

CHAPTER SIX

METHOD OF RESEARCH

6.1 INTRODUCTION

In this chapter, the empirical investigation is described. The aim of the study is stated in paragraph 6.2, while the population and sample are described in paragraph 6.3, followed by a discussion of the instruments used in paragraph 6.4. The variables used are listed in paragraph 6.5, while the research design is described in paragraph 6.6. The statistical techniques which were used to analyse the data are discussed in paragraph 6.7.

6.2 THE AIM OF THE RESEARCH

The aim of the research (see paragraph 1.2) was firstly, to determine whether personal, environmental and behavioural variables influence the self-regulated learning abilities of students from an environmentally-deprived community; and secondly, to determine the relationship between self-regulated learning and the academic achievement in English and maths of the above-mentioned students.

6.3 POPULATION AND SAMPLE

6.3.1 POPULATION

All the standard 7 Vatsonga students (N=2771, see table 6.1), in the secondary schools which fall under the Ritavi 1(one) and 2(two) circuits of the Northern Province constituted the population for this study. The Ritavi 1(one) and 2(two) circuits comprise rural and urban schools. The number of schools, the amount of std 7 classes per school, the number of students per class and the total number of students in these two circuits are given in table 6.1.

TABLE 6.1: Number of schools (rural and urban schools), classes in each school, students per class and the total number of students constituting the population.

Standard 7 classes									
School code	A	B	C	D	E	F	G	H	No. of students
01	68	66	36	-	-	-	-	-	170
02	51	56	-	-	-	-	-	-	107
03	60	64	68	69	-	-	-	-	261
04	50	-	-	-	-	-	-	-	50
05	42	41	47	45	46	-	-	-	221
06	85	84	80	-	-	-	-	-	249
07	76	75	79	-	-	-	-	-	230
08	61	60	59	-	-	-	-	-	180
09	70	70	70	70	70	70	40	40	500
10	44	38	37	-	-	-	-	-	119
11	72	86	80	-	-	-	-	-	238
12	50	31	28	28	48	50	-	-	235
13	55	52	55	49	-	-	-	-	211
Total number of standard 7 students									2771

6.3.2 SAMPLE

From the population, a stratified cluster sample of seven schools, to furnish a sample of 374 subjects, was drawn (see table 6.2).

TABLE 6.2: Schools, classes and the number of students constituting the sample.

School	Selected class	No. of students
01	7A	61
03	7C	59
04	7A	44
05	7D	45
08*	7A*	61
09*	7D*	66
10	7B	38
Total number of students		374

* Urban schools

6.4 INSTRUMENTATIONS

The following tests or questionnaires were used.

6.4.1 THE BIOGRAPHICAL QUESTIONNAIRE

The Biographical Questionnaire (BQ) consisted of a number of items (N=39) designed to obtain information on the subjects' age, sex, family characteristics, learning related and home related characteristics etc. (see appendix A).

6.4.2 THE LEARNING AND STUDY STRATEGIES INVENTORY-HIGH SCHOOL VERSION (LASSI-HS)

The Learning and Study Strategies Inventory-High School Version (LASSI-HS) (see appendix B) is an assessment tool consisting of 76 items, designed to measure students' use of learning and study strategies and methods at the secondary and high school level (Weinstein and Palmer, 1990:3). Students have to respond to the items on a 5-point Likert-type scale (ranging from 1="not at all like me" to 5="very much like me"). Students have to answer according to how well the statements describe them, and not how they think they should be, or what others think of them.

According to the developers (Weinstein and Palmer, 1990) of the LASSI-HS, it is meant to be used as:

- * a diagnostic measure to help identify areas in which students could benefit most from educational intervention;
- * a counseling 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.

In this study, the LASSI-HS was used as a measure to identify students' use of learning strategies in order to determine the influence of learning strategies on academic achievement.

The LASSI-HS consists of ten subscales. A brief description of each subscale is given, the reliability of each subscale (the Alpha levels) as reported in the manual (Weinstein and Palmer, 1990), as well as the Alpha coefficients for the LASSI under South African conditions are given in parentheses. Both Alpha coefficients are given as the LASSI has not yet been standardized under South African conditions for application to the subjects who participated in this study. Some sample items of each subscale are also given with item numbers in parentheses.

6.4.2.1 Attitude

The first subscale contains items addressing attitude to and interest in education and school. Attitude is a variable addressing students' positive or negative interests in education and school. If the relationship between school and life goals is not clear, it is difficult to maintain a mind-set that promotes good work habits, concentration and attention to school and its related tasks.

The student scores obtained on this scale indicate their general attitudes and motivation for succeeding in school and performing the tasks related to school success. Students who score low on this measure need to work on a higher level of goal-setting and reassess how school fits into their future plans. If school is not seen as relevant to the students' life goals, then it will be difficult to generate the level of motivation needed to help take responsibility for one's own learning activities (Weinstein and Palmer, 1990:130).

Cronbach Coefficient Alpha = 0,74 (0,82)

How clear are students about their own educational goals? (14)

Is school really important or worthwhile to them? (68)

6.4.2.2 Motivation

This subscale addresses students' diligence, self-discipline, and willingness to work hard. Motivation is the degree in which students accept responsibility for studying and for their performance. These behaviours include reading textbooks, preparing for class, finishing assignments on time, and being diligent in studying even if the topic is uninteresting.

The student scores attained on this scale indicate the degree in which they accept responsibility for performing the specific tasks related to school success. Students who score low on this measure, need to work on goal setting at the more global levels assessed on the attitude scale, but especially at the more specific level of the individual tasks and assignments. Accepting more responsibility for studying and achievement outcomes requires that students learn to attribute much of what happens to them in school to their own efforts rather than to outside forces such as luck or teachers (Weinstein and Palmer, 1990:13).

Cronbach Coefficient Alpha = 0,78 (0,31)

Do students easily lose interest in their classes? (9)

Do they try to stay up-to-date with their class assignments? (10)

6.4.2.3 Time management

This subscale examines students' use of time management for academic work. Managing time is an important support strategy for learning. Most students create schedules and stick to them when studying. This also requires knowledge about themselves as students and learners. This type of knowledge and self-awareness motivate the students to learn effectively.

The student scores obtained on this scale indicate the degree in which they create and use schedules. Students who score low on this measure may need to learn how to create a schedule and how to deal with distractions, competing goals, and procrastinations. Accepting more responsibility for studying and achievement outcomes, requires that students set learning goals and create plans that will facilitate goal achievement (Weinstein and Palmer, 1990:14).

Cronbach Coefficient Alpha = 0,77 (0,31)

Are they well organized? (62)

Do they anticipate scheduling problems? (3)

6.4.2.4 Anxiety

Anxiety items address the degree in which students worry about school and their performance. Cognitive worry is manifested in negative statements that make it difficult

for students to concentrate and students are easily discouraged about grades. If a student is worried that he will not have the time to finish a test, he is making matters worse by taking more time away to worry about his performance. This type of self-defeating behaviour often sabotages a student's efforts.

The student scores obtained on this scale indicate how tense or fearful they are when approaching academic tasks. Students who score low on this measure need to learn techniques for coping with anxiety and reducing worry so that they can focus on the task and not on their anxiety. Many students are often incapable of demonstrating their true level of knowledge and skills because they are distracted by debilitating anxiety (Weinstein and Palmer, 1990:14).

Cronbach Coefficient Alpha = 0,82 (0,64)

Do students worry so much that it is hard for them to concentrate? (59)

Are they easily discouraged about grades? (28)

6.4.2.5 Concentration

This subscale focuses on students' ability to pay close attention to academic tasks. Concentration helps students to focus their attention on learning-related tasks such as studying and listening in class. If students are distracted, there will be less capacity to focus on the task at hand. For the students, it means that distractions that interfere with concentration, divert attention away from school-related activities.

The student scores obtained on this scale indicate their abilities 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. Those who score low on this measure need to learn techniques to enhance concentration and to set priorities so that they can attend to school as well as their other responsibilities (Weinstein and Palmer, 1990:14).

Cronbach Coefficient Alpha = 0,82 (0,73)

Are they easily distracted? (45)

Can they direct their attention to school work? (42)

6.4.2.6 Information processing

This scale contains items addressing several sub-areas. These include the use of mental imagery, verbal elaboration, comprehension monitoring and reasoning. Students create images from hypotheses to aid their memory and reason in order to form conclusions. Information processing helps to build bridges between what the students know (prior knowledge) and what they are trying to learn and remember (new knowledge).

The student scores obtained on this scale indicate how well they can create imaginal and verbal elaborations and 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 range from simple paraphrasing and summarizing to creating analogies, the use of application, creating organizational schemes and outlining, and the use of inferential, analytical, and synthetic reasoning skills (Weinstein and Palmer, 1990:15).

Cronbach Coefficient Alpha = 0,80 (0,80)

Can students create images to aid their memory? (15)

Can they reason from hypotheses to form conclusions? (4)

6.4.2.7 Selecting main ideas

Items on this scale address students' ability to pick out important information for further study. Selecting main ideas requires that the students be able to select the important material for in depth attention. If a student cannot select the critical information then the learning task becomes complicated by the huge amount of material the individual is trying to acquire. Lacking such a skill, means that the students will not have enough time to study everything that must be covered.

The student scores obtained on this scale indicate their skills for selecting important information to concentrate on for further study in their classroom lecture. 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 (Weinstein and Palmer, 1990:15).

Cronbach Coefficient Alpha = 0,71 (0,30)

Can they focus on the key points in a class discussion? (54)

Can they decide what to underline in a textbook? (43)

6.4.2.8 Study aids

The study aids scale examines the degree in which students create or use support techniques or materials to help them learn and remember new information. Study aids that authors will often use in textbooks are, for example, headings, special markings, summaries, and statements to help students learn from these materials. Students need to know how to use study aids created by others and how to create their own. It is also important for students to know how to generate their own aids by methods such as the creation of diagrams, text marking, creating charts or summary sheets and underlining.

The student scores obtained on this scale indicate their ability to use or create study aids that increase meaningful learning and retention. Students who score low on this measure need to learn more about the types of study aids provided in educational materials and classes and how they can create their own aids to help them to understand their work (Weinstein and Palmer, 1990:16).

Cronbach Coefficient Alpha = 0,68 (0,75)

Do they complete practice exercises? (73)

Do they create or use organizational aids? (52)

6.4.2.9 Self-testing

This subscale focuses on reviewing and preparing for classes and tests. Most of the items deal with some aspects of comprehension monitoring. Self-testing supports and contributes to meaningful learning and effective performance. Without self-testing, learning cannot be complete. Using mental reviews, going over class notes and the text, thinking of potential questions to guide reading, consolidating new knowledge, integrating related information and identifying (if additional studying must be done), are all important methods for checking understanding.

The student scores obtained on this scale indicate their awareness of the importance of self-testing and reviewing and the degree in which they use these methods. Students who score low on this scale need to learn more about the importance of self-testing and need to learn specific methods to review school material and to monitor their comprehension (Weinstein and Plamer, 1990:16).

Cronbach Coefficient Alpha = 0,74 (0,76)

Do students review their work before a test? (19)

Do they stop periodically while reading a textbook to review the content? (30)

6.4.2.10 Test strategies

This final scale focuses on students' approaches to preparing for and taking quizzes and tests. Test-taking strategies include knowing about the characteristics of tests and test items, and how to create an effective test-taking plan.

The student scores obtained on this scale indicate their use of test-taking strategies. Students who score low on this scale may need to learn more about how to create a plan of attack for taking a test, the characteristics of different types of tests and test items, and how to argue an answer. Knowing about test-taking strategies, helps students to target their study activities, set up study goals, implement an effective study plan, and demonstrate their knowledge and skill acquisition so it can be accurately evaluated (Weinstein and Palmer, 1990:17).

Cronbach Coefficient Alpha = 0,81 (0,85)

Do the students prepare appropriately? (31)

Do they know how to approach different types of test questions? (51)

6.4.3 THE MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE (MSLQ)

The MSLQ (see appendix C) includes 44 items on student motivation, cognitive strategy use, metacognitive strategy use, and the management of effort. Students are instructed to respond to the items on a 7-point Likert scale (ranging from 1 = "not at all true of me" to 7 = "very true of me") in terms of their behaviour in the course work. The items of the MSLQ were adapted by its developers from various instruments used to assess students' motivation, cognitive strategy use and metacognition. Factor analysis was used to guide scale construction, resulting in the exclusion of some of the items from the scales because of a lack of correlation or stable factor structure (Pintrich and De Groot, 1990:34).

Factor analysis of the motivation items revealed three distinct motivational factors: Self-efficacy, intrinsic value, and test anxiety. The Self-Efficacy scale (Alpha = 0,89/0,81)¹ consisted of nine items regarding confidence in class work (e.g., "I expect to do very well in this class" (8), "I am sure that I can do an excellent job on the problems and tasks assigned for this class" (11), "I know I will be able to learn the material for this class" (19) (Pintrich and De Groot, 1990:35).

The Intrinsic Value scale (Alpha = 0,87/0,84) was constructed by taking the mean score of the students' response to nine items concerning intrinsic interest in course work, e.g. "It is important for me to learn what is being taught in this class" (4), as well as preference for challenge and master goals e.g., "I prefer class work that is challenging so I can learn new things" (1). Four items e.g., "I am so nervous during a test that I cannot remember facts I have learned" (3). "When I take a test I think about how poorly I am doing" (22). Worry about tests and cognitive interference on tests, were used in the Test Anxiety scale (Alpha = 0,75/0,75) (Pintrich and De Groot, 1990:35).

On the basis of the results of the factor analysis, two cognitive scales were constructed: cognitive strategy use and self-regulation. The Cognitive Strategy Use scale (Alpha = 0,83/0,73) consisted of 13 items pertaining to the use of rehearsal strategies e.g., "When I read material for science class, I continuously repeat the word to myself to help me remember" (41), elaboration strategies such as summarizing and paraphrasing e.g., "When I study for this English class, I put important ideas into my own words" (28), and organizational strategies e.g., "I outline the chapters in my book to help me study" (Pintrich and De Groot, 1990:35).

The Self-Regulation scale (Alpha = 0,74/0,55) was constructed from metacognitive and effort management items. The items on metacognitive strategies, such as planning, skimming, and comprehension monitoring e.g., "I ask myself questions to make sure I know the material I have been studying" (25), "I find that when the teacher is talking, I think of other things and don't really listen to what is being said" (38), and "I often find that I have been reading for class but don't know what it is all about" (37), with the latter two items reflected before scale construction, were adapted from Weinstein *et al.*, (1987) and Zimmerman and Pons (1986). They included students' persistence at difficult or boring tasks and working diligently e.g., "Even when study material is dull and uninteresting, I keep working until I am finished" (33) and "When work is hard I

¹ Alpha levels as reported by Pintrich and De Groot (1990). Alpha levels after the / are for South African conditions. Both Alpha levels are given as the MLSQ have not been standardized for the subjects who participated in this study.

either give up or study only the easy parts" (27), with the latter item reflected before scale construction (Pintrich and De Groot, 1990:35).

6.4.4 THE CHILDREN'S MULTIDIMENSIONAL SELF-EFFICACY SCALES (CMSES)

The Children's Multidimensional Self-efficacy Scales (CMSES) (see appendix D) was developed as a paper-and-pencil test to assess students' perceived capability for correctly performing a variety of learning-related tasks. The Children's Multidimensional Self-efficacy Scales (Bandura, 1989a) as used in this study, consists of 40 statements each describing a task related to effective learning and studying. Students were instructed to respond to the items on a 7-point scale (ranging from 1="not well at all" to 7="very well") in terms of their behaviour in the class.

As there were no right or wrong answers, subjects were advised to be honest and rate their perceived self-efficacy by making a cross that most accurately reflected their own judgments and confidence. Because of a time restriction, no pilot test was run on the Children's Multidimensional self-efficacy Scales (CMSES). All 40 items of the CMSES were completed and scored. A brief description of each subscale is given as well as some sample items and the reliability (i.e., Cronbach's coefficient Alpha). The following formula for Alpha was used:

$$a \text{ or } r_{xx} = \left[\frac{K}{K-1} \right] \left[\frac{S_x^2 - \sum s_i^2}{S_x^2} \right]$$

Where:

- K = number of items on the test;
- $\sum s_i^2$ = sum of the variances of the item scores;
- S_x^2 = variance of the test scores (all K items);

(Ary, Jacobs and Razavieh, 1990:279).

6.4.4.1 Self-efficacy for social resources

Self-efficacy for social resources involves the students' responsibility to get assistance from other people, i.e., teachers, fellow students, adults, and friends. Students take initiatives to get teachers and other students to assist them when they get stuck on their school work. Students also get adults and friends to help them solve their problems.

This behaviour helps students to perform better on their academic tasks after having solved their problems with their teachers, fellow students, adults and friends.

Self-efficacy for enlisting social resources consists of four items concerning how a student can get help from others, e.g., "How well can you get teachers to help you when you get stuck on schoolwork?" (9), "How well can you get another student to help you when you get stuck on schoolwork?" (19), "How well can you get adults to help you when you have social problems?" (27), "How well can you get a friend to help you when you have social problems?" (35) (Bandura, 1989a).

Coefficient Alpha = 0,67

6.4.4.2 Self-efficacy for academic achievement

Self-efficacy for academic achievement involves personal beliefs about one's capabilities to complete academic tasks successfully and to achieve the marks one would like to obtain. Students who have a low sense of efficacy for academic achievement may attempt to avoid working hard, whereas those who judge themselves more efficacious would participate more readily in academic studies (Schunk, 1988:3).

Self-efficacy for academic achievement consists of nine items regarding how student learns, e.g., "How well can you learn biology?" (5), "How well can you learn to use computers?" (10), "How well can you learn general mathematics?" (14).

Coefficient Alpha = 0,77

6.4.4.3 Self-efficacy for self-regulated learning

Self-efficacy for self-regulated learning includes students' feelings of efficacy about performing well on academic tasks. Students' progress on academic tasks can instill confidence that they have the ability to succeed, can enhance their motivation to persist, and increase efficacy for further learning (Zimmerman, 1994:13). They concentrate, take class notes, complete class assignments, plan their school work, organize, arrange for a place to study and participate in class discussions.

Self-efficacy for self-regulated learning consists of eleven items concerning self-regulation, e.g., "How well can you concentrate on school subjects?" (1), "How well can you participate in class discussions?" (2), "How well can you take class notes of class instruction?" (6).

Coefficient Alpha = 0,82

6.4.4.4 Self-efficacy to meet others' expectations

Self-efficacy to meet others' expectations involves students' preparedness or willingness to live up to what their parents, teachers, as well as their peers expect of them in academic achievement.

Self-efficacy to meet others' expectations consists of four items, e.g., "How well can you live up to what your parents expect of you?" (7), "How well can you live up to what your teachers expect of you?" (12), "How well can you live up to what you expect of yourself?" (16).

Coefficient Alpha = 0,70

6.4.4.5 Social self-efficacy

Social self-efficacy involves students' social life, whether they can socialize with others. Social life may include how students make friends, work or live with other people in their environment. Social efficacy consists of four items regarding students' socialization, e.g., "How well can you work in a group?" (3), "How well can you carry on conversations with others?" (17).

Coefficient Alpha = 0,71

6.4.4.6 Self-assertive self-efficacy

Self-assertive self-efficacy involves students' decisions and opinions when other classmates disagree with them, and to stand up for themselves when they feel they are being treated unfairly. It also involves dealing with situations where others are annoying them or hurting their feelings and standing firm to someone who is asking them to do something unreasonable or inconvenient.

Self-assertive self-efficacy consists of four items concerning students' opinions, e.g., "How well can you express your opinions when other classmates disagree with you?" (8), "How well can you stand firm to someone who is asking you to do something unreasonable or inconvenient?" (13), "How well can you stand up for yourself when you feel you are being treated unfairly?" (25).

Coefficient Alpha = 0,72

6.4.4.7 Self-efficacy for enlisting parental and community support

Self-efficacy for enlisting parental and community support refers to the students' self-activities to seek assistance from others, such as getting their parents, brothers, and sisters to help them solve their problems.

Self-efficacy for enlisting parental and community support consists of four items concerning support, e.g., "How well can you get people outside the school to take an interest in your school, for example, community groups, churches etc?" (4), "How well can you get your brother(s) and sister(s) to help you with a problem?" (18).

Coefficient Alpha = 0,69

6.4.5 SUPPORT QUESTIONNAIRE (SQ)

The Support Questionnaire (SQ) (see appendix E) included 24 items on the support students get from their fathers, mothers and teachers. Students were instructed to respond to the items on a scale as shown below in terms of the support they get from their fathers, mothers and teachers.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

A brief description of each subscale is given as well as some sample items and the reliability of the subscales (Alpha level) as calculated by applying the formula given in paragraph 6.4.4.

6.4.5.1 Father support

Father support involves the support that children get from their fathers. This support includes the fathers' encouragement, help, advice, problem solving, inspirations and discussions of future plans with their children concerning their school work. With father support, the child realizes that the father is interested in his or her academic tasks and begins to learn effectively.

Father support consists of eight items. Four items are with regard to the assistance the student gets from the father, e.g., "Does your father encourage you to study?" (1), "How often does your father discuss your school work with you?" (2) (see appendix E).

The last four items are related to the fathers' expectations for their children. E.g., "Does your father make you feel that he is ready and available to give help and advice when you need it?" (3) "Does your father want you to achieve better than other children?" (4). (also see appendix E)

Coefficient Alpha = 0,92

6.4.5.2 Mother support

Mother support includes the support that children get from their mothers. This support includes the mothers' encouragement, help, advice, problem solving, inspiration and discussion of future plans with their children concerning their school work. With mother support, the child realizes that the mother is interested in his or her academic task and begins to learn effectively.

Mother support consists of eight items. Four items concern the assistance the child gets from the mother, e.g., "Does your mother encourage you to study?" (9), "How often does your mother discuss your school work with you?" (10).

The last four items are related to the mothers' expectations for their children, "Does your mother make you feel that she is ready and available to give help and advice when you need it?" (11), "Does your mother want you to achieve better than other children?" (12).

Coefficient Alpha = 0,86

6.4.5.3 Teacher support

Teacher support involves the support that the students get from their teachers. This support includes the teachers' encouragement, help, advice, problem solving, inspiration and discussion of future plans with their students concerning their school work. With teacher support, a student realizes that the teacher is interested in his or her academic task and begins to learn effectively.

The teachers support consists of eight items. Four items with regard to the assistance the student gets from the teacher, e.g., "Do your teachers encourage you to study?" (17), "How often do your teachers discuss your school work with you?" (18).

The last four items are related to teachers' expectations for their students, e.g., "Do your teachers make you feel that they are ready and available to give help and advice when

you need it?" (19), "Do your teachers want you to achieve better than other students?" (20).

Coefficient Alpha = 0,82

6.4.6 SCHOOL MARKS

School marks obtained in English and mathematics in the half-yearly examinations in the schools were used as dependent variables in the study.

6.5 VARIABLES USED

The following independent and dependent variables were used in this study.

6.5.1 INDEPENDENT VARIABLES

Age

Sex

Family defined as the sum of family size, sibsize and birth order.

Socio-economic status is defined as the father's level of education, the mother's level of education, the parents' aspirations, the father and mother's employment, possession of TV and car, and having electricity at home.

The maths goal is defined as the mark students aim to achieve in mathematics.

The English goal is defined as the mark students aim to achieve in English.

Goal setting is defined as the sum of English and maths goals.

Living space is defined as the total number of people living in a home (i.e., family size) divided by the number of rooms in the house.

Attitude

Motivation

Time management

Anxiety

Concentration

Information processing

Selecting main ideas

Study aids

Self-testing

Test-taking strategies

Self-efficacy for social resources

Self-efficacy for academic achievement

Self-efficacy for self-regulated learning

Self-assertive self-efficacy

Self-efficacy for enlisting parents and community support

Intrinsic value

Strategy use

Father support

Mother support

Teacher support

Home support defined as the the sum of father and mother support.

6.5.2 DEPENDENT VARIABLES

Self-regulated learning (defined as the subjects' score on the self-regulation scale of the MSLQ), marks in English, and Mathematics were used as dependent variables.

6.6 EXPERIMENTAL DESIGN

An *ex post facto* design with multiple regression analysis was used to determine the collective and individual influence of the independent variables (paragraph 6.5) on the dependent variables.

6.7 STATISTICAL PROCEDURES AND TECHNIQUES

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

Correlation coefficients were calculated with the CORR Procedure of SAS Programme (SAS INSTITUTE INC, 1985) to determine the relationship between the independent variables (paragraph 7.4) and the dependent variables.

T-tests for independent groups were performed with the T-TEST-procedure of SAS (SAS INSTITUTE INC, 1985) while one way analyses 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 variables, multiple regression analyses were performed. The BMDP-9R (All Possible Subjects Program) was used for the calculation of the multiple regression analyses. The BMDP-9R method RSQ procedure was first used to identify the best subset of variables by applying Mallows' CP criterion. Best is defined as the smallest CP. A further multiple regression analysis was then performed on the best subset by using the BMDP-9R method NONE procedure to determine the contribution of each individual variable to R^2 (Dixon and Brown, 1977:423).

Multiple regression analysis is a method developed for analysing the collective and separate or individual contributions of two or more independent variables, X_1 , X_2 , X_3 ...to the variation of a dependent variable, Y (Kerlinger and Pedhazur, 1973:3 and Kerlinger, 1966:360; 1975:659; 1969:187). This method is appropriate in this research in which the collective and the separate contributions of the independent variables were to be determined with regard to variation in self-regulated learning, and academic achievement in English and mathematics.

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

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

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

$$d = \frac{|\bar{X}_E - \bar{X}_K|}{S_{\max}}$$

Where:

d = effect size;

\bar{X}_E = mean of group E;

\bar{X}_K = mean of group K;

S_{\max} = highest standard deviation of either group E or group K.

(Steyn, 1990:10-10).

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

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

(Steyn, 1990:13-23).

To determine the educational significance (effect size) of the difference between group means as with ANOVA's, the following equation was used:

$$f = \sqrt{(k-1)F/(N-k-1)}$$

Where:

F = F-value from the analysis of variance;

k = number of groups;

N = number of observations;

f = effect size.

(Cohen, 1977).

6.8 PROCEDURE

The researcher visited the schools in the Ritavi 1(one) and 2(two) circuits, area of the Northern Province, to collect information from the headmasters, in connection with the schools and classes in which the research was to be conducted.

From a population of 2771 standard 7, Ritavi 1(one) and 2(two) circuits, area of the Northern Province 374 subjects were selected (see paragraph 6.3).

In all the schools, the subjects first completed the Biographical Questionnaire (BQ), after which they completed the Learning and Study Strategies Inventory High School (LASSI-HS), Children's Multidimensional Self-efficacy Scales (CMSES), Motivated Strategies for Learning Questionnaire (MSLQ-HS) and the Support Questionnaire (SQ). There were breaks of 10 to 15 minutes, or 20 to 30 minutes after every test, depending on the length of the test. The time was recorded from the beginning to the end of every test.

As some of the subjects in the sample had language deficiencies, precautions were taken to ensure that they understood the directions by explaining difficult words from the items or statements, questions and answers. For example, after explaining the instructions for each questionnaire (e.g., the LASSI-HS), the tester required a sample of subjects to tell him the instructions until he was satisfied that they understood them. After the completion of each questionnaire, the subjects were requested to wait until they were told to turn the page, in order to start together at the same time to answer the next questionnaire. After completion of the field work, the data were computerized for statistical analyses (see chapter 7).