and make it free from distractions which may be visual or auditory (Pintrich, 1989:134; Zimmerman, 1988:7).

Students cannot focus their attention when there are many distractions such as other students talking, loud music or having a television on. Students must therefore organise their study environment in such a way that it is free from distractions to facilitate their concentration and enhance their learning (Zimmerman & Martinez-Pons, 1986:618; Zimmerman, 1988:7).

3.3.3.3.3 Help seeking

Help seeking refers to learning support that students receive from other students, their teachers, or their parents (White, 1994:5545; Nelson-Le Gall & Glor-Scheib, 1986:187). Students need to know when, how, and from whom to seek and obtain help to enhance their learning performance. Good learners know that, when they are faced with difficulties they may ask someone (i.e. be it a peer, their teacher, or their parents) who is more knowledgeable to help them (Pintrich, 1989:134; White, 1994:5545).

Appropriate help seeking improves students' academic performance and enhance their learning because help involves social interaction which enables students to act on a

higher level of cognition. When students act under appropriate guidance, they are likely to do well because they are led by an expert in the field concerned (White, 1994:5545; Campione & Armbruster, 1985:332). For example, poor performers can arrange a review session with their teacher which can serve as remedial action on strategies they use for studying and learning their tasks.

3.3.3.3.4 Effort management

Effort management refers to students' persistence at difficult or boring tasks and working diligently until they finish their learning tasks (Pintrich & De Groot, 1990:35). For example, an effective learner may keep on working until he finishes his learning task even if the study material is dull and uninteresting.

Effective effort management is influenced by the value component of students' motivation and their beliefs about the importance and interest in the learning task (Pintrich & De Groot, 1990:34; Pintrich, 1989:135). Students with a motivational orientation that involves goals of mastery, learning, and positive beliefs about a learning task, will persist longer at difficult tasks than students who do not believe that they can perform the task, or who have negative goal orientation (Pintrich & De Groot, 1990:34).

3.3.4 The influence of learning strategies on academic achievement

Students' academic achievement is influenced by the effective use of learning strategies and the effect these strategies have on students' capacity to process, organize and recall vast amounts of information (Woolfolk, 1990:241; Levin, 1988:198). In a study conducted by Rosenheck *et al.*, (1987: quoted by Levin, 1988:198) on associative mnemonic strategies for recalling the learned material, it was found that students provided with mnemonic elaborations such as recording (i.e. rewriting unfamiliar concepts into more familiar or concrete concepts), relating (i.e. relating the concept either pictorially or verbally to its definition), and retrieving (i.e. creating a direct path from the concept to its picture) outperformed students who were left to their own devices to learn.

Effective and efficient learning in the classroom is influenced by students' knowledge about what learning strategies to select and use (Weinstein & Meyer, 1991:19; Alexander & Judy, 1988:375). In an experiment conducted by Pressley, (1986: quoted by Levin, 1988:196) on strategy use, where subjects were exposed to both effective and ineffective learning strategies to determine whether or not they would adopt an effective strategy in a future learning situation, it was found that once students became aware of

the effectiveness of a learning strategy, they tended to use it more often when accomplishing tasks related to the use of that strategy.

Items processed with an effective learning strategy are typically remembered much better than items processed with an ineffective learning strategy. Such realizations are reflected by students' results of their performance (i.e. strategy knowledge) or by their selection of the more effective strategy on a subsequent learning task (Levin, 1988:196; McKeachie, 1987:451). This knowledge can lead students towards more positive expectations of future attainments and greater development of competency in learning (Levin, 1988:196; McKeachie, 1987:451).

3.3.5 The importance of knowledge for effective learning

The knowledge that students have about their own strengths and weaknesses as learners, and what they know about the nature and requirements of different learning tasks, interacts with their knowledge of learning strategies to enable them to select and use appropriate learning strategies effectively and efficiently. Flavell (1979:907) defines such knowledge as metacognitive in nature (i.e. self-awareness or self-appraisal of cognition).

3.3.5.1 Students' knowledge about themselves as learners

Weinstein and Meyer (1991:18) have identified two types of students' self-knowledge, viz. knowledge about how one learns and knowledge about one's prior knowledge of the content or subject being studied. Knowledge about how one learns is concerned with students' awareness of themselves as learners, that is, how reflective they are about themselves as learners and how tuned in they are to themselves as learners (Paris & Winograd, 1990:17; Shute, 1994:3326). Successful students know which learning style they prefer, which subjects are easier or more difficult for them to learn, and what their best and worst time of the day are for studying (Shute, 1994:3326; Weinstein & Meyer, 1991:19).

Knowledge about one's prior knowledge of the task content involves students' use of prior content knowledge in a particular learning task to accomplish their learning goal (Alexander, Kulikowich & Schulze, 1994:314; Weinstein & Meyer, 1991:19). This knowledge must be organized and integrated in a meaningful way to help students make sense out of new material they try to learn and help them store related information together (Alexander *et al.*, 1994:314; Shute, 1994:3327). Relating new information to prior knowledge not only helps with immediate learning, but also helps move

information from the short-term to the long-term memory for storage so that it can be used in future (Weinstein & Meyer, 1991:19). For example, a student who has knowledge about objects that are attracted by a magnet, can use this knowledge to pull out a bolt that has fallen into oil while repairing his bicycle.

Knowledge about oneself as learner also enables individuals to manage their internal and external resources necessary for attaining learning goals (Alexander *et al.*, 1994:314; Shute, 1994:3326). This knowledge includes personal resources such as emotions and study strategies which are responsible for students' decisionmaking and which plays a significant role in students' learning.

3.3.5.2 Students' knowledge about learning tasks

Students' knowledge about learning tasks involves knowledge of tasks such as reading textbooks, listening to lectures, watching demonstrations, writing papers, taking notes, and writing tests or examinations (Pintrich & Schrauben, 1991:157; Blumenfeld, Mergendollar & Swarthout, 1987:136). Learning tasks differ in form and content (Blumenfeld *et al.*, 1987:136).

Task form involves the students' purpose in doing the task, their understanding of the procedures to be followed, their perception of task-specific abilities, and their interest in completing the task (Paris & Newman, 1990:91; Blumenfeld *et al.*, 1987:136). Students' perception of task-specific abilities influence their approach towards learning tasks and their cognitions and behaviours while working (Blumenfeld *et al.*, 1987:139; Weinstein & Meyer, 1991:19). When students consider the task to be difficult, they may approach it more hesitantly.

The complexity of procedures affects how students work and what they learn (Blumenfeld *et al.*, 1987:139; Shute, 1994:3326). Some procedures to be followed are more complex than others when setting out to accomplish tasks. For example, completing a worksheet is not as complex as writing a report about an experiment in the science laboratory. A worksheet requires students to fill in the blanks, whereas writing a report requires them to gather and synthesize information, write grammatically correct English or whatever the language may be, and to communicate in an organized and clear fashion (Blumenfeld *et al.*, 1987:139).

Task content includes the objectives that students are expected to attain as well as the subject matter they are expected to know (Shute, 1994:3327; Blumenfeld *et al.*, 1987:137). Different learning objectives require different levels of cognitive processing

and different prerequisite skills (Shute, 1994:3327; Weinstein & Meyer, 1991:19). Different levels of cognitive processing enable students to meet both their short and long-term goals. For example, students may use what they have learned presently or in the future to meet either their academic, personal, social, or occupational goals.

Students' reactions to task content are influenced by their beliefs about its inherent appeal, its difficulty, and their familiarity with the topic (Blumenfeld *et al.*, 1987:138). The difficulty of the subject influences students' interest and work orientation (Blumenfeld *et al.*, 1987:138; Shute, 1994:3327). Since many children view science and maths as difficult subjects that require high levelled thinking, they are less likely to persist in doing these subjects because they are more ready to assume that they are unable to complete their assignments (Shute, 1994:3327).

The familiarity of the learning content encourages students to exert more effort when completing assignments because they are fairly certain about their success (Shute, 1994:3327; Norwich, 1987:387). Students' knowledge about different learning tasks offers them a chance to become independent learners, capable of selecting and designing their own learning activities (Campione & Armbruster, 1985:333). For example, when an individual has knowledge about the task to be completed, he may first select appropriate and effective learning strategies before tackling it.

3.3.5.3 Students' knowledge about which learning strategies to select and use

The use of effective and efficient learning strategies facilitates acquisition, integration, organization, and storage of information (Campione & Armbruster, 1985:331). Properly and efficiently selected strategies aid in organizing, generating and maintaining motivation, making new information more meaningful, and integrating new information with prior knowledge (Campione & Armbruster, 1985:331).

The effective use of learning strategies depends upon students' declarative, procedural, and conditional knowledge of learning strategies. Forms of declarative, procedural, and conditional knowledge of learning strategies answer questions about what one knows, how one thinks and when and why to apply strategies (Schmitt & Newby, 1986:29; Shuell, 1990b:537). Declarative knowledge informs students about a variety of learning strategies that can be used in accomplishing learning tasks. Procedural knowledge informs students of how each learning strategy works, and conditional knowledge is concerned with knowledge of when, where, and why a particular learning strategy, and not a different one, should be used.

3.4 SELF-EFFICACY

Self-efficacy is discussed in this chapter as an important variable in understanding motivated learning that enables one to explain students' self-regulated learning efforts. High self-efficacy stimulates effort and persistence when problems are encountered while low self-efficacy leads to avoidance techniques and lack of effort (Schunk 1991b:121).

3.4.1 Definition of self-efficacy

Self-efficacy refers to the personal beliefs that one can successfully accomplish the activities required to produce designated outcomes (Bandura, 1986:391; Schunk, 1994a:3; also see par. 2.3.2). Self-efficacy is not concerned with the skills one has, but with the judgement of what one can achieve with whatever skills one possesses (Bandura, 1986:391).

Bandura (1986:391) distinguishes efficacy and outcome expectations (see fig. 3.2). Efficacy and outcome expectations are differentiated because learners may believe that certain actions will produce positive outcomes, but may not act on those outcome beliefs because they doubt their capabilities to execute such actions (Bandura, 1986:392). Perceived self-efficacy is concerned with the judgement of one's capability to perform designated tasks, whereas outcome expectations are concerned with what will result from such actions or activities (Bandura, 1986:391). For example, the belief that one can jump six feet high is an efficacy judgement, but the anticipated social recognition, applause, and self-satisfaction resulting from such a performance will constitute the outcome expectations. It is important to note that Bandura (1986:391) cautions that an outcome is the result of an act and not the act itself.

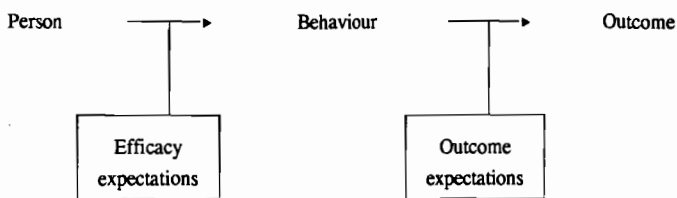


Figure 3.2: Diagrammatic representation of the difference between efficacy expectations and outcome expectations (Bandura, 1977:193).

Efficacy judgements influence students' choice of learning tasks or behavioural settings (Bandura, 1982:123; Schunk, 1985:210). Students tend to avoid threatening situations if they believe that such situations exceed their coping skills and rather become involved in activities they are capable of controlling (Bandura, 1977:194; Schunk, 1985:210). Students who judge themselves efficacious participate more eagerly in learning tasks, whereas those ridden with self-doubt (i.e. perceive themselves more inefficacious) may try to avoid learning tasks (Bandura, 1982:123; 1986:394).

Efficacy judgements determine how much effort an individual will expend and how long he will persist in difficult situations (Bandura, 1977:194; Schunk, 1988:23). Students who have serious doubts about their capabilities slacken their effort, or give up altogether when facing difficulties, whereas those with a high sense of efficacy exert greater effort and persist longer to master the challenge (Bandura, 1982:123; 1986:394).

Efficacy judgements are likely to produce positive outcomes when combined with appropriate skills and adequate incentives because these factors help sustain effort in dealing with stressful situations (Schunk, 1985:211). As students work on their learning tasks, they note their progress towards learning goals which, in turn, acts as an incentive that enhances their self-efficacy for continued learning. Students who regard themselves as efficacious, think, act, and feel differently from those who feel inefficacious and are thus able to actively shape their own future, rather than being told how it should be (Bandura, 1986:395).

Students who judge themselves highly efficacious, will expect favourable outcomes (Bandura, 1986:392). Outcome judgements are related to efficacy judgements in that students who perceive themselves inefficacious will expect low outcomes following their judgements of how well they will perform (Bandura, 1986:392; Schunk, 1985:215). For example, if a student is to write a maths test, he may have high efficacy judgements because he usually scores high in such tests, but may have low outcome judgements if he believes he has not studied hard enough and is not sure of some calculations.

3.4.2 Sources of self-efficacy

A student acquires information on self-efficacy from certain sources of information. McCombs (1988:144) postulates that these sources of information contribute to the development of an individual's judgements of his self-efficacy. The sources of self-efficacy can be differentiated into sources internal to the learner and sources external to the learner (Bandura, 1986:339-340; Schunk, 1989:84).

Bandura (1986:399) cautions that information acquired through these sources does not automatically influence self-efficacy, but should be appraised cognitively (see par. 3.4.3) to have an effect on students' academic performance.

3.4.2.1 Sources internal to the learner

Sources internal to the learner include, among others, enactive learning experiences and physiological reactions or emotional arousal.

3.4.2.1.1 Enactive learning experiences

Enactive learning refers to efficacy information acquired through the consequences of the individual's own actions (Bandura, 1985:276; Schunk, 1991b:87). Successful performance raises self-efficacy in proportion to the difficulty of the task, whereas repeated failure lowers it, more so if the mishaps occur early in the course of events (Bandura, 1985:276; Schunk, 1991b:87). A good learner gains very little by outperforming underachievers in a difficult task, but if he performs well against superior ones, his self-efficacy is enhanced.

Tasks that are successfully completed by oneself raise one's self-efficacy more than those completed with the help of others (Bandura, 1985:276; 1986:402). Tasks that are completed through team work do not increase self-efficacy as much as individual achievements, because learners like to credit their successes to their personal capabilities rather than to the external factors.

3.4.2.1.2 Physiological reactions or emotional arousal

Physiological reactions refer to information that individuals receive from their physiological state in judging their capabilities to perform designated tasks (Bandura, 1977:198; 1986:401; also see par. 2.3.2). For example, excessive perspiration may be an emotional symptom that can be interpreted as the student's belief in his inability to do well. High emotional arousal debilitates students' performance expectancies in that individuals who are beset by aversive experiences feel tense or disturbed when they encounter complex activities because such activities may prove their incapacity to do well (Bandura, 1985:277).

A reduction in anxiety or an increase in physical relaxation can facilitate performance because when someone knows that the fear is realistic, as is the case when writing an examination, he can develop self-competence through maintaining his concentration and

thereby manage his performance anxiety (Weinstein & Mayer, 1986:324; Bandura, 1977:200).

Students' mood states are believed to determine how they learn (Bandura, 1986:408). For example, it is assumed that students can complete tasks that suit their mood states faster and may recall them better if they are in the same mood as when they learned them. Intensive moods make congruent information more prominent, learnable, and memorable because when a particular unit in the memory network is activated, it facilitates recollection of events linked with it (Bandura, 1986:408).

3.4.2.2 Sources external to the learner

Sources external to the learner involve among others, vicarious experiences, verbal persuasion, instruction, strategy training, performance feedback, and goal-setting.

3.4.2.2.1 Vicarious experiences

Vicarious experience are acquired through modelled events presented to learners by their parents, their teachers, or peers (Bandura, 1986:403; Schunk, 1991b:87). Observation of models influences learning positively because observers are informed about appropriate and efficient ways of performing tasks (De Moulin, 1993:168; Schunk, 1984:49). Even students who constantly experience difficulties during learning will be motivated and encouraged to persist longer in accomplishing their tasks when they realise that their peers are performing the same or similar tasks with success (Schunk, 1984:49; Bandura, 1985:277).

Modelling provides the most informative comparative information for gauging one's own capabilities (Bandura, 1986:403). In a study conducted on peer modelling, it was found that after subjects had observed videotapes displaying a model (i.e. a peer) solving subtraction problems more readily using regrouping as a technique, they grasped subtraction problems easily and verbalised achievement beliefs (Schunk, 1989:37; Gorrell, & Capron, 1990:15).

Modelled activities serve as standards against which observers choose to compare their aspired competencies during self-observation (Bandura, 1977:198; 1986:406). Such comparisons with superior performers give rise to self-disapproval because observers may perceive themselves as lacking the ability to perform to a desired standard. Comparisons with less talented individuals in contrast produce favourable self-

evaluations because observers may display their capabilities to perform (Bandura, 1977:198; 1985:277).

Competent models teach observers effective strategies that they can use to deal with challenging or threatening situations (Bandura, 1985:277; 1986:405). Adoption of serviceable strategies can change a student's perceived self-efficacy because they reduce stress and increase preparedness for coping with threats (Bandura, 1985:277).

Modelled activities may reveal that tasks are more manageable than when they were originally perceived by observers. Seeing a skilled person failing to solve a problem through insufficient use of learning strategies or techniques, can boost self-efficacy in observers who believe they have more suitable strategies at their command (Schunk, 1989:26; Bandura, 1986:405).

Bandura (1986:404) distinguishes between mastery and coping models that can help students gain self-confidence when completing their learning tasks. Mastery models are believed to demonstrate faultless performance from the outset in task accomplishments, whereas coping models initially demonstrate fears and deficiencies of observers (i.e. inability to approach difficult tasks), but gradually improve their performances and gain self-confidence (Schunk, 1987:162; Schunk, Hanson & Cox, 1987:60).

In achievement settings, coping models benefit students who experience difficulties in learning new materials because students may perceive themselves as being similar in competence to coping models and believe that if the models can learn, they too can learn (Schunk *et al.*, 1987:60). Such benefits from coping models occur in part through increases in self-efficacy (Schunk, 1987:162). For example, if people of differing characteristics can succeed in accomplishing their learning tasks, then observers have a reasonable basis for increasing their own sense of self-efficacy because they perceive themselves as possessing similar competence.

Coping models emphasise effort attributions for improved performance by stressing increased attention and hard work, whereas mastery models emphasise high ability and low task difficulty (Schunk *et al.*, 1987:60; Schunk, 1987:162). Observers benefit more from seeing models overcome their difficulties through determined effort, than from observing performances easily achieved by proficient models (Bandura, 1986:404; Schunk, 1987:162). Gains achieved by intensified effort not only reduce students' negative affect, but also demonstrate that perseverance eventually brings success. Students are believed to give greater weight to perceived similarity in competence in judging their own self-efficacy when they have reliable information about their peers' learning abilities (Schunk *et al.*, 1987:60).

Observation of coping models raise self-efficacy more than mastery models (Schunk, 1987:162). In an investigation of five studies that were conducted by Schunk (1987:162) on the effects of mastery and coping models, three found the benefits of coping models to be more effective, whereas two found mastery and coping models equally effective. In a study conducted by Schunk and Hanson (1985: quoted by Schunk, 1987:62/3), subjects observed a mastery model and a coping model. The mastery model easily grasped problem-solving operations and verbalized statements reflecting positive achievement beliefs, stressing high self-efficacy (e.g. I can do that one), high ability (e.g. I am good at this), low task difficulty (e.g. That looks easy), and positive attitudes (e.g. I like doing these). The coping model was hesitant initially, made errors, and verbalized statements reflecting negative achievement beliefs, but gradually performed better and began to verbalize coping statements (e.g. I'll have to work hard on this one). Mastery models never verbalized negative beliefs. Observing coping models lead to the highest self-efficacy for skills improvement. Masterly students perceived themselves as equal in competence with the model, whereas coping students viewed themselves as more competent than the models (Schunk, 1987:164). The belief that one is more talented than an unsuccessful model, can thus raise self-efficacy and motivation (Schunk, 1987:164).

3.4.2.2.2 Verbal persuasion

Verbal persuasion refers to suggestions and encouraging statements that students receive from knowledgeable and trustworthy persuaders or people (De Moulin, 1993:168; Schunk, 1984:49). Learners can be encouraged to persist at tasks they are ready to discontinue or try things they are ready to avoid because of their inefficaciousness (Bandura, 1985:277; 1986:405). After having established that the persuader has some expertise towards task demands, learners may develop a positive attitude towards the learning task and feel confident to accomplish it because such persuasions can change their perceived self-efficacy (Bandura, 1986:406; 1977:198).

Bandura (1986:406) asserts that attempts to promote self-efficacy persuasively often take the form of evaluative feedback (i.e. given information that they are acquiring knowledge and skills) about ongoing performance. In a study conducted on attributional feedback, it was found that learners who lacked skills in solving mathematic problems and were periodically given attributional feedback such as "You are doing well" for their rate of progress in a self-paced learning program, did better during test sessions than their counterparts who were just credited on ability or received no feedback at all (Bandura, 1986:406). Encouraging feedback raises students' self-efficacy beliefs and

accelerates mastery of skills for more accomplishments (Weiner, 1984:28; Nicholls, 1984:60).

3.4.2.2.3 Instruction

Instruction refers to a carefully planned technique used in classroom settings to introduce new and unfamiliar material to students to learn (Gunter, Estes & Schwab, 1990:72). Students who readily comprehend instructions and explanations from their teachers are apt to feel more efficacious for learning than students who experience less understanding (Schunk, 1985:214). For example, when a teacher tests students on what they have just learned, students who readily comprehended his instructions will react with more vigour to the test, whereas those who did not readily comprehend teacher's instructions will feel more anxious about the test.

Most of new task material presented to students takes the form of direct instruction (Gunter *et al.*, 1990:72). Direct instruction is characterised by relatively short instructional periods followed by practice until learning is achieved (Gunter *et al.*, 1990:72). Understanding of learning tasks enhances students' self-efficacy for continued learning.

3.4.2.2.4 Strategy training

Students' learning in the classroom depends on their effective use of learning strategies (Schunk, 1985:215; 1989:26). Strategy training gives information on strategy acquisition and strategy usefulness which can help develop students' self-efficacy (Schunk, 1985:215; 1989:26). When a student understands the use of a learning strategy and can effectively apply it in accomplishing his tasks, he may experience a greater control over the learning outcomes which will promote self-efficacy.

According to Weinstein *et al.* (1994:362) modelling plays an important role in the instruction of learning strategies (see par. 3.4.2.2). When a student observes peers using a variety of learning strategies when engaged in different learning tasks, he becomes exposed to the use of this wide range of learning strategies and may use them when planning, analysing, or completing his own learning tasks.

3.4.2.2.5 Performance feedback

Performance feedback involves techniques such as self-evaluation that students can use to determine their learning progress. For example, students can use solutions at the back of

their mathematics books to check their answers on the problems they have solved. Learners also need teacher's feedback to highlight performance outcomes and progress (e.g. "You are getting good at this", or "That is correct"; Schunk, 1989:28; 1985:215). This feedback informs students that they are acquiring skills and knowledge (Schunk, 1985:215; Ames, 1984:91).

Explicit performance feedback helps learners to sustain their motivation and enhances their learning because it conveys information about progress towards goals (Schunk, 1985:216; 1993:8). Individuals with sustained motivation are likely to attain their goals with continued effort and may adopt new challenging goals once their anticipated goals have been attained (Schunk, 1993:9).

3.4.2.2.6 Goal-setting

Goal-setting involves purposive objectives that individuals set to attain during learning which reflect quality, quantity, or rate of performance (Schunk, 1989:29; 1994a:5). Students' self-efficacy is influenced by the goals they set or which are set for them by others (Schunk, 1993:6; 1994b:4). When students are given or select a goal, they may experience a sense of efficacy for attaining it if they observe progress which conveys they are becoming skillful (Schunk, 1985:217; 1989:29).

Schunk and Swartz (1993:338) distinguish between product and process goals. Product goals focus students' attention on task completion (i.e. rate or quantity of performance). Research based on product goals has shown that product goals alone do not bring into prominence the significance of the processes and strategies underlying task completion because during task engagement, students may compare their work with that of their peers instead of their prior performances (Schunk & Swartz, 1993:338). Ames (1992: quoted by Schunk, 1994b:8) asserts that these social comparisons result in low perceptions of ability for students who experience difficulties because they convey information of incapability.

In contrast, process goals involve techniques and strategies students use to learn (Weinstein & Mayer, 1986:315). One type of process goal is to acquire a learning strategy such as an organizational strategy for improving information processing and task performance. Process goals enable students to engage in activities they believe will enhance their learning; that is, because of their strategic knowledge, they may expend effort in task accomplishments and persist longer in difficult situations. Research conducted on a comprehension strategy has shown that process-goal students display higher comprehension skills than product goal students because students who have

adopted process-goals have the use of strategies at their command (Schunk & Swartz, 1993:338). The success of strategy use enhances students' self-efficacy and motivation for more skills acquisition, because such successes serve as basis for more challenging tasks.

3.4.3 Appraisal of self-efficacy

Bandura (1986:399) cautions that information acquired enactively, vicariously, persuasively, and physiologically does not influence efficacy automatically but becomes instructive only through cognitive appraisal. Appraisal of self-efficacy information is an inferential process in which the relative contribution of personal (i.e. ability) and situational (i.e. nonability) factors to performance successes and failures must be weighted (Schunk, 1991b:93; Bandura, 1986:401). In assessing self-efficacy, students take into account factors such as task difficulty, teacher or peer assistance, perceived ability, effort expended, and patterns of success and failures (Schunk, 1991b:93; Bandura, 1986:401).

Appraisal of efficacy information involves two separate functions (Bandura, 1977:200; 1986:401). The first function concerns the type of information people attend to and use as indicators of personal efficacy. For example, students may pay attention to situational circumstances in which behavioural attainments occur (i.e. paying attention in class to understand what is presented to them). The second function concerns the combination of rules that learners use for selecting, weighting, and integrating efficacy information from different sources (Bandura, 1977:201; 1986:401). Thus, a number of contextual factors such as social, situational, and temporal circumstances under which learning occurs affect appraisal (Bandura, 1977:200). Students may use simple judgemental rules such as similarity to models to predict their performance capabilities. The performance of others is often selected as a standard for self-improvement of abilities. Performers choose to compare themselves with proficient models possessing the competencies to which they aspire. Competent models can teach observers effective strategies for dealing with challenging or threatening situations (Bandura, 1986:405).

3.5 CONCLUSION

This chapter focussed on the relationship between learning strategies, self-efficacy, and academic achievement. The literature revealed that there is a relationship between learning strategies and academic achievement. Learning strategies are goal-oriented procedures that are intended to influence the learners' academic achievement by enabling

students to effectively process information. Levin (1988:196) asserts that items processed with an effective learning strategy are recalled much better than items processed with ineffective learning strategy.

The literature also revealed that there is a relationship between self-efficacy and academic achievement. Bandura (1986:395) maintains that students who regard themselves as efficacious, think, act, and feel differently from those who feel inefficacious and can thus be able to produce their own future rather than being told of it. Students who regard themselves as efficacious, adopt serviceable learning strategies to facilitate their understanding, knowledge and skills acquisition (Pintrich, 1989:129).

CHAPTER 4

METHOD OF RESEARCH

4.1 INTRODUCTION

In this chapter the method of research to investigate the hypotheses is discussed. The aim of this study is outlined in paragraph (4.2) and the experimental design in paragraph (4.3). The accessible population and sample (see table 4.1 & 4.2) are discussed in paragraph (4.4), while the instruments that were used to collect data are discussed in paragraph (4.5). The variables used in the study are listed in paragraph (4.6). The procedure followed while conducting the study is discussed in paragraph (4.7); and, the statistical techniques used to analyse the data are outlined in paragraph (4.8).

4.2 AIM OF THE RESEARCH

As stated in Chapter One (see par. 1.2), the aim of this research was to determine whether self-regulated learning, learning strategies, and self-efficacy influence Standard Ten Qwaqwa students' academic achievement in Physical Science.

4.3 EXPERIMENTAL DESIGN

An *ex post facto* design was used to test the hypotheses. As an *ex post facto* design (Mc Millan & Schumacher, 1989:336) is desirable to study cause-and-effect relationships, it was therefore used to determine the influence of pre-existing conditions (i.e. independent variables) on the academic achievement of Standard Ten Qwaqwa students in Physical Science (i.e. the dependent variable; see par. 4.6).

4.4 ACCESSIBLE POPULATION AND SAMPLING

The secondary school students in Standard Ten taking Physical Science as an examination subject in the Qwaqwa Central Circuit of the North Eastern Free State region formed the study population for this project. According to the records supplied by the principals of the secondary schools in this circuit, there were five hundred-and-fifteen (N=515; see table 4.1) Standard Ten students in the nine (9) secondary schools with Standard Ten classes who take Physical Science as an examination subject in this circuit.

Table 4.1: Number of schools, number of classes taking Physical Science in each school, and the total number of students constituting the study population.

Standard Ten classes					
School code	A	B	C	D	Total
01	42 *	-	-	-	42
02	20 *	-	-	-	20
03	39 *	-	-	-	39
04	44	-	-	-	44
05	48 *	-	-	-	48
06	43 *	-	-	-	43
07	36 *	33	-	-	69
08	42 #	43 *	40	43 #	168
09	-	-	42 *	-	42
TOTAL	314	76	82	43	515

* Represents classes constituting the sample for this study (see table 4.2) and

represents classes randomly selected as substitutes for sampled classes should substitutes have been necessary.

From the study population, a random cluster sample of eight (8) classes was drawn (see table 4.2).

Table 4.2: Number of randomly selected classes and number of students who completed the instruments.

School	Selected class	No. of students
01	10	A37
02	10	A19
03	10	A32
05	10	A46
06	10	A36
07	10	A30
08	10	B36
09	10	C37
TOTAL		273

A total of 273 students, instead of 313 students as was initially established from the records supplied by principals, completed the tests/questionnaires. From the total number of 313 students who were to complete the tests, 25 students were absent from school during the course of the week the test programme was run and about 15 of the students had dropped out.

4.5 INSTRUMENTATION

A Biographical Questionnaire, the Learning and Study Strategies Inventory - High School Version (LASSI-HS), the Children Multidimensional Self-Efficacy Scales (CMSES), and the Motivated Strategies for Learning Questionnaire (MSLQ) were used as instruments to collect data for this study.

4.5.1 The Biographical Questionnaire

The Biographical Questionnaire was designed to collect data on the students' personal backgrounds (see Appendix A). The items were intended to obtain information about students' home background and family characteristics. The subjects were also requested to give information about the physical characteristics of their homes.

4.5.2 The Learning and Study Strategies Inventory - High School Version (LASSI-HS)

According to Weinstein and Palmer (1990:3) the Learning and Study Strategies Inventory - High School Version (see Appendix B) is an assessment tool designed to measure students' use of learning and study strategies and methods at the secondary school level. The LASSI-HS consists of 76 items to which students were instructed to respond on a five-point Likert-type scale (ranging from 1 = "Not at all like me" to 5 = "Very much like me").

The LASSI-HS serves as

- * a diagnostic measure to help identify areas in which students could benefit most from educational interventions;
- * a counselling tool for student advising, for academic remediation and enrichment, student learning assistance and high school programmes;

- * a basis for planning individual prescriptions for both remediation and enrichment;
- * a pre-post achievement measure for students participating in programmes or courses focusing on learning strategies and study skills; and
- * an evaluation tool to assess the degree of success of intervention programmes or courses (Weinstein & Palmer, 1990:3).

In this study the LASSI-HS was used as a diagnostic measure to identify shortcomings in students' use of learning strategies.

The LASSI-HS consists of ten (10) sub-scales. As all the sub-scales were not relevant for this study, only seven (7) were used (see Appendix B). A brief description of each sub-scale is given with their alpha levels as reported in the User's Manual (Weinstein & Palmer, 1990:13) and the Alpha coefficients for the LASSI under South African conditions in parentheses. Sample items are also given for each sub-scale.

4.5.2.1 Time management

The time management sub-scale examines students' use of time management principles for academic work. Managing time effectively helps students to create workable schedules. Creating and using schedules encourages students to take more responsibility for their own learning.

Students' scores on this sub-scale measure the degree to which they create and use schedules. For example, students who score low on this measure may need to learn more about how to create a schedule and how to deal with distractions, competing goals, and procrastination. Students may show acceptance of responsibility for studying by setting realistic school goals and creating plans that will facilitate goal achievement. These activities are enhanced by effective time management.

Coefficient Alpha = 0,82 (0,31)

Sample items: "I only study when there is pressure of a test". (14)

"I make good use of study hours after school". (30)

4.5.2.2 Concentration

Concentration focuses on students' ability to pay attention to their school-related activities such as studying and listening in class, rather than on distracting thoughts. People have a limited capacity to process what is going on around them and in their own thoughts. If they are easily distracted from their studies, then there will be less capacity to focus on the task at hand.

Student scores on the sub-scale measure their ability to concentrate and direct their attention to school and school-related tasks, including study activities. Students who score high on this measure are effective at focusing their attention and maintaining a high level of concentration, whilst students who score low on this measure are less successful at focusing their attention on the task at hand by eliminating interfering thoughts and need to learn techniques that can help them enhance their concentration and to set priorities so that they can attend to school as well as their other responsibilities. The learning techniques for focusing attention and maintaining concentration help students implement effective learning strategies that can make learning and studying more effective and more efficient.

Coefficient Alpha = 0,82 (0,73)

Sample items : "I find it hard to pay attention during class". (26)

"I am distracted from my studies very easily". (28)

4.5.2.3 Information processing

The information processing sub-scale includes the use of mental imagery, verbal elaboration, and reasoning. Students' meaningful learning is enhanced by the use of verbal elaboration and organizational strategies. These strategies help to build bridges between what a student knows (i.e. prior knowledge) and what he is trying to learn or remember. The use of prior knowledge, experience, and reasoning skills help students make meaning out of new information they try to learn and is critical to success in educational and training settings.

Students' scores on this sub-scale measure how well they can create imaginal and verbal elaborations as well as organizations to foster understanding and recall. Students who score low on this measure need to learn methods that they can use to add meaning and organization to what they are trying to learn. These methods include paraphrasing, summarizing, creating analogies, use of inferential processes, creating organization

schemes and outlining, as well as synthetic reasoning skills. Students who have a repertoire of these strategies and skills will find it easier to incorporate new information with prior knowledge in such a way that acquisition and recall will be effective.

Coefficient Alpha = 0,80 (0,80)

Sample items : "I try to find connection between what I am learning and what I already know". (24)

"I try to make connections between various ideas in what I am studying". (51)

4.5.2.4 Selecting main ideas

This sub-scale focuses on students' ability to select important information to concentrate on for further study. Effective and efficient studying requires that students should be able to select important material for better understanding. Students must be able to differentiate between and select important information from unimportant information. If a student cannot select the critical information, the learning task becomes complicated by the huge amount of material the student is trying to access.

Students' scores on this sub-scale measure their skills at selecting important information to concentrate on for further study in either classroom lecture or autonomous learning situations. Students who score low on this measure need to learn more about how to identify important information so that they can focus their attention and information processing strategies on appropriate material.

Coefficient Alpha = 0,71 (0,75)

Sample items : "I try to identify the main ideas when I listen to my teacher teaching". (6)

"I use chapter headings as a guide to find important ideas in my reading". (39)

4.5.2.5 Study aids

The study aids sub-scale examines the degree to which students create or use study aids to help them learn and remember new information. Students can benefit from study aids created by others such as chapter headings, special writing types, or blank spaces and by generating their own study aids by using methods such as summarizing, creating diagrammes, text marking and underlining.

Students' scores on this sub-scale measure their ability to use or create study aids that support and increase meaningful learning and retention. Students who score low on this measure may need to learn more about the types of study aids provided in educational materials and classes and how they can create their own aids. Using and creating study aids improves both the effectiveness and the efficiency of learning, more especially in autonomous learning situations.

Coefficient Alpha = 0,68 (0,75)

Sample items : "I make drawings or sketches to help me understand what I am studying". (31)

"I make simple charts, diagrammes, or tables to pull together material in my classes". (33)

4.5.2.6 Self-testing

The self-testing sub-scale focuses attention on knowledge acquisition and comprehension monitoring that can be achieved through reviewing and testing one's level of understanding. Reviewing and testing are strategies that support and contribute to meaningful learning and effective performance. These strategies also contribute to knowledge consolidation and integration across topics. For example, using mental reviews, going over class notes and the text, thinking up potential questions to guide reading or help prepare for an examination are all important methods for checking understanding, consolidating new knowledge, integrating related information (i.e. both from what is being learned and from what is already known), and identifying if additional studying must be done.

Students' scores on this sub-scale measure their awareness of the importance of self testing and reviewing as well as the degree to which they use these methods. Students who score low on this measure need to learn more about the importance of self-testing and need to learn specific methods (e.g. structured reviews, mental reviews, asking questions before, during, and after reading, or using a systematic approach to study) to review school material and monitor their comprehension.

Coefficient Alpha = 0,74 (0,76)

Sample items : "I stop often while reading and think or review what has been said". (19)

"I test myself to be sure I know the material I have been studying". (41)

4.5.2.7 Test-taking strategies

This sub-scale focuses on students' approaches to test-taking strategies. Students' effective test performance depends on both preparation strategies and test-taking strategies. Students need to know how to prepare for the type of performance that will be required and how to maximize that performance. Test preparation includes knowing about the type of test (i.e. whether it is going to be a short-answer or a multiple-choice test), and knowing about the methods for studying and learning the material in a way that will facilitate recall and later use. Test taking strategies include knowing about the characteristics of tests and test items, and how to create an effective test-taking plan.

Students' scores on this sub-scale measure their use of test-taking and test-preparation strategies. Students who score low on this measure may need to learn more about how to prepare for tests, how to create a plan of attack for taking a test, the characteristics of different types of tests and test items, and how to reason through to an answer. Knowledge about test-taking and preparation strategies and how to use them help students target their activities, set up study goals, and implement an effective study plan.

Coefficient Alpha = 0,81 (0,85)

Sample items : "When studying for an exam, I try to think which questions might be in the paper". (10)

"I try to think of possible test questions when I study for tests". (13)

4.5.3 The Children's Multidimensional Self-Efficacy Scales (CMSES)

The Children Multidimensional Self-Efficacy Scales (see Appendix C) were developed by Bandura as a paper-and-pencil test to assess students' perceived capability to correctly perform a variety of learning related tasks. The Children's Multidimensional Self-Efficacy Scales consist of seven (7) sub-scales. As all the sub-scales were not relevant for this study, only three (3) that consist of twenty-four (24) statements each describing a task related to effective learning and studying were used. The subjects were instructed to respond to items on a seven-point Likert-type scale (ranging from 1 = "Not well at all" to 7 = "Very well") according to which statement best describes them.

4.5.3.1 Self-Efficacy for Academic Achievement

The Self-Efficacy for Academic Achievement sub-scale (Alpha = 0,77) involves students' personal beliefs about their own capabilities to accomplish academic tasks

successfully and to achieve better marks in their tests or exams. Students who have a low sense of efficacy for academic achievement may attempt avoiding working hard, whereas those who feel or judge themselves more efficacious may participate more eagerly in performing their academic tasks.

The self-efficacy for academic achievement sub-scale consists of a nine (9) items concerning how a student learn, e.g. "How well can you learn biology?" (4); "How well can you learn algebra?" (14); and "How well can you learn science?" (21)

4.5.3.2 Self-Efficacy for Self-Regulated Learning

According to Zimmerman *et al.* (1992:665) the Self-Efficacy for Self-Regulated Learning sub-scale ($\text{Alpha} = 0,82$) is used to assess students' perceived capability to use a variety of self-regulated learning strategies, such as planning and organizing their academic activities. The Self-Efficacy for Self-Regulated Learning sub-scale is also used to assess students' use of cognitive strategies to understand and remember the material being taught, resisting distractions, motivating themselves to complete school work, structuring environments and make them conducive for study, and participating in class.

The Self-Efficacy for Self Regulated Learning sub-scale consists of 11 items concerning students' self-regulation, e.g. "How well can you finish homework assignments by deadlines?" (12); "How well can you take class note of class instructions?" (5) and: "How well can you use the library to get information for class assignments?" (7)

4.5.3.3 Self-Efficacy for Enlisting Parental and Community Support

The Self-Efficacy for Enlisting Parental and Community Support sub-scale ($\text{Alpha} = 0,69$) involves students' self-activities to seek help from others such as parents, brothers and sisters to help them complete their learning tasks or solve problems. Students can get their parents involved in their school activities and people outside the school (e.g. community groups and churches) can also be involved in their school activities.

The Self-Efficacy for Enlisting Parental and Community Support's sub-scale consists of 4 items concerning students' support, e.g. "How well can you get your brothers and sisters to help you with a problem?" (10); "How well can you get your parents to take part in school activities?" (13) and: "How well can you get people outside the school to take an interest in your school (e.g. community groups and Churches)?" (3)

4.5.4 The Motivated Strategies for Learning Questionnaire (MSLQ)

According to Pintrich and De Groot (1990:35), the Motivated Strategies for Learning Questionnaire was designed to assess students' motivation, cognitive strategy use, metacognitive strategy use, and management of effort (see Appendix D). In this study only the Cognitive Strategy Use and the Self-Regulation sub-scales were used to collect data. The alpha coefficient for each sub-scale as reported by Pintrich and De Groot (1990:35) is given, while the alpha coefficients for the Motivated Strategies for Learning Questionnaire under South African conditions are given in parenthesis. The subjects were instructed to respond to items on a seven-point Likert-type scale (ranging from 1 = "Not at all true of me" to 7 = "Very true of me") according to how the statement best describes them.

4.5.4.1 The Cognitive Strategy Use sub-scale

The Cognitive Strategy Use sub-scale (Alpha = 0,83/0,73) consists of 13 items related to the use of rehearsal strategies, e.g. "When I read material for this class, I say the words over and over to myself to help me remember" (19); elaboration strategies such as summarizing and paraphrasing, e.g. "When I study for this class, I put important ideas into my own words"(6), and organizational strategies, e.g. "I outline the chapters in my book to help me study" (20).

4.5.4.2 The Self-Regulation sub-scale

The Self-Regulation sub-scale (Alpha= 0,74/0,55) was constructed from metacognitive and effort management strategies and consists of 9 items. The items on metacognitive strategies include planning, e.g. "I ask myself questions to make sure I know the material I have been studying"(3); skimming, e.g. "When I study for a test, I try to put together information from class and from the book" (1); and comprehension monitoring, e.g. "I often find that I have been reading for class but don't know what it is all about" (16).

The items on effort management strategies include such factors as students' persistence at difficult or boring tasks, e.g. "Even when the study material are dull and uninteresting, I keep working until I finish" (11); and working diligently, e.g. "When work is hard I either give up or study only the easy parts" (5).

4.6 VARIABLES USED IN THIS STUDY

4.6.1 Independent variables

Biographical variables

- * AGE
- * SEX
- * Educational level of parents
- * Living with both parents, mother, father, relatives, or and friends
- * Parents' employment status
- * Family size
- * Sibsize
- * Birthorder
- * Brothers and sisters in high school
- * Living place
- * Electricity
- * Parents' aspirations
- * Parents' homework expectations
- * Place to study
- * Help with homework at home
- * Time spent on homework
- * Science goal (Defined as the mean of the Highest or the Lowest mark to be satisfied with)
- * Socio-economic status

Variables related to learning strategies

- * Time management
- * Concentration
- * Information processing
- * Selecting main ideas

- * Study aids
- * Self testing
- * Test-taking strategies

Variables related to self-efficacy

- * Self-efficacy for academic achievement
- * Self-efficacy for self-regulated learning
- * Self-efficacy for enlisting parent and community support

Variables related to self-regulated learning

- * Self-regulated learning
- * Strategy use

4.6.2 Dependent variable

Academic achievement in Physical Science (i.e. a semester mark) was used as a dependent variable in this study. The Physical Science marks were standardized because the science mark for different schools was not calculated out of the same total (i.e. some schools had their mark in Standard Grade, while some had it in Higher Grade). To get the Physical Science mark for each school on the same level, it was therefore necessary to standardize it by subtracting the mean of each school and then dividing it by the standard deviation of that school. To get a mark out of hundred, the standardised score (i.e. z - score) was multiplied by ten and a score of fifty was added. The following is the Z - score formula: $Z = 10z + 50$

where Z= standard score and

z = value

4.7 THE PROCEDURE FOR CONDUCTING THE STUDY

The researcher visited secondary schools in Qwqwa Central Circuit to collect information from the headmasters in connection with the number of their Standard Ten students doing Physical Science who were to take part in completing questionnaires for this study.

There were 313 subjects selected (see table 4.1) of whom only 273 (see table 4.2) subjects actually took part in the study.

In conducting the study, the researcher first explained the aim of this study to the subjects and then described the procedure to be followed when completing the questionnaires. The directions of each questionnaire were read and explained before the subjects were allowed to complete it and 5-10 minutes breaks were given between tests. Time taken to complete each test was recorded. For example, students took 30 minutes to complete the Biographical Questionnaire, 30 minutes to complete the LASSI-HS, 20 minutes for the MSLQ and 15 minutes for the CMSES.

4.8 STATISTICAL PROCEDURES AND TECHNIQUES

The data was processed with the mainframe computer of the PU for CHE.

Correlation coefficients were calculated with the CORR Procedure of SAS Program (SAS INSTITUTE INC, 1985) to determine the relationship between the independent variables and the dependent variable.

Independent t-tests were performed with the T-TEST-procedure of SAS (SAS INSTITUTE INC, 1985) while one-way analysis of variance (ANOVA's) were performed by means of the PROC GLM procedure of SAS.

To determine the collective and individual influence of the independent variables on the dependent variable, multiple regression analyses were performed. The Proc RSquare programme (All Possible Subjects Regression) was used for the calculation of the multiple regression analyses. The Proc RSquare programme was first used to identify the best sub-set of individual variables that has the greatest influence on academic achievement in Science by applying Mallow's Cp criterion. Best contribution is defined as the smallest Cp. Further, multiple regression analyses were then performed on the best subset by using Proc RSquare programme to determine the contribution of each individual variable to R^2 (Dixon & Brown, 1979:423).

Multiple regression analysis is a method for analysing the collective and separate contributions of two or more independent variables, X^1, X^2, X^3, \dots to the variation of a dependent variable, Y (Kerlinger & Pedhazur, 1973:3). This method is appropriate in this research in which the collective and the separate contributions of self-regulated learning, learning strategies, and self-efficacy on the academic achievement in Physical Science are to be determined.

Multiple regression analysis also helps to explain the variance of a dependent variable and to study the influence of several independent variables on academic achievement (Kerlinger & Pedhazur, 1973:4).

The means, standard deviations, smallest and largest values of each variable were taken from the multiple regression printout.

The practical or educational significance (i.e. effect size) was calculated by using two equations. To determine the educational significance of the difference between two groups of means, the following equation was used:

$$d = \frac{\bar{X}_1 - \bar{X}_2}{S_{\max}}$$

Where:

d = effect size;

\bar{X}_1 = mean of group 1;

\bar{X}_2 = mean of group 2;

Criterion: S_{\max} = maximum standard deviation of the two groups.

To determine the educational significance of the contribution of a single variable to R^2 , the following equation was used:

$$f^2 = \frac{\text{contribution to } R^2}{1 - R^2}$$

(Stein, 1990:13-23).

The following criterion of Cohen (1976:339) was used to determine the educational significance of the contribution to R^2 (i.e. effect size) of each independent variable:

Small effect $f^2 = 0,02$;

Medium effect $f^2 = 0,15$;

Large effect $f^2 = 0,35$.

4.9 CONCLUSION

In this chapter the method of research was described. The main aim of the empirical investigation was to gather data that could be used to determine the relationship between self-regulated learning, learning strategies, self-efficacy and academic achievement in Physical Science.

The population and sample used was described in paragraph 4.4, while the questionnaires used were discussed in paragraphs 4.5.1, 4.5.2, 4.5.3, and 4.5.4. The statistical procedures and techniques used to analyse the data were described in paragraph 4.8 whereas the procedure of conducting the study was described in paragraph 4.7.

CHAPTER 5

STATISTICAL ANALYSES AND INTERPRETATION OF RESULTS

5.1 INTRODUCTION

As mentioned in paragraph 1.2, the aim of this study was to determine whether self-regulated learning, learning strategies, and self-efficacy have an influence on the academic achievement in Physical Science of Standard Ten students in Qwaqwa. In this chapter, the hypotheses are stated in paragraph (5.2), followed by a discussion of the subjects in paragraph (5.4), the classification of the independent variables (paragraph 5.5), identification of the best subset of variables that contributes the most to academic achievement in Science (par. 5.6) and the analyses of results in paragraph (5.7).

5.2 HYPOTHESES

Three hypotheses were set, i.e.:

5.2.1 Hypothesis 1

There is a relationship between *self-regulated learning* and the academic achievement of Standard Ten Qwaqwa students in Physical Science.

5.2.2 Hypothesis 2

There is a relationship between *learning strategies* and the academic achievement of Standard Ten Qwaqwa students in Physical Science.

5.2.3 Hypothesis 3

There is a relationship between *self-efficacy* and the academic achievement of Standard Ten Qwaqwa students in Physical Science.

5.3 PROCEDURE

A series of one way analysis of variance (ANOVA) and t-tests were calculated firstly to better describe the subjects in terms of the biographical variables mentioned in paragraph

4.6.1, and secondly to determine whether each of these variables affect academic achievement in Science on an individual basis. To test the hypotheses, multiple regression analyses were used to determine the collective and individual contribution of each independent variable to R^2 .

5.4 DISCUSSION OF SUBJECTS

On the basis of the information from the biographical questionnaire (par. 4.5.1), a detailed description of the sample is possible by considering the relationship between the various biographical variables and academic achievement in Physical Science. Although caution was taken to make sure that the subjects understood the tests, some subjects did not complete all the items which resulted in missing data which consequently affected the number of the subjects per analysis. The total number of subjects was 273, but in most of the tables the number of subjects vary because of missing data.

5.4.1 Summary statistics and correlation coefficients

The summary statistics for each variable and the correlation coefficients between these variables and Physical Science were first calculated (see table 5.1).

Table 5.1: Summary statistics for each variable and correlation coefficient with the dependent variable.

Variables	Mean	Standard deviation	Smallest value	Largest value	Correlation coefficient with Physical Science
Age	19,80	2,42	16	30	-0,20
Sex	1,47	0,50	1	2	-0,20
Father's level of education	1,75	1,53	1	7	-0,05
Mother's level of education	1,80	1,49	1	7	0,01
Subjects living with both parents	1,45	0,50	1	2	0,04
With whom are subjects living	1,88	1,23	1	5	0,02
Are both parents employed?	1,18	0,38	1	2	0,04
Who from mother or father is employed?	1,52	0,50	1	2	-0,03
Father's place of work	1,35	0,48	1	2	0,06
Mother's place of work	1,56	0,50	1	2	0,03
Time of arrival	1,34	0,47	1	2	0,04

Variables	Mean	Standard deviation	Smallest value	Largest value	Correlation coefficient with Physical Science
Family size	6,18	2,02	2	12	-0,00
Sibsize	3,09	2,16	0	8	-0,02
Birthorder	1,68	1,91	0	8	-0,04
Brothers and sisters in high school	0,79	0,95	0	5	-0,03
Living place	3,00	0,50	1	5	0,06
Electricity	1,20	0,40	1	2	0,07
Parents' encouragement for study	1,86	0,35	1	2	0,09
Parents' homework expectations	1,83	0,37	1	2	0,02
Study area	1,83	0,38	1	2	0,06
Help with homework at home	1,20	0,40	1	2	0,03
Time spent on homework	2,41	1,02	1	5	0,04
Physical Science as difficult subject	1,59	0,49	1	2	-0,14
Extra tuition	1,43	0,50	1	2	0,10
High mark/goal	98,89	15,65	60	160	0,12
Lowest mark/goal	128,70	24,31	80	170	0,16
Satisfaction with the mark received	1,22	0,41	1	2	0,16
Socio-economic status	1,28	0,57	1	3	-0,02
Time management	3,43	1,06	1	5	0,14
Concentration	3,15	1,01	1	5	0,22*
Information processing	3,14	1,07	1	5	0,10
Selecting main ideas	2,20	0,63	1	3	0,08
Study aids	2,59	1,03	1	5	-0,03
Self-testing	3,08	1,04	1	5	0,09
Test strategies	2,65	0,97	1	5	0,22*
Self-efficacy for academic achievement	2,58	1,31	1	5	0,07
Self-efficacy for self-regulated learning	3,50	1,83	1	7	0,07
Self-efficacy enlisting parent and community support	2,25	1,00	1	4	-0,11
Strategy use	3,13	1,12	1	5	0,06
Self-regulated learning Physical Science	3,16	1,51	1	6	0,05
	0,02	0,99	-2	5	

* Small effect $r = 0,10$
 ** Medium effect $r = 0,30$
 *** Large effect $r = 0,50$

5.4.2 Age of subjects

Table 5.2: Age distribution of the subjects.

Age in years	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Number of subjects	5	31	47	43	40	40	25	8	7	3	3	1	1	1	1

The average age of Standard Ten students who have never failed a standard and started school at the age of six years ought to be 17 years and 18 years for those students who started school at the age of seven years. The mean age of Standard Ten students can therefore be considered to be 17 to 18 years. Table 5.2 reveals that five of the 25 subjects were below the average age (i.e. 16 yrs). Only 78 of the subjects were of the age expected of Standard Ten students, while 173 of the subjects were above the average age (i.e. 19 - 30 yrs), which implies that most of the subjects have either failed or missed more than one year of schooling.

Students who are below the average age may not perform well academically, because younger children have limited knowledge resources (Weinstein & Mayer, 1986:317). Students who are above the average age may not perform well either because students who have failed more than one year or missed one or more years of study, decrease progressively according to the number of years they have failed or missed schooling (Mathebula, 1992:66).

A one-way analysis of variance revealed that there is a statistically significant difference in the academic achievement in Physical Science between younger and older students: $F(8,240) = 2,7$; $p = 0,001$; $f = 0,1$ (see table 5.4). Tukey's *post hoc* comparison revealed that each of the students in the 17 and 18 year-age group achieved statistically significant better marks than students from the older age groups. It can therefore be concluded on the basis of statistical significance that younger students who have never failed or missed a year were better achievers in Physical Science than older students who had failed a year or more or even missed a number of school years. Though considering the low effect size ($f = 0,1$), one cannot attach much educational or practical significance to these results.

5.4.3 Sex of subjects

An analysis of table 5.5 reveals that there was a statistically significant difference in the academic achievement in Physical Science ($t = 3,28$; $p < 0,0012$; $d = 0,4$) between

boys and girls. Boys achieved higher marks in Physical Science than girls. This difference though, is not of much practical significance because of the medium or average practical or educational significance ($d = 0,4$; see table 5.5) of the difference.

5.4.4 Family characteristics

5.4.4.1 The socio-economic status of the family

Socio-economic status was defined in this study as the father and mother's level of education, the type of employment of the parents and whether their houses were electrified or not.

No statistically significant differences were found between high and low socio-economic students and academic achievement in Physical Science (see table 5.4).

Table 5.3: Family characteristics.

Father's educational level Number of subjects	Std 5 or lower 182		Standard 6 7 8 9 10 30 8 13 4 8					Post matric 8				
Mother's educational level Number of subjects	Std 5 or lower 171		Standard 6 7 8 9 10 43 8 13 8 8					Post matric 6				
Parent's employment status Number of subjects	Both employed 101		Mother employed only 71				Father employed only 81					
Family size (number of members) Number of subjects	02	03	04	05	06	07	08	09	10	11	12	13 or more
	7	12	35	44	49	40	35	14	11	3	2	5
Subjects living with: Number of subjects	both parents 113		mother 88		father 12		relatives 37		friends -	alone 10		
Sibsize Number of subjects	0	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th born	
	28	42	36	51	36	22	22	9	4	3	4	
Birth order Number of subjects	0	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th born	
	89	69	32	21	19	13	9	3	-	2		
Brothers & sisters in high school Number of subjects	0	1	2	3	4	5	6	7	8	9 or more		
	120	84	36	8	4	1	1	1	1	1		

Living place Number of subjects	Farm 2	Town 15	Village 230	Squatter camp -	Hostel 10
Electricity at home Number of subjects	No 197		Yes 51		
Study area Number of subjects	No 36		Yes 169		
Hours studying at home Number of subjects	1 50	2 93	3 81	4 22	5 or more 11
Parents' homework expectations Number of subjects	No 41		Yes 204		
Help with homework at home Number of subjects	No 196		Yes 50		

5.4.4.2 The educational level of the parents

The educational level of the parents was defined as the highest school standard the parents had attained. From table 5.3 it can be inferred that only eight of the subjects' fathers and six mothers have higher qualifications than Standard Ten. The table further reveals that 182 of the subjects' fathers and 171 mothers have not attempted Standard Six. Fathers of four of the subjects and eight of their mothers have attained Standard Nine, while eight fathers and mothers of the subjects have attained Standard Ten. Parents who have not continued with their education beyond Standard Six may not consider education important because of ignorance, and thus may not encourage their children to study.

Mothers and fathers with a college education have a positive influence on their children's academic achievement because they have had formal education (Caldas, 1993:206). Such parents manage to give their children guidance of how to study and to do their homework. Literate parents know more about their children's performance and have more social contact with their children's teachers. Such parents participate more eagerly in school meetings and choose even better schools for their children.

Table 5.4: Summary of analysis of variance.

Independent variables	F-value	P-value	Effect size (f)
Age	2,7	0,01*	0,1+
Father's level of education	0,75	0,61	0,02
Mother's level of education	2,02	0,1	0,1+
Family size	0,39	0,95	0,02
Sibsize	0,88	0,52	0,02
Birthorder	0,53	0,81	0,01
Brothers and sisters in high school	0,3	0,91	0,01
Time spent on homework	0,18	0,95	0,00
Socio-economic status	1,84	0,16	0,01
Time management	2,59	0,04**	0,04
Concentration	3,76	0,01*	0,1+
Information processing	0,89	0,47	0,01
Study aids	0,33	0,86	0,01
Self-testing	1,82	0,13	0,03
Test strategies	4,14	0,003*	0,1+
Selecting main ideas	0,91	0,41	0,01
Self-efficacy for academic achievement	0,45	0,77	0,01
Self-efficacy for self-regulated learning	1,33	0,25	0,03
Self-efficacy for social support	0,94	0,42	0,01
Strategy use	0,66	0,62	0,01
Self-regulated learning	2,35	0,04**	0,1+

* p < 0,1	+ Small effect f = 0,01
** p < 0,05	++ Medium effect f = 0,25
	+++ Large effect f = 0,35

A one-way analysis of variance revealed that there is no statistical significant difference in the academic achievement in Physical Science between students whose fathers had a higher educational level and those with less education (see table 5.4). A one-way analysis of variance revealed no statistical significant difference between students whose mothers had a higher educational level and those with less education (see table 5.4).

5.4.4.3 The parents' employment status

An analysis of tables 5.3 and 5.5 reveals that only 101 of the subjects' parents were both employed, 71 of the subjects' mothers were employed, while 81 fathers of the subjects were employed.

Parents who are both employed, may be associated with a higher socio-economic status and their children may be characterised by higher academic achievement than children of parents where the mothers or fathers are employed. Parents who are both employed have sufficient income that enable them to provide, for example, books for the children, a balanced diet, pay for their educational tours and offer them a study place which may positively influence their children's academic achievement.

Children who had only their mothers or fathers employed, may be associated not only with low socio-economic status, but also with poor academic achievement because the income of the parents may be insufficient to cater for their children's educational needs.

An analysis of table 5.5 reveals that there was no statistical significant difference in the academic achievement in Physical Science of students whose parents were both employed and students with only one parent (either the father or mother) employed.

Table 5.5: Means, standard deviations, and t-values of the parents' employment status and some physical characteristics of the home and academic achievement in Physical Science.

$$d = \frac{\bar{X}_E - \bar{X}_K}{SK}$$

Variables	No. of subjects	Mean acad. achiev.	Standard deviation	t-value	DF	P-value	Effect size (d)	
Sex: Boys	133	52,04	11,14	3,28	237	0,0012*	0,4	
Girls	116	48,1	7,84					
Father and mother employed:	No Yes	204 44	50,03 51,0	9,85 10,47	-0,56	61	0,576	-0,1
Who is employed:	Mother Father	71 81	50,64 50,06	9,52 10,59				
House electrified:	No Yes	197 51	49,90 51,66	9,88 9,91	-1,13	78	0,2604	-0,2
Encouragement to study:	No Yes	35 210	47,92 50,63	9,86 9,99				

Parents home-work expectations:	No	41	49,62	9,87	-0,36	57	0,7223	-0,1
	Yes	204	50,22	9,86				
Study area:	No	36	48,87	10,25	-0,78	50	0,4395	-0,1
	Yes	169	50,33	9,8				
Help with homework:	No	196	49,99	10,55	-0,58	120	0,5616	-0,1
	Yes	50	50,69	6,62				
Physical Science as difficult subject:	No	101	51,91	10,02	2,27	211	0,03**	0,3
	Yes	147	49,00	9,75				
Satisfaction with mark:	No	193	49,35	9,95	-2,61	88	0,0108**	-0,4
	Yes	54	53,20	9,50				
d = effect				* p < 0,1	Small effect d = 0,2			
$\bar{X}E$ = mean of group E				** p < 0,05	Medium effect d = 0,5			
$\bar{X}K$ = mean of group K					Large effect d = 0,8			
SK = standard deviation of group K (Steyn, 1990:10-12)								

5.4.4.4 Family size

Family size is defined as the number of people that constitute a family. An analysis of table 5.3 reveals that seven subjects were from families which comprised two members only. This may mean that those subjects were either living with their father or their mother. Families of twelve of the subjects comprised three members, which means the parents had only one child or that the family consisted of two children living with either the mother or the father. A family of four may mean that two subjects were living with both the father and mother. The other possibility may be that either the father or the mother was living with three children in a family of four members. Table 5.3 further reveals that the majority of subjects were from families with five to six members (i.e. small families) and others were from families comprising 7-8, 9-10, 11-12, and 13 or more members (i.e. above average to large families). A large family can be a family which has seven or more members (i.e. a father, mother, and five or more children).

Small families are associated with higher academic achievement of the child, because in small families parents have more time to attend to their children's needs than is the case with large families. In a large family, parents do not have sufficient time to attend to the individual needs of all their children satisfactorily. Parents of large families may also

lack the necessary financial support which may also contribute to their children's poor academic achievement.

A one-way analysis of variance revealed that there is no statistical significant difference in the academic achievement in Physical Science (see table 5.4) between students from large families and students from small families.

5.4.4.5 Sibsize

Sibsize is defined as the number of children (i.e. brothers and sisters) in the family. An analysis of table 5.3 reveals that 28 of the subjects had neither brothers nor sisters, which means that they were the only children in those families. Table 5.3 further reveals that 42 of the subjects had one brother and/or sister, which means that there were two siblings in the family. Some subjects had two or three brothers and/or sisters whereas other subjects had four to ten brothers or sisters. An analysis of table 5.3 further reveals that the majority of the subjects (187) came from small families and only 70 from large families.

Children who had few siblings might have performed better academically. In the absence of parents, for example, when the parents were away at work, older siblings might interact with younger siblings at home and taught them how to read and write. Thus, older siblings served as intellectual resources for the younger siblings in the family.

A one-way analysis of variance revealed that there is no statistical significant difference in the academic achievement in Physical Science (see table 5.4) between students who had no siblings and students who had one or more siblings.

5.4.4.6 Birth order

Birth order is defined as the relative rank of a child in the age hierarchy among the siblings in the family. An analysis of table 5.3 reveals that 89 of the subjects were first borns or the only-children in the family, 69 were second borns, 32 were third borns, 65 were fourth to seventh borns, while only two were ninth borns.

Subjects who are second, third, and fourth borns might have had better opportunities for cognitive development because they were in an environment where older siblings attended them, helped them with their homework, and showed them how to solve

problems better than first borns and the only children in the family who were to pioneer learning all by themselves.

A one-way analysis of variance revealed that there is no statistical significant difference in the academic achievement in Physical Science (see table 5.4) between students who are first borns and students who are second, third fourth up to ninth borns in the family.

5.4.4.7 Brothers and sisters in high school

Brothers and sisters in high school refer to the number of brothers and sisters the subjects have in high school. Table 5.3 reveals that 120 of the subjects had no brothers or sisters in high school, while 84 of the subjects had at least one brother or sister in high school. Subjects who had neither a brother nor a sister in high school are believed to have been disadvantaged because they lacked knowledge of what high school learning entailed and how it differed from primary school learning than subjects who had at least one brother or sister in high school. It may be assumed that families with more than one child in high school who made the most of schooling, may be characterised by a culture of learning which is to the advantage of younger children. However, if the older siblings, were poor high school students with a negative and disruptive attitude towards school, a culture of learning might have been absent, and it might have been an advantage to the child who had no siblings who attended high school.

A one-way analysis of variance revealed that there is no statistical significant difference in the academic achievement in Physical Science (see table 5.4) between students who had no brothers or sisters in high school and students who had one or more brothers and/or sisters in high school.

5.4.4.8 The people the child were living with

From table 5.3, it is inferred that 109 of the subjects were living with both of their parents (i.e. intact families), 88 of the subjects were living with their mothers and 12 were living with their fathers (i.e. single-parent families), while the other 37 were living with their relatives and ten in hostel.

Children living with both parents are usually characterised by higher academic performance than children living with a single parent. Single-parent families may have a negative influence on the academic achievement of the child because of low income. Children miss the company and warmth of both parents when they live with a single parent, relatives or in hostels.

5.4.4.9 A place to study

A place to study is a study-related variable which required the subjects to indicate whether they had a place to study or not. From tables 5.3 and 5.5, it can be inferred that 36 of the subjects had no place to study, whereas 169 of the subjects had a place to study.

Students who do not have a study place, and have to study where there is loud music, or television on, or other distractions, perform poorly on academic tasks as compared to students who have quiet study places (Pintrich, 1989:134).

No significant differences with regard to place to study and academic achievement in Physical Science were found (see table 5.5).

5.4.4.10 Time spent on studying at home

The hours a student studies at home is a study-related variable that required subjects to indicate the number of hours they used daily for study at home. An analysis of table 5.3 reveals that 50 of the subjects studied for one hour, 93 for two hours while 114 studied for more than two hours.

Students who spent more of their time on learning are to perform better academically. Such students may have meaningful engagement in their learning tasks and content, and may complete more exercises or study projects.

A one-way analysis of variance revealed that there is no statistical significant difference in the academic achievement in Physical Science (see table 5.4) between students who spent only one hour on their studies and students who spent two or more hours on their studies.

5.4.4.11 Parents' homework expectations

Parents' homework expectations is a study-related variable which required subjects to indicate whether their parents expect them to do homework at home or not. An analysis of tables 5.3 and 5.5 reveal that 41 of the subjects' parents did not expect them to do homework, while 204 of the subjects' parents did expect them to do their homework.

Parental expectations involve factors such as parental knowledge of formal education and life prospects. Parents who have knowledge of formal education may play a more

motivating role in their children's education and may also direct them in how to do their homework than parents who have no formal education because of their illiteracy.

An analysis of table 5.5 reveals that there was no statistical significant difference in the academic achievement in Physical Science between students whose parents expected them to do their homework and students whose parents did not bother.

5.4.4.12 Help with homework at home

Help with homework at home is a study-related variable which required the subjects to indicate whether there was someone at home who helped them with homework or not. From tables 5.3 and 5.5, it can be inferred that 196 of the subjects had no one to help them with homework at home, whereas 50 of the subjects had someone to help them with their school work.

An analysis of table 5.5 reveals that there was no statistical significant difference in the academic achievement in Physical Science between students who had someone to help them with their homework and students who had no one to help them with their homework. Students who had someone to help them with their school work were to do better in Physical Science than students who did not receive any form of help.

5.4.5 Home related characteristics

Electricity

Electricity is the only home-related variable used in this study. From tables 5.3 and 5.5, it can be inferred that 197 of the subjects' homes had no electricity, whereas 51 of the subjects' homes were electrified. Subjects from homes without electricity may not progress well academically because of the unavailability of good lights for studying in the evenings. Students whose homes are not electrified are forced to use candles and other means of lighting which may affect their eyes or they do not study at all in the evenings while at home. This kind of a situation is associated with low socio-economic status because parents cannot afford to install electricity, hence their children suffer with regard to studying in the evenings.

An analysis of table 5.5 reveals that there were no statistical significant difference in the academic achievement in Physical Science between students from electrified homes and students from unelectrified homes. Students from electrified homes were to do better in Physical Science than students from unelectrified homes because of good lighting.

In summary, an analyses of all variables related to students' demography reveal that variables such as age and sex are statistically significant to the academic achievement in Science.

5.5 CLASSIFICATION OF THE INDEPENDENT VARIABLES

To test the hypotheses (par. 5.2) the following independent variables were used:

Variables related to the students' demography

- * Family size, sibsize, birthorder, brothers and sisters in high school were grouped together into a single composite variable defined as *family characteristics*.
- * Father and mother's level of education, employment status of parents, and whether the houses were electrified or not were grouped together into a single composite variable defined as *socio-economic status*.
- * Encouragement for study, parents' homework expectations, place to study, and help with homework were grouped together into a single composite variable defined as *support*.
- * *Goal-setting* which was defined as the mean of the highest or the lowest mark to be satisfied with.

Variables related to self-regulated learning

- * Strategy use
- * Self-regulated learning

Variables related to learning strategies

- * Time management
- * Concentration
- * Information processing
- * Selecting main ideas
- * Study aids
- * Self-testing

- * Test-taking strategies

Variables related to self-efficacy

- * Self-efficacy for academic achievement
- * Self-efficacy for self-regulated learning
- * Self-efficacy for social support

5.6 IDENTIFICATION OF THE BEST SUBSET OF VARIABLES THAT CONTRIBUTES THE MOST TO ACADEMIC ACHIEVEMENT IN PHYSICAL SCIENCE

A multiple regression analysis was performed on the variables listed in paragraph 5.5 with academic achievement in Science as a dependent variable. These variables collectively explain 25,47 percent ($R^2 = 0,2547$) of the variance in academic achievement in Science. By using the Cp-criterion (see par. 4.8) the following subset of variables that contribute most to academic achievement in Science, viz., age, sex, self-efficacy for social support, and self-regulated learning were identified.

An analysis of these variables reveals that only one self-efficacy variable (i.e. self-efficacy for social support) and only one self-regulated learning variable together with age and sex were included in the best subset of variables that contributes the most to academic achievement in Science. No learning strategy, family or support variables were included. As no learning strategy variables were included in the best subset, hypothesis two was not investigated. Thus only hypothesis one and three were investigated.

A further multiple regression analysis was then performed on the four variables in the best subset to determine their collective and individual contribution to academic achievement in Science (see table 5.6).

Table 5.6: The collective and individual contribution of the variables in the best subset of variables to R^2 . Criterion: Academic achievement in Physical Science.

$$R^2 = 0,0707 \quad (R^2_a = 0,0526); \quad C_p = -1,2156$$

Variables	Regression coefficients	Contribution to R^2	F-value	Effect size f^2
Age	-1,457	0,0199	4,42**	0,02 ⁺
Sex	-9,7051	0,0255	5,64**	0,03 ⁺
Self-efficacy for social support	-0,6684	0,0041	0,89	0,004 ⁺
Self-regulated learning	0,7242	0,0212	4,71**	0,02 ⁺
* $p < 0,01$		+ Small effect $f^2 = 0,02$		
** $p < 0,05$		++ Medium effect $f^2 = 0,15$		
		+++ Large effect $f^2 = 0,35$		
INTERCEP: 78,2142				

5.7 ANALYSES OF RESULTS

An analysis of table 5.6 reveals that the four independent variables comprising the best subset of variables together explain 7,07 percent ($R^2 = 0,0707$; $R^2_a = 0,0526$) of the variance in academic achievement in Science.

An analysis of table 5.6 reveals that only one variable included in the best subset is a self-regulated learning variable. Self-regulated learning contributes 2,12 percent to the percentage of the variance of Science achievement ($R^2 = 0,0212$; $p < 0,05$; $f^2 = 0,02$). Although self-regulated learning makes a statistically significant contribution to academic achievement in Science, the effect size is small and thus of little educational or practical significance.

Although an ANOVA revealed a statistically significant difference in academic achievement in Science between students who were more self-regulated and students who were less self-regulated [$F(5,243) = 2,35$; $p = 0,04$; $f = 0,1$], Tukey's *post hoc* comparison revealed no difference in self-regulated learning between high and low achievers (see table 5.4).

An analysis of table 5.6 reveals that the only self-efficacy variable included in the best subset of variables is self-efficacy for social support. Self-efficacy for social support makes a statistically significant contribution to academic achievement in Science though

its effect size ($f^2 = 0,004$) is very small and thus of little educational or practical significance.

An ANOVA revealed no statistical significant difference in academic achievement in Science between students who were more self-efficacious and students who were less self-efficacious in terms of self-efficacy for enlisting social and parental support [$F(4,244) = 0,66$; $p > 05$; $f = 0,01$; see table 5.4].

5.8 CONCLUSION

In this chapter the focus was on the statistical analyses and interpretation of results. The main aim of these analyses and interpretation of results was to determine the relationship between self-regulated learning, learning strategies, self-efficacy and academic achievement in Science.

The statistical analyses revealed a statistically significant relationship between self-regulated learning and academic achievement in Science and between self-efficacy for social support and academic achievement in Science. Although these relationships were statistically significant, one can't depend much on them because of their low educational significance.

The relationship between learning strategies and academic achievement in Science could not be investigated as there were no learning strategy variables included in the best subset of variables that contribute most to academic achievement in Science.

CHAPTER 6

SUMMARY, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

This chapter consists of a summary of the research. A statement of the problem is given in paragraph (6.2), followed by a summary of the literature review in paragraph (6.3). The method of research is discussed in paragraph (6.4) and the results in (6.6). The limitations of the study are discussed in paragraph 6.8, while some recommendations are made in paragraph (6.9).

6.2 STATEMENT OF THE PROBLEM

The failure rate and poor academic performance in Physical Science of Standard Ten Qwaqwa students in the North Eastern Free State region is high compared to the general pass rate. This poor academic achievement has resulted in students regarding Physical Science as a difficult subject.

Although some students are more motivated to learn than others, and often choose challenging tasks and sometimes overcome obstacles, students in general are not always aware of all the variables that influence their achievement and are therefore partly responsible for their own academic failure. Awareness of variables such as self-regulation, learning strategies, and self-efficacy are thought to influence students' academic achievement.

The aim of the research was therefore to determine whether self-regulated learning, learning strategies and self-efficacy influence the academic achievement of Standard Ten Qwaqwa students in Physical Science.

6.3 THE REVIEW OF LITERATURE

6.3.1 The relationship between self-regulated learning and academic achievement

Zimmerman (1990:13) postulates that the self-regulated learning theories of academic achievement lay emphasis on how students select, organize, create advantageous learning environments for themselves, and on how they plan the form and amount of their own instruction (see par. 2.2). Although all students are responsive to some degree during

instruction, only students who display initiative, intrinsic motivation, and personal responsibility achieve a particular academic success. Self-regulated learning students are distinguished by their systematic use of metacognitive and motivational strategies, their responsiveness to feedback regarding the effectiveness of their learning, and their self-efficacy for academic accomplishment (Zimmerman, 1990:14). When students' perceptions of self-efficacy are linked to a sequence of self-regulative responses such as strategy monitoring (i.e. self-observation), strategy attribution (i.e. self-judgement), and strategy use (i.e. self-reaction), their learning is no longer passive but becomes self-motivated (Zimmerman & Martinez-Pons, 1992:203). Training students to self-regulate their learning has proven to be effective with students who are at risk academically and who often display passivity or learned helplessness (Zimmerman & Martinez-Pons, 1992:203).

6.3.2 The relationship between learning strategies and academic achievement

Learning strategies (see par. 3.3) are defined as behaviours and thoughts that a learner engages in during learning that are intended to influence the learner's encoding process (Weinstein & Mayer, 1986:315). According to Levin et al. (1982: quoted by Weinstein & Mayer, 1986:319) students who use the keyword method when learning academic contents such as the definition of concepts, recall better than students who don't use the keyword method. According to Rikards and August (1975: quoted by Weinstein & Mayer, 1986:318) students who underline sentences in a passage are able to recall substantially more information than students who simply read a passage without underlining.

6.3.3 The relationship between self-efficacy and academic achievement

Self-efficacy (see par. 2.3.2 & 3.4.1) is defined as personal beliefs about one's capabilities to organize and implement the actions necessary to attain a designated performance level and influences students' choice of learning activities (Bandura, 1982:122). Students who have a low sense of self-efficacy for acquiring cognitive skills may attempt to avoid working hard (i.e. expending high effort), whereas those who judge themselves more efficacious would participate more eagerly in academic study. Bandura (1977:203) postulates that, students who have a high sense of self-efficacy for learning expend greater effort and persist longer when studying than those who doubt their capabilities.

6.4 THE METHOD OF RESEARCH

6.4.1 Subjects

All the Standard Ten Qwaqwa students (N=515, see table 4.1) in the nine secondary schools which fall in the Central Circuit constituted the study population for this study. From the study population, a random cluster sample of eight classes, giving a number of 313 subjects that were selected, of which only 273 actually took part in the study (see table 4.2).

6.4.2 Instruments

The following instruments were used in the study: Biographical Questionnaire, LASSI-HS, MSLQ, and Self-Efficacy Questionnaire.

6.4.2.1 The Biographical Questionnaire

The Biographical Questionnaire (see par. 4.5.1) consists of 29 items designed to obtain information about students' home background, the physical characteristics of their homes, and their academic achievement in Physical Science.

6.4.2.2 The Learning and Study Strategies Inventory - High School Version (LASSI-HS)

The LASSI-HS (see par. 4.5.2) is an assessment tool consisting of 76 items designed to measure students' use of learning and study strategies, and methods at the secondary school level (Weinstein & Palmer, 1990:3). In this study students responded to 52 items on a five-point Likert-type scale (ranging from 1 = "Not at all like me" to 5 = "Very much like me").

The LASSI-HS consists of ten subscales of which the following seven sub-scales were used for this study: time management, concentration, information processing, selecting main ideas, study aids, self-testing and test strategies.

6.4.2.3 The Self-Efficacy Questionnaire (SEQ)

The SEQ (see par. 4.5.3) was developed as a paper-and-pencil test to assess a student's perceived capability to perform correctly a variety of learning related tasks. Only three

of the seven sub-scales were used for this study, viz. self-efficacy for academic achievement, self-efficacy for self-regulated learning, and self-efficacy for enlisting parental and community support. The SEQ consisted of 24 items to which students responded on a seven-point Likert-type scale (ranging from 1 = "Not well at all" to 7 = "Very well").

6.4.2.4 The Motivated Strategies for Learning Questionnaire (MSLQ)

The MSLQ (see par. 4.5.4) included 22 items on students' use of self-regulated learning strategies (i.e. cognitive strategy use and self-regulation). Students responded to the items on a seven-point Likert-type scale (ranging from 1 = "Not at all true of me" to 7 = "Very true of me") in terms of their behaviour in the class.

6.5 THE PROCEDURE

A sample of 313 subjects was selected (see par. 4.4) from a study population of 515 Standard Ten students from the Qwaqwa Central Circuit secondary schools. Only 273 subjects actually took part in the study.

6.6 THE RESULTS

Variables listed in paragraph 5.5 were used to determine the best subset of variables that make the biggest contribution to academic achievement in Science. A multiple regression analysis was performed on these variables and it was found that collectively they explain 25,47 percent (contribution to $R^2 = 0,2547$) of the variance in academic achievement in Science. After applying the Cp-criterion, four out of twenty-one variables (i.e. age, sex, self-efficacy for social support, and self-regulated learning) were identified as those contributing most to academic achievement in Science. These four variables collectively explain 7,07 percent (contribution to $R^2 = 0.0707$) of the variance in academic achievement in Science.

An analysis of these four variables revealed that only one self-efficacy variable (viz. self-efficacy for social support) and only one self-regulated learning variable (viz. self-regulated learning) were included in the best subset. As no learning strategy variables were included in the best subset, it was therefore not considered feasible to investigate hypothesis 2.

6.7 DISCUSSION OF RESULTS

The results reveal that there is a relationship between self-regulated learning, self-efficacy for social support, and academic achievement in Science. According to the literature review, self-regulated learners personally activate, alter, and sustain their learning activities in specific contexts (Zimmerman, 1990:309). It is assumed that self-regulated learners are proactive in seeking out information and taking necessary steps to process such information because they are able to plan, set goals, keep records, seek social assistance, structure the environment and review their study material during the process of learning (Zimmerman & Martinez-Pons, 1988:284). Self-regulated learners are able to attend to and concentrate on instruction, organize and rehearse information to be remembered, establish a productive working environment and use resources effectively to achieve academic goals (Schunk, 1994b:2).

The relationship between self-efficacy for social support and academic achievement in Science is in agreement with the review of the literature that seeking social assistance is a student-initiated effort to seek help from peers, teachers and adults to solve problems that may hinder goal attainment (Zimmerman, 1989a:337). It is assumed that effective learners know that when they are faced with difficulties, they may ask someone knowledgeable to provide them with assistance to overcome such difficulties (Pintrich, 1989:134). Availability of an appropriate support system improves students' academic performance and enhances their learning because it enables them to act on a higher level of cognition (White, 1994:5545).

It can thus be concluded that the students in this study who are more self-regulated and those with strong self-efficacy beliefs for social support are better in academic achievement in Science than students who are less self-regulated and those that have low self-efficacy.

It can also be concluded that self-regulated learning and self-efficacy for social support are important variables that affect the academic achievement in Science of Qwaqwa students in Standard Ten.

6.8 CONCLUSION

It can be concluded that hypothesis 1 (par. 5.7), viz. that there is a relationship between self-regulated learning and academic achievement, could be accepted with relation to self-regulated learning. This implies that this variable has a positive influence on self-regulated learning and academic achievement.

Hypothesis 2, i.e. that there is a relationship between learning strategies and academic achievement, was not investigated because no learning strategy variables were included in the best subset of variables that make the biggest contribution to academic achievement in Science.

Hypothesis 3 (par. 5.7), i.e. that there is a relationship between self-efficacy and academic achievement, could not be accepted as there was no single variable that could prove educationally significant between self-efficacy and academic achievement in Science.

6.9 LIMITATIONS

The study may have suffered because of the following limitations:

6.9.1 Missing data

Due to either lack of a clear understanding of the questionnaires, or a negative attitude towards the testing done, some students failed or neglected to complete them fully. This resulted in missing data and inconsistency in the numbers of sample sizes for the various analyses.

6.9.2 Language medium

The subjects were Basotho students speaking Sesotho, while the questionnaires were in English. The assumption can be made that some students did not fully comprehend the questionnaires, and even though their medium of instruction is English, they failed to answer some items correctly.

6.9.3 Instrumentation

With relation to the instrumentation, questionnaires such as the Learning and Study Strategies Inventory-High School Version (LASSI-HS), Motivated Strategies for Learning Questionnaire (MSLQ) and Children's Multidimensional Self-efficacy Scale (CMSES) were developed in the United States of America. These questionnaires had been adapted, but had not been standardized for use in South Africa. Questionnaires developed and standardized for South African conditions were, however not available, and therefore there was no option but to use those mentioned.

6.10 RECOMMENDATIONS

It is recommended that:

- * More research should be done on South African children/students, to determine which variables affect their academic performance and how or why certain variables are more important than others. Knowledge of such variables is necessary to develop special educational programmes to address the problem of poor academic achievement in black schools.
- * Teachers should be made aware of those variables that have an impact on academic achievement and should be trained to manipulate variables such as self-regulated learning, learning strategies, and self-efficacy to create more positive learning environment for their students.
- * Students should be advised to use effective learning strategies to improve their learning and academic achievement.
- * It is also recommended that, where possible, the questionnaires used with black students should be translated into their mother tongue to make sure that they understand what is expected from them and be standardized.

6.11 CONCLUDING REMARKS

It is hoped that the findings of this study will help to solve those problems which affect students' self-regulated learning, strategy use, self-efficacy and poor achievement in Physical Science. Parents should take better care of their children's education, teachers should help students choose variables that impact positively on their learning, and students should learn to take the responsibility for their own failures.

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APPENDIX A
BIOGRAPHICAL QUESTIONNAIRE

BIOGRAPHICAL QUESTIONNAIRE

Questionnaire number:

--	--	--

 (1-3)

Card number:

1

 (4)

1. Name of student: _____

2. Age:

--

 (5-6)

--	--

 (7-8)

Years Months

3. Sex: Male

1

 Female

2

 (9)

4. Indicate with a cross your father's highest level of education.

Std 5 or lower	1	
Std 6	2	
Std 7	3	
Std 8	4	
Std 9	5	
Std 10	6	
Post matric qualification	7	(10)

5. Indicate with a cross your mother's highest level of education.

Std 5 or lower	1	
Std 6	2	
Std 7	3	
Std 8	4	
4 Std 9	5	
5 Std 10	6	
Post matric qualification	-	(11)

6. Are you living with both your father and mother?

No	<input type="checkbox"/>	1
Yes	<input type="checkbox"/>	2

(12)

7. If not, indicate with a cross with whom you are living.

Mother	<input type="checkbox"/>	1
Father	<input type="checkbox"/>	2
Relatives	<input type="checkbox"/>	3
Friend	<input type="checkbox"/>	4
Alone	<input type="checkbox"/>	5

(13)

8. Are both your father and mother employed?

No	<input type="checkbox"/>	1
Yes	<input type="checkbox"/>	2

(14)

9. If not, indicate with a cross which one is employed.

Mother	<input type="checkbox"/>	1
Father	<input type="checkbox"/>	2

(15)

10. Is your father's place of work in your neighbourhood?

No	<input type="checkbox"/>	1
Yes	<input type="checkbox"/>	2
Not applicable	<input type="checkbox"/>	3

(16)

11. Is your mother's place of work in your neighbourhood?

No	<input type="checkbox"/>	1
Yes	<input type="checkbox"/>	2
Not applicable	<input type="checkbox"/>	3

(17)

12. When do your parents or the people you are living with arrive home from work?

Before sunset

1

After sunset

2

(18)

13. How many people (including yourself) live in your home?

02	03	04	05	06	07	08	09	10	11	12	13 or more
----	----	----	----	----	----	----	----	----	----	----	------------

(19-20)

14. How many blood brothers and/or sisters do you have?

0	1	2	3	4	5	6	7	8	9 or more
---	---	---	---	---	---	---	---	---	-----------

(21)

15. How many of your brothers and sisters are older than you?

0	1	2	3	4	5	6	7	8	9 or more
---	---	---	---	---	---	---	---	---	-----------

(22)

16. How many of your brothers and sisters are in high school?

0	1	2	3	4	5	6	7	8	9 or more
---	---	---	---	---	---	---	---	---	-----------

(23)

17. Where do you live?

Farm

1

Town

2

Village

3

Squatter camp

4

Other

5

If other, state where: _____

(24)

18. Do you have electricity in your home?

No

1

Yes

2

(25)

19. Do your parents encourage you to study?

No	1
Yes	2

(26)

20. Do your parents or the people with whom you live expect you to do homework (i.e. schoolwork) after school?

No	1
Yes	2

 (27)

21. If yes, do they provide a quiet area or place for you to study?

No	1
Yes	2

 (28)

22. Is there someone at home who helps you with your homework?

No	1
Yes	2

 (29)

22. How many hours do you spend doing homework every day?

1	2	3	4	5 or more
---	---	---	---	-----------

(30)

24. Is Physical Science one of your difficult subjects at school?

No	1
Yes	2

 (31)

25. Do you get extra tuition in Physical Science after school hours?

No	1
Yes	2

 (32)

26. What is the mark you would like to obtain in Physical Science?

--	--	--

(33-35)

27. What is the lowest mark you would be happy with in Physical Science?

--	--	--

(36-38)

28. Are you satisfied with the mark you received for Physical Science in the last test or exam?

No

1

Yes

2

(39)

29. School

--

(40-41)

For office use
Mark obtained in
last exam

--

APPENDIX B

LASSI-HS

LASSI-HS

LEARNING AND STUDY STRATEGIES INVENTORY - HIGH SCHOOL VERSION

by

Claire E. Weinstein & David Palmer,
Department of Educational Psychology,
University of Texas at Austin.

Adapted for South African Students by J.L. de K. Monteith,
Potchefstroom University for CHE

DIRECTIONS

The Learning and Study Strategies Inventory - High School Version (LASSI-HS) is designed to find out how you learn, how you study, and how you feel about learning and studying. On these pages you will find 52 statements about learning and studying. Read each statement and then mark one of these choices on the answer sheet:

1. NOT AT ALL LIKE ME
2. NOT VERY MUCH LIKE ME
3. SOMEWHAT LIKE ME
4. FAIRLY MUCH LIKE ME
5. VERY MUCH LIKE ME

To help you decide which choice to mark, we will explain what is meant by each one.

By **NOT AT ALL LIKE ME**, we do not necessarily mean that the statement would never describe you, but that it would be true of you only rarely. Cross out number 1 for this choice.

By **NOT VERY MUCH LIKE ME**, we mean that the statement would generally not be true of you. Cross out number 2 for this choice.

By **SOMEWHAT LIKE ME**, we mean that the statement would be true of you about half the time. Cross out number 3 for this choice.

By **FAIRLY MUCH LIKE ME**, we mean that the statement would generally be true of you. Cross out number 4 for this choice.

By **VERY MUCH LIKE ME**, we do not necessarily mean that the statement would always describe you, but that it would be true of you almost all the time. Cross out number 5 for this choice.

Try to answer according to how well the statement describes you, not how you think you should be or what others do. There are no right or wrong answers to these statements. Please work as quickly as you can without being careless and please answer all the items. Use a pencil or a ballpoint pen to cross out the numbers.

STATEMENTS

- 1 I can tell the difference between more important and less important information.
- 2 I find it difficult to stick to a study schedule/time table.
- 3 After a class, I look over the work we did to help me understand the information.
- 4 I find that when my teacher is teaching I think of other things and don't really listen to what is being said.
- 5 I use special study aids, such as italics and headings, that are in my textbook to help me understand and remember.
- 6 I try to identify the main ideas when I listen to my teacher teaching.
- 7 I try to think through a topic and decide what I am supposed to learn from it rather than just read it over when doing schoolwork.
- 8 Even when study materials are dull and not interesting, I manage to keep working until I finish.
- 9 I learn new words or ideas by imagining a situation in which they occur.
- 10 When studying for an exam, I try to think which questions might be in the paper.
- 11 The notes I take as I read my textbooks are helpful when I review the textbook material.
- 12 I do poorly on tests because I find it hard to plan my work within a short period of time.
- 13 I try to think of possible test questions when studying my class material.
- 14 I only study when there is the pressure of a test.
- 15 I change the material I am studying into my own words.
- 16 I compare class notes with other students to make sure my notes are correct.
- 17 I look over my work or notes before the next class.
- 18 I have trouble summarizing what I have just heard in class or read in a textbook.
- 19 I stop often while reading and think over or review what has been said.
- 20 When I study a topic I try to make the ideas fit together and make sense.
- 21 When I study, I have trouble figuring out just what to do to learn the material.
- 22 I check to see if I understand what my teacher is saying during a class period.
- 23 I am sometimes unable to keep my mind on my schoolwork because I am restless or moody.
- 24 I try to find connections between what I am learning and what I already know.
- 25 I end up "cramming" (learning a lot of work in a very short period) for almost every test.
- 26 I find it hard to pay attention during class.

- 27 I key in on the first or last sentences of most paragraphs when reading my textbooks.
- 28 I am distracted from my studies very easily.
- 29 I try to find connections between what I am studying and my own experiences.
- 30 I make good use of study hours after school.
- 31 I make drawings or sketches to help me understand what I am studying.
- 32 I have trouble understanding just what a test question is asking.
- 33 I make simple charts, diagrams, or tables to pull together material in my classes.
- 34 I don't understand some class material because I do not listen carefully.
- 35 I read textbooks intended for my classes.
- 36 When I decide to do schoolwork, I set aside a certain amount of time and stick with it.
- 37 It is hard for me to know what is important to remember in a textbook.
- 38 I pay attention fully when studying.
- 39 I use the chapter headings as a guide to find important ideas in my reading.
- 40 I memorize grammatical rules, technical terms, formulas, etc., without understanding them.
- 41 I test myself to be sure I know the material I have been studying.
- 42 I put off schoolwork more than I should.
- 43 I try to see how what I am studying would apply to my everyday living.
- 44 My mind wanders a lot when I do schoolwork.
- 45 I go over homework assignments when reviewing class materials.
- 46 I have a hard time knowing how to study for different types of subjects.
- 47 Often when doing schoolwork I seem to get lost in details and can't remember the main ideas.
- 48 When they are available, I go to study, or review sessions or extra classes.
- 49 I spend so much time with my friends that my schoolwork suffers.
- 50 In taking tests, writing themes, and other schoolwork, I find I have not understood what the teacher wants and lose marks because of it.
- 51 I try to make connections between various ideas in what I am studying.
- 52 I have a hard time finding the important ideas in my reading.

CARD NUMBER

2

(1)

If you think the statement is not at all like you, cross out 1; if a statement is not very much like you, cross out 2; if a statement is fairly much like you, cross out 3, if a statement is much like you, cross out 4; and if a statement is very much like you, cross out 5.

KEY

1

2

3

4

5

Not at all like me

Not very much like me

Fairly much like me

Much like me

Very much like me

1.	1	2	3	4	5	(2)	24.	1	2	3	4	5	(25)	1	2	3	4	5	(48)
2.	1	2	3	4	5	(3)	25.	1	2	3	4	5	(26)	1	2	3	4	5	(49)
3.	1	2	3	4	5	(4)	26.	1	2	3	4	5	(27)	1	2	3	4	5	(50)
4.	1	2	3	4	5	(5)	27.	1	2	3	4	5	(28)	1	2	3	4	5	(51)
5.	1	2	3	4	5	(6)	28.	1	2	3	4	5	(29)	1	2	3	4	5	(52)
6.	1	2	3	4	5	(7)	29.	1	2	3	4	5	(30)	1	2	3	4	5	(53)
7.	1	2	3	4	5	(8)	30.	1	2	3	4	5	(31)						
8.	1	2	3	4	5	(9)	31.	1	2	3	4	5	(32)						
9.	1	2	3	4	5	(10)	32.	1	2	3	4	5	(33)						
10.	1	2	3	4	5	(11)	33.	1	2	3	4	5	(34)						
11.	1	2	3	4	5	(12)	34.	1	2	3	4	5	(35)						
12.	1	2	3	4	5	(13)	35.	1	2	3	4	5	(36)						
13.	1	2	3	4	5	(14)	36.	1	2	3	4	5	(37)						
14.	1	2	3	4	5	(15)	37.	1	2	3	4	5	(38)						
15.	1	2	3	4	5	(16)	38.	1	2	3	4	5	(39)						
16.	1	2	3	4	5	(17)	39.	1	2	3	4	5	(40)						
17.	1	2	3	4	5	(18)	40.	1	2	3	4	5	(41)						
18.	1	2	3	4	5	(19)	41.	1	2	3	4	5	(42)						
19.	1	2	3	4	5	(20)	42.	1	2	3	4	5	(43)						
20.	1	2	3	4	5	(21)	43.	1	2	3	4	5	(44)						
21.	1	2	3	4	5	(22)	44.	1	2	3	4	5	(45)						
22.	1	2	3	4	5	(23)	45.	1	2	3	4	5	(46)						
23.	1	2	3	4	5	(24)	46.	1	2	3	4	5	(47)						

APPENDIX C
CHILDREN'S MULTIDIMENSIONAL SELF-EFFICACY SCALES

CHILDREN'S MULTIDIMENSIONAL SELF-EFFICACY SCALES

Developed by:

ALBERT BANDURA
Stanford University
Stanford, California

This questionnaire is designed to help us get a better understanding of the kinds of things that are difficult for students. Please indicate your opinions about each of the statements below by crossing the appropriate number. Your answers will be kept strictly confidential and will not be identified by name. Please give your frank opinions.

1	2	3	4	5	6	7
Not well at all		Not too well		Pretty well		Very Well

How well can you concentrate on school subjects?

How well can you participate in class discussions?

How well can you get people outside the school to take an interest in your school (for example, community groups, churches)?

How well can you learn biology?

How well can you take class notes of class instruction?

How well can you learn reading and writing language skills?

How well can you use the library to get information for class assignments?

How well can you learn general mathematics?

How well can you plan your school work?

How well can you get your brother(s) and sister(s) to help you with a problem?

How well can you learn social studies?

How well can you finish homework assignments by deadlines?

How well can you get your parents to take part in school activities?

How well can you learn algebra?

How well can you organize your school work?

How well can you learn to use computers?

How much can you get your parent(s) to help you with a problem?

How well can you study when there are other interesting things to do?

How well can you learn a foreign language?

- 20 How well can you arrange a place to study without distractions?
- 21 How well can you learn science?
- 22 How well can you remember information presented in class and textbooks?
- 23 How well can you learn English grammar?
- 24 How well can you motivate yourself to do school work?

CHILDREN'S MULTIDIMENSIONAL SELF-EFFICACY SCALES

Card number 3 (1)

Please indicate your opinions about each of the statements by crossing the appropriate number.

KEY							
1	2	3	4	5	6	7	
Not well at all		Not too well		Pretty well		Very well	

1	1	2	3	4	5	6	7	(2)
2	1	2	3	4	5	6	7	(3)
3	1	2	3	4	5	6	7	(4)
4	1	2	3	4	5	6	7	(5)
5	1	2	3	4	5	6	7	(6)
6	1	2	3	4	5	6	7	(7)
7	1	2	3	4	5	6	7	(8)
8	1	2	3	4	5	6	7	(9)
9	1	2	3	4	5	6	7	(10)
10	1	2	3	4	5	6	7	(11)
11	1	2	3	4	5	6	7	(12)
12	1	2	3	4	5	6	7	(13)
13	1	2	3	4	5	6	7	(14)
14	1	2	3	4	5	6	7	(15)
15	1	2	3	4	5	6	7	(16)
16	1	2	3	4	5	6	7	(17)
17	1	2	3	4	5	6	7	(18)
18	1	2	3	4	5	6	7	(19)
19	1	2	3	4	5	6	7	(20)
20	1	2	3	4	5	6	7	(21)
21	1	2	3	4	5	6	7	(22)
22	1	2	3	4	5	6	7	(23)
23	1	2	3	4	5	6	7	(24)
24	1	2	3	4	5	6	7	(25)

APPENDIX D

**MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE
(HIGH SCHOOL) MSLQ-HS**

MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE
(HIGH SCHOOL)
(MSLQ - HS)

National Center for Research to Improve Postsecondary Teaching
and Learning
(NCRIPAL)

School of Education, The University of Michigan,
Ann Arbor, Michigan

Adapted by

J.L. de K. Monteith (Potchefstroom University for CHE)

and

M.J. Mofokeng

for

standard 10 students

*The attached questionnaire asks you about your study
habits, your learning skills, and your motivation for work
in this course.*

*THERE ARE NO RIGHT OR WRONG ANSWERS TO THE
QUESTIONNAIRE. THIS IS NOT A TEST.*

*We want you to respond to the questionnaire as
accurately as possible, reflecting your attitudes and
behaviors in this course.*

SELF-REGULATED LEARNING STRATEGIES

The following questions ask about your learning strategies and study skills for this class. Again, there are no right or wrong answers. Answer the questions about how you study in this class as accurately as possible. Use the same scale to answer the questions.

Not at all true of me	1	2	3	4	5	6	7	Very true of me
-----------------------	---	---	---	---	---	---	---	-----------------

If you think the statement is very true of you, cross out 7; if a statement is not at all true of you, cross out 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you. Cross out this number.

- 1 When I study for a test, I try to put together the information from class and from the book.
- 2 When I do homework, I try to remember what the teacher said in class so I can answer the questions correctly.
- 3 I ask myself questions to make sure I know the material I have been studying.
- 4 It is hard for me to decide what the main ideas are in what I read. (*R)
- 5 When work is hard I either give up or study only the easy parts. (*R)
- 6 When I study I put important ideas into my own words.
- 7 I always try to understand what the teacher is saying even if it doesn't make sense.
- 8 When I study for a test I try to remember as many facts as I can.
- 9 When studying, I copy my notes over to help me remember material.
- 10 I work on practice exercises and answer end of chapter questions even when I don't have to.
- 11 Even when study materials are dull and uninteresting, I keep working until I finish.
- 12 When I study for a test I practice saying the important facts over and over to myself.
- 13 Before I begin studying I think about the things I will need to do to learn.
- 14 I use what I have learned from old homework assignments and the textbook to do new assignments.
- 15 I often find that I have been reading for class but don't know what it is all about. (*R)
- 16 I find that when the teacher is talking I think of other things and don't really listen to what is being said. (*R)
- 17 When I am studying a topic, I try to make everything fit together.
- 18 When I'm reading I stop once in a while and go over what I have read.
- 19 When I read material for this class, I say the words over and over to myself to help me remember.
- 20 I outline the chapters in my book to help me study.
- 21 I work hard to get a good grade even when I don't like a class.
- 22 When reading I try to connect the things I am reading about with what I already know.

MSLQ - HS

If you think the statement is very true of you, cross out 7; if a statement is not at all true of you, cross out 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you. Cross out this number.

KEY

Not at all true of me

1

2

3

4

5

6

7

Very true of me

1	1	2	3	4	5	6	7	(26)
2	1	2	3	4	5	6	7	(27)
3	1	2	3	4	5	6	7	(28)
4	1	2	3	4	5	6	7	(29)
5	1	2	3	4	5	6	7	(30)
6	1	2	3	4	5	6	7	(31)
7	1	2	3	4	5	6	7	(32)
8	1	2	3	4	5	6	7	(33)
9	1	2	3	4	5	6	7	(34)
10	1	2	3	4	5	6	7	(35)
11	1	2	3	4	5	6	7	(36)
12	1	2	3	4	5	6	7	(37)
13	1	2	3	4	5	6	7	(38)
14	1	2	3	4	5	6	7	(39)
15	1	2	3	4	5	6	7	(40)
16	1	2	3	4	5	6	7	(41)
17	1	2	3	4	5	6	7	(42)
18	1	2	3	4	5	6	7	(43)
19	1	2	3	4	5	6	7	(44)
20	1	2	3	4	5	6	7	(45)
21	1	2	3	4	5	6	7	(46)
22	1	2	3	4	5	6	7	(47)