

**THE INFLUENCE OF INDEPENDENT LEARNING AS A  
LEARNING STRATEGY ON THE ACADEMIC  
ACHIEVEMENT OF NURSING STUDENTS**

**BY**

**Gondongwe Elizabeth Mambanda**

**THE INFLUENCE OF INDEPENDENT LEARNING  
AS A LEARNING STRATEGY ON THE  
ACADEMIC ACHIEVEMENT OF NURSING STUDENTS**

**BY**

**GONDONGWE ELIZABETH MAMBANDA**

**RN; RM; MCH; B.Ed (NURSING), B.Ed (HONS)**

**DISSERTATION SUBMITTED FOR THE DEGREE MAGISTER EDUCATIONIS  
IN GUIDANCE AT THE POTCHEFSTROOMSE UNIVERSITEIT VIR  
CHRISTELIKE HOËR ONDERWYS**

**SUPERVISOR: PROF. J.L. MARAIS**

**POTCHEFSTROOM**

**1997**

## ACKNOWLEDGEMENTS

I wish to extend my heartfelt thanks and sincere gratitude to the following for the contributions they made towards the completion of this study:

- Glory to the Almighty for giving me sustenance.
- Professor J.L. Marais, my supervisor. My decision to undertake this demanding study under his guidance is an expression of my esteem for his expertise. It was a privilege and enriching experience for me to study under his excellent supervision. "Pay attention to your teacher and learn all you can." (Proverbs 23:12.)
- The Department of Health and Developmental Social Welfare for granting me permission to use the Mmabatho College of Nursing Students.
- My friends and colleagues, for untiring encouragement and support.
- My parents, brothers, particularly N.I. Gondongwe, and sisters who proved pillars of strength when the going became tougher in my life.
- Loveness and Douglas Sibanda, Baba Thato Hlogwane and Sarah Blackie Monareng for their overall assistance.
- Sisi D, as affectionately referred to by Tino, Tendi, Ndafo and Ruva. To her, I say thank you very much. Without Sisi D, all this could have been impossible.

- Collin Zhuawu for the acronyms and initials used in the text.
- S.H. Ali for constant motivation and interest in my studies.
- S.K. Simba for putting the bibliography in order.
- The Principal of Mmabatho College of Nursing for allowing me to carry out this research.
- Mrs. L. Davey of the Afrikaans and Dutch Department (University of North West) who translated the summary from English to Afrikaans.
- Professor H.S. Steyn of the Statistical Services (PU vir CHO) who assisted in the statistical analysis.
- Mr. Johann Blaauw who did the editing of the dissertation.
- A special word of acknowledgement to Miss Alma Theron, who skillfully, tirelessly and expertly did the typing.
- Mrs. S. du Toit who did the proof-reading.
- To Therjiwe Milwana, Rachael and Michael Mafumbate.
- Constance and William Chitumba for spiritual support.
- Tendai Enigma for the final touch-ups.
- Ein Murevesi for long-lasting emotional support.

Thank you LORD. Isaiah 43: 1-7

## DEDICATION

"By what power or what name did you do this?" Acts 4:7

"It is by the name of Jesus Christ that all this was done" Acts 4:10

"In the name of Jesus Christ ....." Acts 3:6

## DECLARATION

I hereby declare that:

"The influence of independent learning as a learning strategy on the academic achievement of first year scientific foundations of nursing students at Mmabatho college of nursing" is my own work, that all the sources used and quoted have been indicated and duly acknowledged by means of complete references, and that this dissertation had not been previously submitted by me for any degree at another university.

Signed: \_\_\_\_\_

*Gondongwe*

GONDONGWE ELIZABETH MAMBANDA

## **SUMMARY**

### **THE INFLUENCE OF INDEPENDENT LEARNING AS A LEARNING STRATEGY ON THE ACADEMIC ACHIEVEMENT OF NURSING STUDENTS.**

The purpose of this research was to determine by means of a literature review the influence of independent learning as a learning strategy on the academic achievement of nursing students.

The literature review concluded that independent learning, particularly metacognition as a learning strategy, influenced the academic achievement of nursing students.

Students who manage, appraise, evaluate, regulate and monitor their learning tasks achieve better academically than their counterparts. Note-taking and summarising enable students to recall information better. Self-regulated students become engrossed in the learning task on their own.

By means of an empirical investigation, it could be concluded that metacognition in particular influences academic achievement through the use of guided learning in the form of an independent learning package.

Recommendations were made regarding the implementation of properly structured guidance for independent learning as a learning strategy for nursing students.

## **OPSOMMING**

### **DIE INVLOED VAN ONAFHANKLIKE LEER AS 'N LEERSTRATEGIE, OP DIE AKADEMIESE PRESTASIE VAN VERPLEEGSTUDENTE.**

Die doel met hierdie studie/navorsing was om deur middel van 'n literatuuroorsig die invloed van onafhanklike studie as leerstrategie op die akademiese prestasie van verpleegkundestudente te bepaal.

Die literatuuroorsig het bewys dat onafhanklike studie, en in die besonder metakognisie as leerstrategie, die akademiese prestasie van verpleegkundestudente beïnvloed het.

Die studente wat hul studietake beheer/beplan, waardeer, evalueer, reël en monitor, presteer akademies beter as hul studiegenote/eweknieë. Die neem van aantekeninge en die maak van opsommings stel die student in staat om inligting beter te herroep. Self-gereguleerde studente verdiep hulle op eie houtjie in die leertaak.

Deur middel van 'n empiriese ondersoek kon tot die gevolgtrekking gekom word dat metakognisie in die besonder akademiese prestasie beïnvloed deur die gebruik van geleide studie in die vorm van 'n onafhanklike studiepakket.

Aanbevelings rakende die implementering van behoorlik gestruktureerde voorligting vir onafhanklike studie as leerstrategie by verpleegstudente is ook gemaak.

**TABLE OF CONTENTS****Page No.****ACKNOWLEDGEMENTS****SUMMARY****OPSOMMING****CHAPTER 1**

<b>1.</b>	<b>STATEMENT OF THE PROBLEM, AIM OF THE RESEARCH AND RESEARCH METHODS .....</b>	<b>1</b>
1.1	Introduction and statement of the problem .....	1
1.2	Aim of the research.....	5
1.3	Acronyms and initials .....	5
1.4	Research hypothesis .....	6
1.5	Method of research .....	8
1.6	Experimental design.....	9
1.7	Procedure and overview of the study.....	10

**CHAPTER 2**

<b>2.</b>	<b>LEARNING AND LEARNING STRATEGIES.....</b>	<b>11</b>
2.1	Introduction.....	11
2.2	Description of the concept of learning.....	11
2.2.1	Nature of the learner .....	17
2.2.1.1	Affective emotional factors .....	17
2.2.1.2	Motivation.....	18
2.2.1.3	Study habits .....	18
2.2.2	Nature of the knowledge to be learnt.....	20
2.2.3	Nature of the learning process.....	20
2.3	Discussion of different learning strategies.....	23

2.3.1	Explanation of learning strategies .....	23
2.3.2	Types of learning strategies in general .....	31
2.3.2.1	Cognitive learning strategies .....	32
2.3.2.2	Metacognitive learning strategies .....	36
2.3.2.2 (a)	Monitoring learning strategies .....	37
2.3.2.2 (b)	Planning learning strategies .....	38
2.3.2.2 (c)	Independent learning as learning strategy (ILS) .....	38
2.3.2.3	Resource management learning strategies .....	41
2.3.2.3 (a)	Management of the study environment .....	42
2.3.2.3 (b)	Management of available time .....	42
2.3.2.3 (c)	Management of support strategies .....	43
2.3.2.3 (d)	Management of effort strategies .....	44
2.3.3.	Conclusion.....	44

### **CHAPTER 3**

<b>3.</b>	<b>THE RELATIONSHIP BETWEEN INDEPENDENT LEARNING AS A LEARNING STRATEGY AND ACADEMIC ACHIEVEMENT.....</b>	<b>46</b>
3.1	Introduction .....	46
3.2	Independent learning as a learning strategy .....	47
3.3	Learning with others.....	50
3.4	The relationship between independent learning as a learning strategy and academic achievement.....	51
3.5	Conclusion .....	56

### **CHAPTER 4**

<b>4</b>	<b>METHOD OF RESEARCH .....</b>	<b>57</b>
----------	---------------------------------	-----------

4.1	Introduction .....	57
4.2	Aim of the research .....	58
4.3	Setting.....	58
4.4	Population and sample.....	58
4.5	Instrumentation .....	61
4.6	Variables used in the study .....	75
4.7	Experimental design .....	75
4.8	Statistical procedures.....	76
4.9	Procedure.....	78
4.10	Conclusion .....	80

## **CHAPTER 5**

<b>5</b>	<b>STATISTICAL ANALYSIS AND INTERPRETATION OF RESULTS.....</b>	<b>81</b>
5.1	Introduction .....	81
5.2	Hypotheses.....	81
5.3	Overview.....	83
5.4	Comparison.....	88
5.4.1	Comparison within the Control Group (CG): Before and after one month .....	88
5.4.2	Comparison of the Control Group (CG) and Experimental Group (EG): Before one month.....	88
5.4.3	Comparison of the Control Group (CG) and Experimental Group (EG): After one month .....	89
5.4.4	Comparison of the(EGD=EGPO - EGPR) and (CGD=CGPO-CGPR): After one month.....	89

5.4.5	Comparison of the Experimental Group: Before and after one month .....	90
5.5	Data summaries and graphics.....	90
5.6	Hypotheses tests.....	91

## **CHAPTER 6**

<b>6</b>	<b>SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION .....</b>	<b>93</b>
6.1	Introduction .....	93
6.2	Statement of the problem.....	93
6.3	Review of the literature .....	94
6.3.1	The relationship between independent learning as a strategy and academic achievement .....	94
6.4	Method of research.....	96
6.4.1	Subjects.....	96
6.4.2	Instrumentation .....	97
6.4.3	Procedure.....	97
6.5	Results .....	97
6.6	Limitations .....	100
6.7	Recommendations .....	100
6.8	Conclusion .....	102
	<b>THE SOURCE LIST .....</b>	<b>103</b>

### **MAPS USED IN THE STUDY**

Map 4.1	Map fo Mmabatho area to show where Mmabatho college of Nursing is situated .....	79
Map 4.2	Course map for SFN 100 .....	62
Map 4.3	Course map for the respiratory system .....	71

## LIST OF FIGURES

Figure 2.1	Schematic presentation of the learning.....	12
Figure 2.2	Theories of learning.....	14
Figure 2.3	Ausubel's 4 dimensions of learning.....	19
Figure 2.4	Model of information processing .....	26
Figure 2.5 (a)	Memory system - sensory store.....	27
Figure 2.5 (b)	Memory system - short term.....	27
Figure 2.5 (c)	Memory system - long term.....	27
Figure 3.1	Self activity .....	48
Figure 4.1	Pre-score (prscore) for both groups.....	77
Figure 5.1	Chapter overview .....	85

## LIST OF TABLES

Table 4.1	Small table of random digits .....	59
Table 4.2	Elements of comprising the sample study.....	60
Table 4.3	Scores at the beginning of the study.....	61
Table 4.4	Time table for the respiratory system = 18 .....	65
Table 4.5	Post-test scores for both groups .....	73
Table 4.6	Difference in pre-test scores and post-test.....	74
Table 4.7	Presentation of all data that was collected.....	75
Table 5.1	Scores of post-test for all students (Poscore).....	87
Appendix 1		
Appendix 2		
Appendix 3		
Appendix 4		

# CHAPTER 1

## 1. STATEMENT OF THE PROBLEM, AIM OF THE RESEARCH AND RESEARCH METHODS

### *1.1 INTRODUCTION AND STATEMENT OF THE PROBLEM*

When marks are related to academic achievement those marks reflect academic achievement and nothing more (Kubiszyn & Borich, 1984: 132). The Oxford Thesaurus (1993: 3) states that academic achievement is that gain, attainment or accomplishment which is scholarly and of theoretical interest only. The same source continues to explain the term learning as that "knowledge which is acquired through some study". One of the highest educational ideals an educator aims at is to guide the students so that they become independent learners. Independent learning is attained by providing the student with self-study packages which have self-contained units. It allows the independent learner to attain specific learning objectives that are related to a particular concept or skill (Cooper, 1983: 157-186).

Effective learning strategies such as independent learning is an essential prerequisite for academic achievement of students. Most students in Mmabatho College of Nursing appear to be uninterested in utilising independent learning as a learning strategy, hence the poor academic achievement. Informal discussions held with a number of stakeholders indicated that the students' poor academic achievement seem to be attributable to the lack of utilisation of independent learning as a learning strategy. The problem is that students prefer the lecture method to independent learning as a

learning strategy. The problem of lack of independent learning as a learning strategy has many implications. Poor academic achievement as a problem can be improved by employing independent learning as a learning strategy. According to Schmeck and Weinstein (1985: 5-11) learning strategies are sequences of procedures that are implemented by the student for accomplishing some learning tasks.

Independent learning as one of the learning strategies assumes that students learn at their own pace. Students should be exposed to independent learning as a learning strategy. Zimmerman (1989: 329-339) describes independent learners as those students who are self-regulated learners, while Pintrich (1989: 117-160) describes them as critical thinkers. Inadequate teachers render this approach even more difficult since there is a dire need for close follow-up when guiding these students.

Serious shortages of teachers and of expert guidance and counselling teachers make realizing this an impossibility. Independent learning is based on the andragogic principle of students' active participation in their learning and the assumption of responsibility for one's own learning (Mellish & Brink, 1990: 192; Quinn, 1988: 38; Abey & Shayer, 1994: 55). Zimmerman (1988: 11) supports the idea of independent learning as learning which is self-regulated in nature. He further explains the social cognitive approach of how an educator can guide students to be more self-regulated as independent learners so as to improve their academic achievement. Some of the variables described include personal values, which emphasise self-direction in self-regulated learners (SRL), and their behavioural influences which focus on learning strategies.

The researcher became aware of a significant incidence of a high failure rate or poor academic achievement at Mmabatho College of Nursing in the North West Province of South Africa and that prompted this research study. Elshout-Mohr & Van Hout-Wolters (1995: 273) believe that "Leer- en studeerprocessen van die lerende vervullen een centrale rol in het onderwys". It is a well-known fact which causes concern that the majority of disadvantaged students, mainly blacks in South Africa, perform below average and have higher failure and dropout rates than whites (Harker, 1991: 28). Many first year college students are exposed to lecturing as a method for the first time. They are also faced with the task of processing the masses of information being taught in the lecture rooms and which has to be learned.

Although poor academic achievement has not been researched in the North West Province, it has been recorded by class teachers in school registers. What needs to be done is to find out if independent learning as a learning strategy has an influence on academic achievement of first year nursing students, and also what can be done about it. According to Pintrich and De Groot (1991: 33), students are required to assume responsibility for own learning. The initiation of learning is an important aspect of the students' academic achievement in a lecture context. A learning strategy can actually be said to be a sequence of procedures that are designed for accomplishing learning (Schmeck, 1988: 5). In this study the question is whether or not there will be a relationship between learning strategy and accomplishment of learning.

Independent learning includes, among others, rehearsing, paraphrasing, monitoring, summarising and note taking to mention but a few. This study proposes to analyze the following of the already mentioned variables as they pertain to first year nursing

students learning Scientific Foundations of Nursing (SFN 100) courses. These include Anatomy, Physiology, Applied Chemistry and Biophysics. It is assumed that if an educator can improve the metacognitive abilities of the students, and guide them to more effective learning strategies, that will not only improve the students' academic achievement, but will also allow the educator to spend more time with the less SRL. It also insures that the students become more autonomous and less reliant on the teacher/facilitator.

According to Cross and Paris (1988: 131) and Jacobs and Paris (1987: 258) metacognition is understood to involve self-appraised knowledge as well as self-managed thinking. In independent learning as a learning strategy, as an example, metacognitive learners assess their knowledge of the assigned task. The students do self-appraising by checking their subject knowledge, for example in doing the pretest, which is a form of self-motivation. This approach does influence the nursing students' academic achievement because if in their self-appraisal they realize that they have not reached the accepted academic achievement, they seek other ways that can help improve their performance. A score of 50% is considered a satisfactory academic achievement at Mmabatho College of Nursing. However, the College experienced failure rates in SFN 100 of 34% in 1993 and 38% in 1994. Pintrich (1987: 38) maintains that personal judgements, such as being able to organise and study independently, help attain higher levels of academic achievement.

Students are believed to choose the learning strategy they consider more relevant and employ that (Zimmerman, 1989: 329-339). In this manner it is assumed that the learning strategy a student chooses, correlates with the student's academic achievement, thereby optimising learning.

## 1.2 AIM OF THE RESEARCH

The aim of this study was to seek an answer to the following research question:

What is the relationship between independent learning as a learning strategy and the academic achievement of first year SFN 100 nursing students?

## 1.3 ACRONYMS AND INITIALS

<b>ILS:</b>	<i>Independent learning strategy</i>
<b>SRL:</b>	<i>Self-regulated learners</i>
<b>SFN:</b>	<i>Scientific Foundations of Nursing</i>
<b>SFN 100:</b>	<i>Scientific Foundations of Nursing for First Year Students Studying Anatomy, Physiology, Applied Chemistry &amp; Biophysics</i>
<b>SFN 113:</b>	<i>Respiratory System Module Learning Package</i>
<b>EGPR:</b>	<i>Academic achievement score of students that was obtained from the test <u>before</u> the students were subjected to guidance, that is independent learning as a learning strategy. Those students belonged to the experimental group sample.</i>
<b>EGPO:</b>	<i>Academic achievement scores of students that are obtained from the same test written <u>after</u> one month, during which the guided study method/independent learning as a learning strategy was used. The students belonged to the experimental group.</i>
<b>CGPR:</b>	<i>Academic achievement scores of the control group <u>before</u> one month.</i>
<b>CGPO:</b>	<i>Academic achievement scores of the control group <u>after</u> one month.</i>
<b>EGD:</b>	<i>This measures the change in the academic achievement scores in the experimental group <u>after</u> one month of the exposure to the independent learning as a learning strategy (=EGPO-EGPR)</i>
<b>CGD:</b>	<i>This measures the change in the academic achievement scores in the control group <u>after</u> one month of uncontrolled learning of the respiratory system (=CGPO-CGPR)</i>
<b>PRSCORE:</b>	<i>Academic achievement score of the <u>first time</u> testing for all 40 students (both experimental &amp; the control group)</i>
<b>PRETESTING:</b>	<i>This is the collection of data <u>before</u> the instruction of an experimental intervention</i>
<b>PRETEST-POST-TEST DESIGN:</b>	<i>This is an experimental design in which data are collected from the research subjects both <u>before</u> and <u>after</u> the introduction of the experimental/intervention/manipulation/treatment</i>
<b>EG:</b>	<i>Experimental Group</i>
<b>CG:</b>	<i>Control Group</i>
<b>ANA:</b>	<i>Anatomy</i>
<b>PHY:</b>	<i>Physiology</i>
<b>ACB:</b>	<i>Applied Chemistry and Biophysics</i>
<b>SD:</b>	<i>Standard Deviation</i>
<b>N:</b>	<i>Population</i>
<b>n:</b>	<i>Sample</i>
<b>N<sub>1</sub>:</b>	<i>First sample</i>

<b>N<sub>2</sub>:</b>	<i>Second sample</i>
<b>M.Ed:</b>	<i>Master of Education</i>
<b>PU vir CHO:</b>	<i>POTCHEFSTROOMSE UNIVERSITEIT VIR CHRISTELIKE HOËR ONDERWYS (POTCHEFSTROOM UNIVERSITY FOR CHRISTIAN HIGHER EDUCATION)</i>
<b>GUIDANCE:</b>	<i>Is an activity in which the teacher brings children into contact with the world as it really is, and helps them make choices wisely in their day-to-day lives. Guidance has as its major component counselling.</i>

#### **1.4 RESEARCH HYPOTHESIS**

To achieve the above-mentioned aim (see Par. 1.2.1), the following research hypotheses were tested.

##### **Hypothesis 1**

There is a relationship between the academic achievement scores of the control group before one month and after one month, that is CGPO vs CGPR

$$H_0: cgpo = (cgpr = 0)$$

$$H_a: cgpo > cgpr (cgd > 0)$$

##### **Hypothesis 2**

There is a relationship between the academic achievement scores of the experimental group and the control group at the beginning, that is, before manipulation, that is, exposure to independent learning as a learning strategy;

EGPR vs CGPR

$$H_0: egpr = cgpr$$

$$H_a: egpr = cgpr$$

**Hypothesis 3**

There is a relationship between the academic achievement scores of the experimental group after the treatment/exposure to independent learning as a learning strategy and the academic achievement scores of the control group after one month;

EGPO vs CGPO

Ho: egpo = cgpo

Ha: egpo > cgpo

**Hypothesis 4**

There is a relationship between the changes in both the experimental group's academic achievement scores and the control group's academic achievement scores at the end of the one month (the experimental group having been subjected to guided independent learning as a learning strategy, while the control group was left to learn in any way it chose);

EGD vs CGD

Ho: egd = cgd

Ha: edg > cgd

### **Hypothesis 5**

There is a relationship between the academic achievement scores of the experimental group after treatment/exposure to independent learning as a learning strategy and the academic achievement scores of the same experimental group before the manipulation/exposure to independent learning as a learning strategy;

EGPO vs EGPR

Ho:  $egpo = egpr$  ( $egd = 0$ )

Ha:  $egpo > egpr$  ( $egd > 0$ )

All these hypotheses were tested to find out if a relationship exists between independent learning as a learning strategy and academic achievement of first year SFN 100 nursing students.

### ***1.5 METHOD OF RESEARCH***

The method of research consisted of literature review and an experimental study. Literature on nursing, academic achievement, learning, learning strategies in general and independent learning in particular was reviewed. A DIALOG - search was done with the above-mentioned variables as the key words.

## **1.6 EXPERIMENTAL DESIGN**

A pretest - posttest design (before - after experimental design) was used to determine the relationship between independent learning strategy and academic achievement of first year SFN 100 nursing students. Data was collected before the intervention (that is, as the baseline). "This is a strong design which involves imposing some intervention on one group of nursing students (the experimental group) while imposing no restraint/manipulation on another (the control group) (Best & Kahn, 1986: 127). This design allowed the dependent variable (academic achievement) to be measured at two points, before and after the experimental treatment (Polit & Hungler, 1991: 152). For the purpose of this study, Virginia Henderson's theory of nursing, namely that "nursing is primarily assisting individuals (sick or well) with those activities contributing to health or its recovery (or to a peaceful death) they would perform unaided when they have the necessary strength, will-power or knowledge" will be used.

Nursing also helps individuals carry out prescribed therapy and to be independent of assistance as soon as possible (Henderson, 1979), and this is taken as the basis of nursing practice.

The core of nursing consists of concern, cure, competency, comprehensiveness and coordination. The letters of the word 'NURSE' spell out the core concepts in Nursing: N = Nearness to clients and nurturing their abilities to share in or take responsibility for the recovery and maintenance of health.

U = Understanding, unselfishness and unity between the traid of nurse, doctor and client.

- R = Realism, reason, reassurance and reserve about the client's affairs.
- S = Service, self-sacrifice, self-discipline, self-assurance and supporting, sustaining and securing the client.
- E = Expertise, example, education of clients and their families, extension of the client's ability to cope with the situation, for example by being the eyes, ears, hand and mind of the unconscious, the helpless, the blind, the deaf and the vulnerable (Searle, 1987: 62).

### ***1.7 PROCEDURE AND OVERVIEW OF THE STUDY***

The main aim of this study (see par. 1.2) was to determine the influence of independent learning as a learning strategy (see par. 3.2) on the academic achievement of first year SFN 100 nursing students. Chapter 1 was confined to the statement of the problem, Chapter 2 dealt with learning and learning strategies. In Chapter 3 the relationship between independent learning as a learning strategy and academic achievement was discussed. The method of research was explained in Chapter 5, while Chapter 6 dealt with the summary, limitations, recommendations and a concluding paragraph.

## **CHAPTER 2**

### **2. LEARNING AND LEARNING STRATEGIES**

#### ***2.1 INTRODUCTION***

The purpose of this chapter on learning strategies is to explain, in-depth, the concepts of learning and learning strategies. The goal of this chapter will be attained by discussing learning and learning strategies from a social cognitive viewpoint. A description of learning (see par 2.2) will first be given, followed by a discussion of the different learning strategies in general (see par. 2.3).

#### ***2.2 DESCRIPTION OF THE CONCEPT OF LEARNING***

Learning is considered to be the primary reason for the existence for schools and a means by which socialization is effected (Ferron 1989: 106). The same source goes on to expand by saying that it would be difficult to imagine how man could be separated from learning, for the two are inseparable.

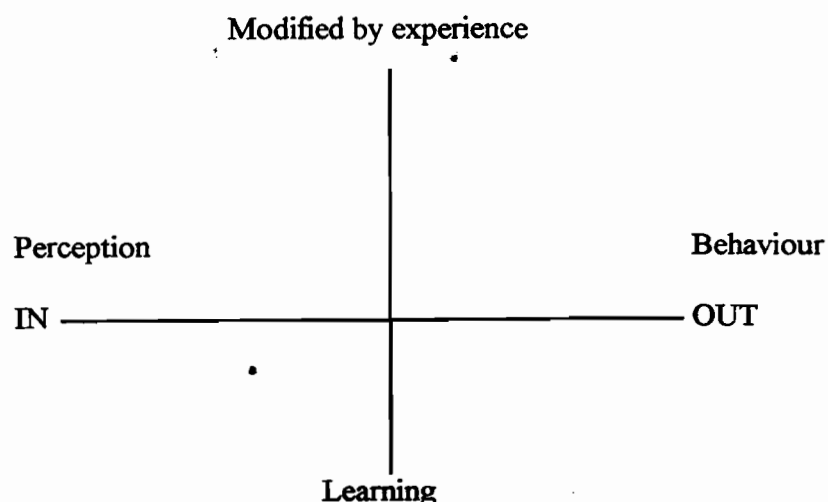
The study of learning involves three perspectives: behaviouristic, cognitive and biological (Atkinson, et al., 1993: 253). Learning is central to human behaviour, and it continues from birth to death. According to Hilgard et al. (1979: 38) learning may be defined as a "relatively permanent change in behaviour that occurs as a result of prior experience". Learned behaviour is seen as the product of prior experience, so that changes in behaviour due to maturation or disease are not included. According to

Fisher (1984: 85) learning is the process by which perception and behaviour are modified by experience.

Learning can actually still take place without there being a 'teacher'. As such, we can learn by merely observing others who may not even know they are being watched. We can learn without other people being involved at all (Gross, 1987: 45). In a way, one can say that learning is a hypothetical construct, that is, it cannot be directly observed but can only be inferred from observable behaviour. An example is where an individual's performance on a task at Time 2 differs from that at Time 1, we may infer that learning has taken place. But if that change is observed on just that one occasion we would be much hesitant about making such an inference.

The following (Figure 2.1) is a schematic presentation of the process of learning, as one of the cognitive functions of the frontal lobe:

**FIGURE 2.1 SCHEMATIC PRESENTATION OF THE LEARNING PROCESS**



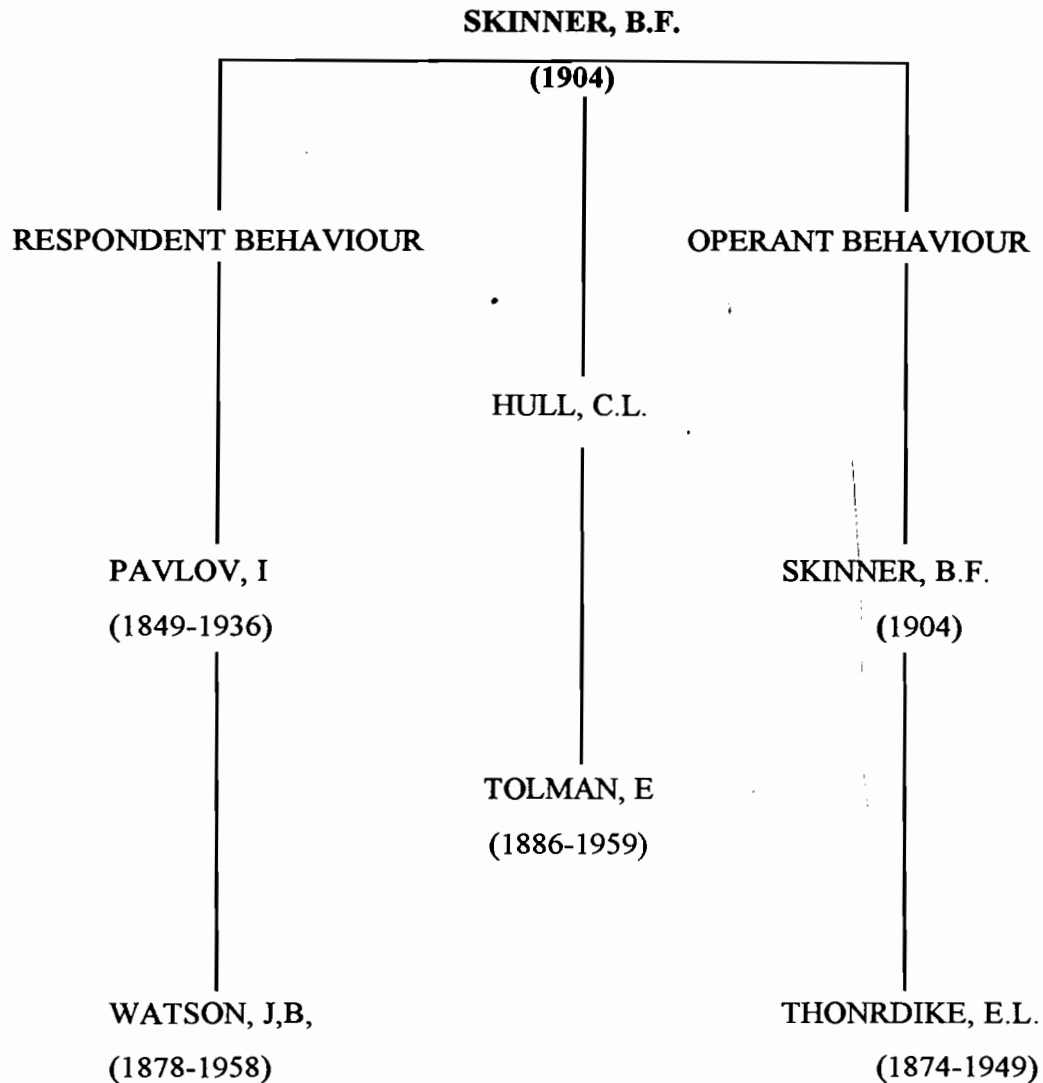
It is generally agreed by psychologists that learning is relatively permanent, and is also due to some previous experience.

There is, however, less agreement as to what exactly changes when learning takes place, and also what kind of past experiences are involved. Putting it in another way, Gross (1987: 47) wonders how the changes do occur, and what mechanisms are involved? Psychologists differ as to the overt (behavioural) as opposed to the covert (cognitive) changes.

Figure 2.2 below schematically, presents the origins of the different theories of learning. It is also noted that Skinner is the father of human learning. From that origin emerged two extreme schools of thought, namely:

- the respondent (classical conditioning) behaviour, and
- the operant behaviour

The third schools of thought come from Hull and Tolman. These two basically, toed the "father's" line of thinking (see figure 2.2).

**FIGURE 2.2 THEORIES OF LEARNING**

From figure 2.2 the different types of learning are derived. The classical conditioning or the respondent behaviour approach is concerned with reflexes. It attributes all learning to conditioning. Alternatively it can be described as responses to specific stimuli. On the other hand, the operant conditioning or operant behaviour approach suggests that the following factors should be present before learning can take place:

- Each step of the learning process must be short and should grow from previous learned behaviour.
- In the early stages, learning should be regularly rewarded and at all stages it should be carefully controlled by a schedule of continuous or intermittent reinforcement.
- This reinforcement is a feature of discovery learning (independent learning).
- Reward should follow quickly when a correct response appears.
- Learners should be given the opportunity to discover stimulus discrimination so that they can attain academic achievement. From these principles Skinner devised a scheme known as 'programmed learning', now extensively employed so that each student may progress at his own pace.
- Children should work on their own to discover basic principles.

Figure 2.2 shows the major figures in the behaviourist tradition and how they are related to each other.

Another aspect is that without the two approaches (respondent behaviour and operant behaviour) to learning the individual supporters of the two approaches differed from each other in minor respects. What is of importance is that in reflecting on them (Ferron, 1989: 106; Vester, 1986: 29; Smith, 1984: 22; Quinn, 1988: 28, Atkinson *et al.*, 1993: 253; Hilgard, *et al.*, 1979: 38; Fisher, 1984: 85 and Gross, 1987: 45), all agree that learning has one common feature, that is, NEWNESS. This implies that something that did not exist or which was not grasped has been manifested or brought to light.

Simply acquiring information is the lowest level of learning. Most useful, for the purpose of this study, are generally acceptable observations about adult learning.

These are:

"Learning goes on through life; hence one would say, to live is to learn. It is actually not a task but a way of being alive.

Learning is a personal and natural process and so one cannot learn for another person. It takes place within an individual. Learning involves change, no matter how small the change may be.

Learning therefore has its intuitive side, that is, the 'knowing' which cannot be tracked - without it we would still be in our infancy." (Smith, 1984: 36.)

In this section the more formal aspects of the professional learning process will be considered, for the simple reason that the subjects of this study were students on a programme to prepare them to be professional nurses. Bruner, as quoted by Nash et al. (1990: 287) states that there are three variables which should be taken into consideration.

These are:

- the nature of the learner,
- the nature of the knowledge to be learnt and
- the nature of the learning process.

Authors agree that teaching should be directed towards helping students understand phenomena and ideas in the way subject experts understand them (Ramsden, 1988: 13). This requires that learners need to change their ways of seeing, experiencing and conceiving aspects of the real world around them. Again it implies that teaching has to

be an activity that assumes an understanding of learning. Teachers, therefore, should become scholars of their own students' learning. An important implication of this is, therefore, that teaching and research in education must be inseparable - two sides of the same coin.

### **2.2.1 NATURE OF THE LEARNER**

A variety of factors affect the student's learning ability. These include:

- intelligence,
- creativity,
- emotional state,
- motivation,
- study habits, and
- memory.

#### **2.2.1.1 AFFECTIVE EMOTIONAL FACTORS**

Learning is affected by one's level of anxiety, for example. One finds that a mild degree of anxiety plays a positive role in learning, but too high a level of anxiety has a negative effect on the learning process. Closely linked is also one's level of self-esteem. If it is low, one tends to set unrealistically low learning and achievement goals, and tends to perform less well than fellow students of similar background and intelligence whose self-esteem is higher. It appears that low self-esteem subjects are so fearful of further blows to their self regard that they set themselves low goals in order to avoid the chances of failure.

### **2.2.1.2 MOTIVATION**

When one is intrinsically motivated, one tends to learn things better. An example is when one is interested in a subject. Extrinsic motivation, such as examinations and approval by a lecturer or teacher, leads to successful learning as well. It is believed that motivation and the thinking processes are influenced by the quality of listening and speaking (oracy) in the learning environment. Explaining, questioning and listening, for example, help to maximize attention as well as sharpen perception so as to establish a "mental set" or schema (Soobiah, 1988: 139).

### **2.2.1.3 STUDY HABITS**

Good study habits play an important role in the learning process (Nash, *et al.*, 1990: 228). Some examples are:

- setting oneself realistic learning targets, which includes not being too ambitious
- building internal rewards, for example, taking oneself for an outing after completing a study unit successfully
- ensuring punctuality and time-scheduling, for example adhering to set limits and not putting off until tomorrow what one can do today
- practising whole versus partial learning, for example reading through all of the new material to get an overall picture before breaking material into smaller units
- organizing one's material into some sequence and in an understanding manner
- All these are likely to improve the student's academic achievement.

To see how best we may further optimise learning, it is necessary to examine two principal approaches to learning:

Discovery learning, and  
Reception learning.

**(A) Discovery learning (Bruner, 1960)**

This approach is learner-centred. It involves first-hand experience, that is, experimentation and the development of critical abilities. The process of learning by discovery involves:

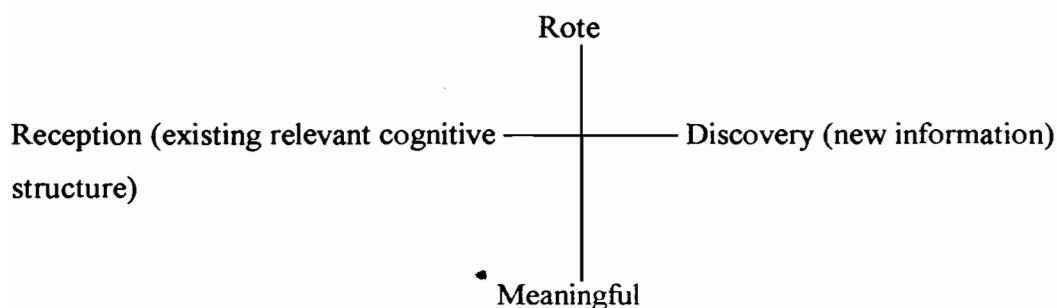
- induction, that is, taking particular instances and using them to devise a general case with a minimum of instructions, and
- errorful learning, which employs trial and error strategies in which there is a high probability of errors and mistakes before an acceptable generalisation is possible.

**(B) Reception learning (Assimilation theory) (Ausubel, 1968)** Ausubel presents two main principles that are necessary for subject matter organisation, namely:

- progressive differentiation, where general ideas are presented first (advanced organisers) followed by a gradual increase in details and specify.
- integrative reconciliation, where new ideas must be consciously related to previously learned material (subsumes).

In summary, Ausubel presents four dimensions of learning (Figure 2.3).

**FIGURE 2.3 AUSUBEL'S FOUR DIMENSIONS OF LEARNING**



(New and old material is incorporated to form a more detailed cognitive structure)

Derived from Figure 2.3, there are three conditions that are necessary for the attainment of meaningful learning. The same is believed to be essential for problem-solving. Some examples:

- the learner must adopt a "mind set" to learn the task in a meaningful manner,
- the task must be logical, and
- the learner's cognitive structures must contain relevant ideas with which new material can interact.

### **2.2.2 NATURE OF THE KNOWLEDGE TO BE LEARNT**

Learning can take place at a variety of levels. Bloom as quoted by Claxton (1990: 130) organised levels of learning skills in the cognitive domain as follows:

- knowledge, that is, simple knowledge of facts, terms and theories
- comprehension, that is, understanding of meaning of knowledge
- application, that is, the ability to apply knowledge analysis, in other words, the ability to break down material into its constituent parts and see relationships between them. Sythesis, that is, the ability to reassemble these parts into new and meaningful relationships, thus making new wholes.
- evaluation, which involves the ability to judge the value of material using explicit and coherent criteria. This is either of one's own devising or derived from the work of others.

### **2.2.3 NATURE OF THE LEARNING PROCESS**

According to Gagne (1974: 291) learning involves:

- motivation, perceiving and attending to the knowledge material;

- acquisition, that is, making sense of the material;
- retention, that is storing the material in the longterm-memory situated in the cerebral cortex;
- recall, which involves retrieving the material from the memory;
- generalization of the material, which involves transferring knowledge to other situations; and
- performance, which is putting into practice (Nash, et al., 1990: 289).

It is important to note that a failure to learn may take place at any point in time. Whatever may be the case, the greatest pleasure and satisfaction from the learning process is derived from doing things and making discoveries for oneself (Ferron, 1989: 107).

In order that students understand what they learn, the aim should be focused on what is to be learned and how it should be learnt, that is, the learning strategy (Scott, 1991: 44). When the goal of learning is to gain, remember and reproduce knowledge, learning is aimed at the outcomes and products. On the other hand, if the goal of learning is to acquire cognitive strategies with which to gain, remember and use knowledge and skills, learning is then viewed in terms of the processes and outcomes of learning (Wortmann, et al., 1992: 273).

In the product-oriented approach to learning, the student is a passive recipient (Sack, 1989: 226). This is the type of student who is good at absorbing what is given but is unable to initiate learning. Such a student cannot sustain learning without the help and control of others.

A process-oriented approach to learning leads itself to the student's cognitive process of guided and independent inquiry (Shuel, Jacob & Marton, as quoted by Scott, 1991: 16). As the selection, organisation and integration of prior and new information refers to the level of processing (Mayer, 1988: 46), one can term it the how of learning (learning strategy). The focus in this approach is on the students' acquisition and construction of knowledge.

Social learning theory recognizes that one of the features of being human is our tendency to regulate our own behaviour, even in the absence of observers and external constraints. It is said that learning strategies amplify our opportunities for influencing our environment. We can select the situations to which we expose ourselves and the arenas in which we contend.

Student guidance must be aimed at helping the student acquire not only verbal content, but a variety of general and task-specific learning and motivational strategies. These will help search for, interpret, master, remember and use new capabilities and knowledge. The process-oriented student becomes proficient at controlling, directing, regulating and evaluating her own learning in a responsible manner (Weinstein, 1992: 235).

The following are some of the main characteristics of a process-oriented student:

- critical thinker
- problem solver
- active knowledge constructor

- intrinsically motivated and uses learning strategies that will use deep encoding, such as the independent learning; and
- uses metacognitive components, for example, knowledge, experience, goals and learning strategies. This approach leads to the student's conscious monitoring of and control over own learning. It actually gives the student the necessary power to manage her own learning (Pintrich, 1989: 129).

### ***2.3 DISCUSSION OF DIFFERENT LEARNING STRATEGIES***

In striving to achieve challenging goals, the students apply appropriate learning strategies. The next portion of this chapter includes an explanation of learning strategies (see par. 2.3.1), a discussion of types of learning strategies in general (see 2.3.2), followed by independent learning as learning strategy (see par. 2.3.3), and lastly the chapter conclusion (par. 2.3.4).

#### **2.3.1 EXPLANATION OF LEARNING STRATEGIES**

According to Weinstein and Mayer (1986: 315) learning strategies are thoughts and behaviours that a student engages in during learning that are intended to influence the encoding process.

Kalat (1993: 331) states that the depth-of-processing implies that the way one thinks about a memory when one stores it determines cues, which will help one remember later in life. The human brain is different from a library for example. The human being does not store each memory in a separate place, as a library stores books.

When one stores a memory one attaches to it certain retrieval cues, like file cards. These retrieval cues are the associations which human beings use both for storing a memory and in trying to recall it. Depending on one's depth of processing, one may set up many retrieval cues or only one or two. Tulving & Thompson (1973: 355), however, state that no matter how many cues one sets up, it helps if one uses those same cues when trying to find the memory again. Newman et al. (1982: 119-123) state that although cues that were not present when one stored the memory may help somewhat to evoke the memory, they are less effective than cues that were present at the time of storage.

Encoding specificity is the principle that memory is strengthened by using the same retrieval cues when retrieving a memory as when storing it. Figure 2.4 presents a schematic representation of the information-processing model of memory. It resembles a computer's memory system, including temporary as well as permanent memory.

Learning strategies are procedures tailored for specific purposes of information processing. They may include note-taking, imagining, creating analogies, outlining, paraphrasing and summarising (Pressley & Ghatala, 1940: 140); Weinstein, 1987: 590). Each of these learning strategies serve a different purpose (See par. 2.3.2) (Weinstein, 1987: 590). Learning strategies help students to be aware of whatever they learn. It should be noted that learning strategies are different from learning styles in that the latter refers to a predisposition to adopt a certain learning strategy (Weinstein & Macdonald, 1988: 305; Schmeck, 1988: 100). Learning strategies on the other hand help students understand the characteristics that are involved in their learning. The students' knowledge of themselves as learners, their knowledge of the

learning task and the know-how of learning/mastery of learning are important variables which influence how the student finally achieves academically.

Learning strategies are active, dynamic and teachable methods of processing information. Learning styles on the other hand are confined to the adoption of only one class of learning strategies (Schmeck, 1988: 85; Weinstein & Mayer, 1968: 315; Weinstein et al., 1988: 175). Weinstein & MacDonald (1988: 301-305) also differentiate between learning strategies and learning styles in terms of their weaknesses. The same source goes on to explain how students' learning difficulties can be overcome by informing students of some simple/easy learning strategies. This is, for example, acquiring some basic knowledge, such as summarising.

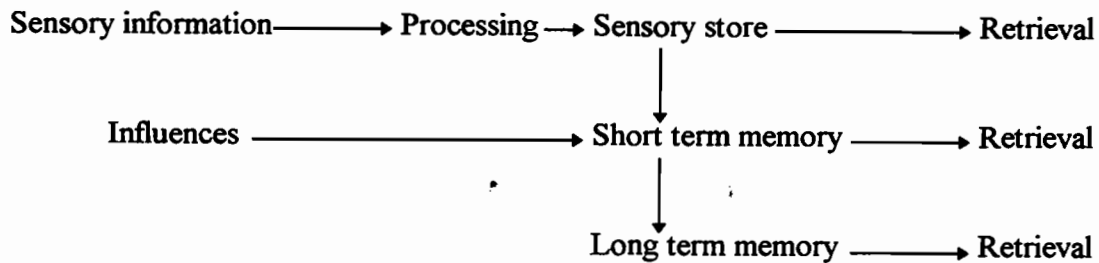
It is stated that with learning styles, the students' learning disabilities are not so easy to overcome. This is so because only one class of strategy is employed despite its shortcomings.

The human mind remembers some experiences for less than a minute, others for hours or days, and still others for a lifetime. Is that because the human mind simply loses certain memories faster than others, or does it indicate that the human brain has different kinds of memory - some temporary and others permanent?

According to one view, the information-processing model of memory, the human memory is analogous to the memory system of a computer (Kalat, 1993: 321). This is so because information enters the system, is processed and coded in various ways, and

is then stored (see Figure 2.4).

## FIGURE 2.4 MODEL OF INFORMATION PROCESSING



According to Atkinson & Shiffrin as quoted by Kalat (1993: 322) memory first enters temporary storage (as when information is typed into a computer), and then enters permanent storage (as when information is entered onto a disk). Later, in response to a retrieval cue, a person can recover the information (Nickerson & Adams, 1979: 300).

### **Sensory store:** (see Figure 2.5 (a))

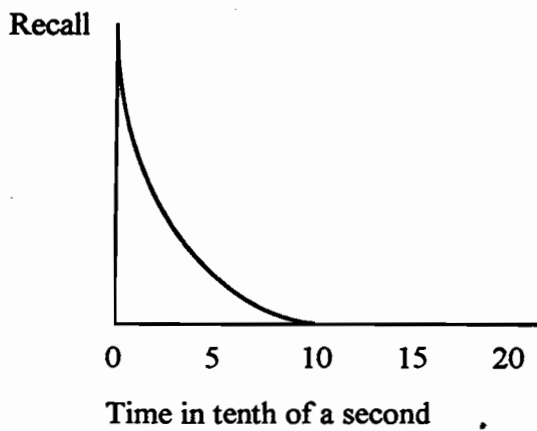
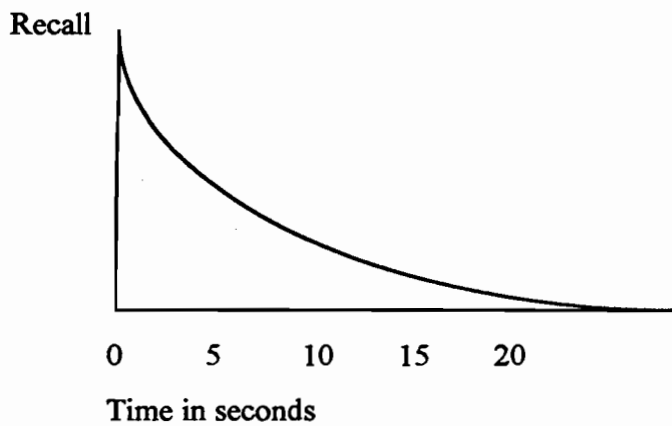
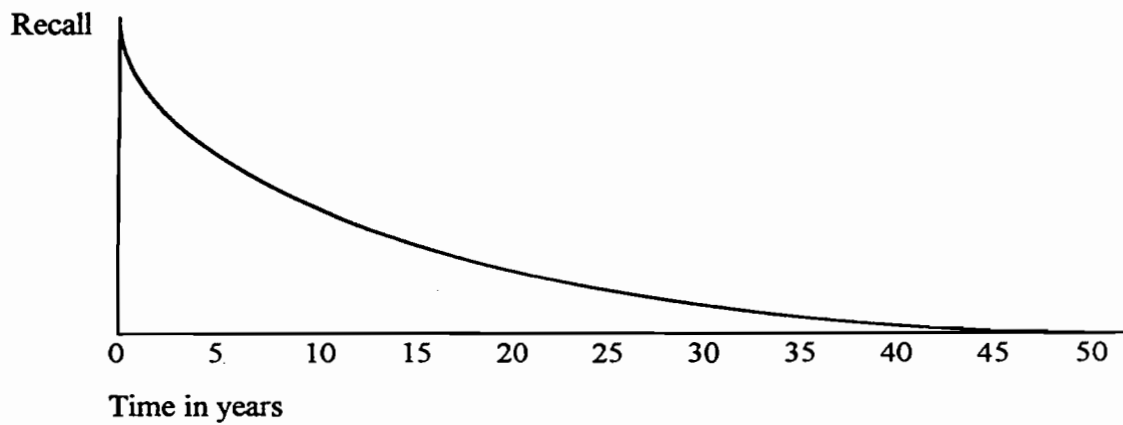
An example is when one sees something for an instant, and then someone asks the individual to recall one detail. It has a very small duration, like a fraction of a second. This is virtually everything one sees or hears at one instant.

### **Short-term memory:** (see Figure 2.5 (b))

An example is when one looks up a telephone number in a directory, in which case one remembers it only long enough to dial it. Its duration can be only 20 seconds if it is not rehearsed.

### **Long-term memory:** (see figure 2.5 (5))

This is vast and uncountable. It lasts perhaps a lifetime. An example is that one remembers the house one lived in when one was 7 years old.

**FIGURE 2.5 (A) MEMORY SYSTEM - SENSORY STORE****FIGURE 2.5 (B) MEMORY SYSTEM - SHORT TERM****FIGURE 2.5 (C) MEMORY SYSTEM - LONG TERM**

Unlike the behaviourist's assumption that learning involves the formation of associations between the stimuli and responses (see par. 2.2) information processing theorists put emphasis on the internal process of information processes and then view learners as active seekers and processors of information (Schunk, 1991: 139).

Information can be processed on a surface level requiring the rehearsal of information, as in the rehearsal learning strategy (see par. 2.3.2.1 (a)) or can still be processed on a deeper level as that requiring the elaboration and organisational learning strategies (see par. 2.3.2.1 (b) and par. 2.3.2.1 (c) respectively).

It should however be noted that surface processing of information leads to low-level learning, as in rote learning, while more meaningful learning is enhanced by the more deeper form of information processing (Schunk, 1991: 139).

All these learning strategies are extremely important in the student's mastery of learning. Actually they help improve and increase the students' understanding of the text information (Weinstein & Mayer, 1986: 317; Pintrich, 1989: 130; Dembo, 1991: 271; Schunk, 1991: 143) and hence improve academic achievement. Rehearsal of information is important if the goal of learning is to recall items or words (see par. 2.3.2.1 (a)) whereas elaboration (see par. 2.3.2.1 (b)) and organisational (see par. 2.3.2.1 (c)) processing of information enable students to understand the structure of information. An example is the mechanism of breathing in the respiratory system. The level at which information is processed thus implies that a much greater or higher level of understanding occurs when material is processed at such deeper levels (Weinstein, 1987: 592; Schunk, 1991: 143; Weinstein & Underwood, 1985: 243).

All stimuli from the environment are received by the sensory register. This is a structure where information processing is started (Gagne, 1985: 71; Dembo, 1991: 268). The sensory register keeps this information for a brief period of time (usually a fraction of a second) (Gagne, 1985: 71). Information which will not be relevant for learning is filtered out through a process of selective attention, while all that is necessary for learning is transferred to the short-term memory (see Figure 2.5 (b)). This is also called the working memory, which enables information to be processed (Dembo, 1991: 268; Weinstein, *et al.*, 1988: 220).

As is reflected (see Figure 2.5(b)) regarding the short-term memory, it is very limited in its capacity as well as its duration (its duration can only be 20 seconds, unless it is rehearsed). It should be noted that unless the information is utilised quickly, it decays quickly (Schunk, 1991: 152; Gagne, 1985: 72). In order for information to be kept in the short term memory for a long time (as already mentioned), it must be integrated with knowledge from the long-term memory (see Figure 2.5 (c)). Remember that the information in the long-term memory is actually encoded for permanent storage (Dembo, 1991: 270; Schunk, 1991: 152).

Encoding of information is the whole process of transforming information into a form that is meaningful or semantic (Gagne, 1985: 81; Mayer, 1988: 46; Dembo, 1991: 271; Schunk, 1991: 156). Dembo (1992: 272) emphasises that the information in the long-term memory is stored in either the episodic or semantic memory. The episodic memory keeps information of what took place and recalls the images of what actually prevailed during those events (Schunk, 1991: 156). The semantic memory on the

other hand addresses those memories which are meaningful and well organised. But this does not include sounds or shapes; it focuses on concepts whose meaning is understood and which the learners can refer to their day to day life or environment (Dembo, 1991: 271; Gagne, 1985: 72).

The memory of semantics contains knowledge of dates and information in books, for example knowledge of task performance or when and why a particular learning strategy can be more appropriate or more suitable to be used (Dembo, 1991: 271; Cross and Paris, 1988: 131; Jacobs and Paris, 1987: 259). Actually these learning strategies (rehearsal (see par. 2.3.1 (a); elaboration (see par. 2.3.1 (b) and organisational (see par. 2.3.2.1 (c)) are the factors which are said to influence the level of processing information in learning. These are the very factors which control encoding in the human mind.

In short, semantic memory is memory for factual information whereas episodic memory is memory for specific events in a person's life (Tulving & Thompson, 1973: 364). People remember facts they have heard (a semantic memory) but forget when, and from whom they heard it (an episodic memory) (Kalat, 1993: 333).

The following table (Table 2.1) summarises different types of memories:

**TABLE 2.1 DIFFERENT TYPES OF MEMORIES**

<b>MEMORY</b>	<b>DESCRIPTION</b>	<b>EXAMPLES</b>
Working memory	Memory of temporary information one is working with. It is replaced by new information later in life.	Where one parked a vehicle today, the day's schedule, where one left off sweeping the floor, and an individual's current bank balance.
Reference memory	Permanent memory to which an individual can always refer back.	One's identity number, what jobs one had, and what red robots mean when driving.
Semantic memory	Memory of factual information.	Who is the president, how many cups in a litre, where one bought one's car.
Episodic memory	Memory of specific events in one's life.	One's first kiss, the time when one's valued pet died, and one's first day at college or university.
Procedural memory	This refers to how one performs some duty.	How to change a tyre and how to ice a cake.
Declarative memory	This commonly refers to some facts about life and living.	An individual's identity number and who the president is.

### 2.3.2 TYPES OF LEARNING STRATEGIES IN GENERAL

A number of researches have been conducted on learning strategies. Pintrich (1989: 129-130) categorises learning strategies into three main groups, viz, cognitive, metacognitive and resource management. Weinstein and Mayer (1986: 316) draw distinctions between cognitive, comprehensive monitoring and affective strategies of learning. Mathebula (1992: 30) categorises learning strategies into rehearsal, elaboration, organisational, comprehensive and affective. Common to these analyses is that there are some commonalities, namely that in almost all of them there is involvement, such as rehearsal, elaboration, organisation, comprehension, monitoring

or metacognition, such as planning, monitoring and regulation. Affective and resource management learning strategies are common too (Pintrich, 1989: 130).

### **2.3.2.1 COGNITIVE LEARNING STRATEGIES**

These are knowledge-acquisition learning strategies. They include strategies that are relevant to the student's learning or encoding of material as well as learning strategies that influence information retrieval (Weinstein & MacDonald, 1988: 305-2; Pintrich, 1989: 130). Cognitive learning strategies include examples such as rehearsal, elaboration and organisation. In relation to these learning strategies, Weinstein and Mayer (1986: 317) state that each of these three cognitive learning strategies has both a basic and a complex version, depending on the nature of the task involved.

#### **2.3.2.1 (a) REHEARSAL LEARNING STRATEGIES**

In this type of learning strategy, the learner gets involved in naming items or reciting during the learning process (Pintrich, 1989: 139; Weinstein, 1987: 592; Weinstein & Mayer, 1986: 317; Mathebula, 1992: 35).

The following is a presentation of both the simple /basic and the complex rehearsal learning strategies.

#### **REHEARSAL LEARNING STRATEGIES**

<b>FOR BASIC TASKS</b>	<b>FOR COMPLEX TASKS</b>
Rehearsal learning strategies for basic tasks involve such strategies as naming and reciting items from some ordered lists (Weinstein & Mayer, 1986: 316).	Rehearsal learning strategies for complex tasks involve such strategies as note-taking, underlining and summarising (Wade & Trathen, 1989: 40, Weinstein & Mayer, 1986: 318).

<p>As Mathehula (1992: 35) puts it, "basic rehearsal learning strategies are really for activation of information in the working memory."</p> <p>Rehearsal learning strategies for basic tasks are designed to facilitate word-for-word recall (Weinstein &amp; Mayer, 1986: 592)</p>	<p>Pintrich (1989: 130) on the other hand states that by shadowing, "the student learns by saying the material aloud" while Wade &amp; Trathen (1989: 40) support the idea of note-taking. This could be done by jotting down facts the student deems important.</p> <p>These are assumed to influence attention and the encoding process, but do not help students to integrate new with prior knowledge (Pintrich, 1989: 130). They only help because noted texts are learnt better than unnoted elements (Wade &amp; Trethen, 1989: 40)</p>
---	--

### 2.3.2.1 (b) *ELABORATION LEARNING STRATEGIES*

These are types of learning strategies that help the students to add new information on top of their knowledge base in a much more organised fashion. This makes information easier to understand and remember (Weinstein & Underwood, 1985: 243).

The following is a presentation of both the basic and complex elaboration learning strategies:

#### **ELABORATION LEARNING STRATEGIES**

<b>FOR BASIC TASKS</b>	<b>FOR COMPLEX TASKS</b>
<p>Elaboration learning strategies for basic tasks include paired-associate learning, for example, learning of foreign language vocabulary.</p> <p>Serial list learning, such as learning to recite the alphabet and recall list learning, that is, learning to name all parts of the brain in random order (Weinstein &amp; Mayer, 1986: 319) are relevant examples.</p> <p>User 'mnemonics' also comes under the basic elaboration learning strategies. An</p>	<p>Students in this situation can store information in long-term memory. This can also be done by building internal connections between new and "old" information, or prior knowledge.</p> <p>Examples here are;</p> <ul style="list-style-type: none"> <li>- summarising,</li> <li>- paraphrasing,</li> <li>- general note-taking,</li> <li>- explaining, and</li> <li>- question-asking.</li> </ul> <p>(Weinstein &amp; MacDonald, 1988: 305;</p>

<p>example is the most common and basic term, 'BODMAS',</p> <p>which stands for:-  <b>B - Brackets</b>  <b>O - Of</b>  <b>D - Division</b>  <b>M - Multiplication</b>  <b>A - Addition</b>  <b>S - Substraction</b></p> <p>The most effective elaboration learning strategies for paired-associate learning involve using mental images to help relate and represent items in pairs (Weinstein &amp; Mayer, 1986: 319). An example is the circle of Willies in the study of the nervous system. The student has to remember a circle in order to visualise the Circle of Willies.</p>	<p>Weinstein &amp; Mayer, 1986: 319;  Weinstein &amp; Underwood, 1985: 243)</p> <p>In such a situation the students are able to internalise what they are learning or what they read.</p> <p>When a learner adds new knowledge to what they already know, they elaborate the information to make it more meaningful (Weinstein &amp; MacDonald, 1988: 243). Students are able to connect information from department to department, for example general science, scientific foundations, etc. The emphasis is on a holistic approach which in a way also aids better understanding.</p>
---	---

It should be noted that elaboration learning strategies for complex skills make students grow. Paraphrasing, for example, refers to the expression of ideas in one's own words (Weinstein, et al., 1993: 9). It actually tests one's understanding and also helps the student identify gaps or errors in her understanding, hence it leads to better understanding (Weinstein, et al., 1993: 11). With regard to note-taking, as long as students do not take notes verbatim, but use their own words (Pintrich, 1989: 130), note-taking as explained earlier on under the rehearsal learning strategies differ from elaboration learning strategies in that it facilitates far better storage of learning material and information retrieval.

The fact that one is able to make a summary of some learned material shows a higher level type of learning domain. It implies that one is able to read and make a synthesis from many sources and put it down in an abridged and more understandable manner (Garner, 1987: 110; Van der Westhuizen, 1989: 566). It is also said that text

summarisation is yet another tool for making cognitive progress, and for monitoring cognitive progress (Garner, 1987: 110; Bondy, 1984: 236).

### **2.3.2.1 (c) ORGANISATIONAL LEARNING STRATEGIES**

Organisational learning strategies help in organising and putting information in a different way that helps quicker and deeper understanding (Weinstein, 1987: 592; Pintrich, 1989: 130).

The following is a representation of both basic and complex forms of the organisational learning strategies:

#### **ORGANISATIONAL LEARNING STRATEGIES**

<b>FOR BASIC TASKS</b>	<b>FOR COMPLEX TASKS</b>
<p>Organisational learning strategies for basic skills help in remembering a list of items. This can be done by sorting the items into some longer organisational framework.</p> <p>According to Weinstein and Mayer (1986: 321) items can be organised into groups on the basis of their shared or common characteristics or features. An example is grouping into some categories like plasma membrane, cytoplasm, riboplasm, golgi complex and mitochondria is equivalent to parts of the human cell just in the same way as empathy, immediacy, confrontation, interpretation, role playing, personal experiences and feedback is similar to in-depth exploration in the counselling process.</p>	<p>These help the student to select appropriate information and construct connections within the information to be learned (Pintrich, 1989: 131).</p> <p>The student identifies main ideas and linkages of information with relevant prior knowledge (Weinstein and Mayer, 1986: 321; Pintrich, 1989: 131). Mathebula (1992: 31) purports that students in organisational learning strategies for complex tasks make connections or links within that which is to be studied.</p>

A number of sources agree that learning strategies, such as rehearsal, elaboration and organisation, influence the level of information processing (Dembo, 1991: 282; Gagne,

1985: 72-73; Weinstein & Mayer, 1986: 318; Wade & Trathen, 1989: 40; Pintrich, 1989: 130). Learning strategies such as the rehearsal type enhance the processing of information on a surface level (see par. 2.3.2.1 (a)). Elaboration and organisational learning strategies on the other hand enable deep-level processing of information (see par. 2.3.2.1. (b) and (c) respectively (Pintrich 1989: 130; Mathehula, 1992: 36; Weinstein & Underwood, 1985: 243; Weinstein & MacDonald, 1986: 243)).

### ***2.3.2.2 METACOGNITIVE LEARNING STRATEGIES***

In lay man's terms metacognition means, "to think about how one thinks and feels" (Scott, 1991: 21). In scientific terms it refers to the students' knowledge of the variables that influence the learning and motivation, and control over those variables. The same source goes on to state that metacognition consists of four important interactional cognitive components. These are knowledge, experience, goals and learning strategies, all of which influence the outcome of learning or academic achievement. A process-oriented student, for example, is considered as one who uses metacognitive knowledge to control learning.

Metacognitive learning strategies, such as monitoring, predicting, evaluating and regulating, may be resorted to so as to maintain some concentration, especially when one is bored or tired (Corno, 1987: 337; Zimmermann, 1989: 338).

### 2.3.2.2 (a) *MONITORING LEARNING STRATEGIES*

Monitoring metacognitive learning strategies include the tracking of information, as happens when one reads, does self-testing as in an examination, and also when monitoring comprehension of a lecture.

All these help the student to integrate new knowledge with that already acquired (Pintrich, 1989: 133). Other examples are:-

- re-reading portions of text to increase mastery,
- reviewing material,
- using test-making strategies, for example, skipping some questions and later coming back in an examination.

The independent learner monitors her work to determine how well she knows her work. This learning strategy is similar to self-observation. According to Zimmerman (1989: 333), self-observation is informative of the progress that an independent learner is making towards her goal. It is maintained that self-observation can be influenced by such personal processes like self-efficacy, goal-setting and metacognitive planning (Zimmerman, 1989: 333). Self-efficacy, which is the perception of one's own ability to perform a task successfully (Kalat, 1993: 314), may influence self-observation, especially when the student believes that she has the ability for greater academic achievement (Schunk, 1990: 72). In this situation the students may realise from their self-observation that they are not making progress, but may tell that they are efficacious enough to improve. This implies the belief in one's self-efficacy, which leads to development of confidence that actually they can do far better.

Goal-setting may also influence self-observation. In this situation the students set very challenging goals for themselves. Once the student realises that she is not meeting her goals, she quickly switches over to some other learning strategies so that she can meet her goals (Zimmerman, *et al.*, 1992: 664).

#### **2.3.2.2 (b) *PLANNING LEARNING STRATEGIES***

Metacognitive planning may influence self-observation. This is so that a student who engages in metacognitive planning monitors, plans, regulates and evaluates her work (Wenden, 1989: 581; Jacobs & Paris 1987: 259). Students who spend time planning tend to academically achieve better than those who do not make the effort (Pintrich, 1989: 132). Such students also self-judge themselves by using a learning strategy to improve their understanding and also to find out if they have enough knowledge to perform the task that is required (Bandura, 1986: 352; Wenden, 1989: 581; Pressley & Ghatala, 1990: 121). Social cognitive theorists believe that independent learning as a learning strategy involves three classes of sub-processes, namely self-observation, self-judgement and self-creation (Zimmerman, *et al.*, 1992: 187-188; Schunk, 1990: 72-73; 1991: 88-156).

#### **2.3.2.2 (c) *INDEPENDENT LEARNING AS LEARNING STRATEGY (ILS)***

Independent learning as learning strategy focuses on individual learning needs and styles allows the highest level of academic achievement by each student (De Tornay & Thompson, 1987: 186). ILS is a goal that many nurse educators have been working towards for several years. It has not fully fledged because it needs major changes in the traditional philosophies and procedures (Clark, 1981: 582-599). The following are major characteristics of ILS:

- requires active involvement of the learner,
- places the responsibility for learning on the student,
- states that students are capable of making choices because they are aware,
- requires specification of explicit objectives,
- feedback requires specification of explicit objectives,
- is flexible in that it provides the student with some considerable choice in selecting from alternative activities and multisectoral resources, the sociological pattern to be used, and the place at which learning can take place,
- the teacher in ILS is a:
  - \* facilitator,
  - \* manager,
  - \* resource person, and
  - \* consultant in the total learning process (Clark, 1981: 584-596; Cross, 1976: 52-55).

### **Self-observation**

Schunk (1990: 72) states that self-observation informs the independent learner of goal progress. The student in this case monitors her behaviour (Schunk 1991: 149; 1990: 72). An example is that of students who keep records of their academic achievement. Such individuals become aware of their progress. As Zimmerman (1989: 333) puts it, "self-observation is informative of the progress that independent learners are making towards their goals". The other factors which influence self-observation such as self-efficacy, goal-setting (see par. 2.3.2.2 (a) and metacognitive planning (see par. 2.3.2.2 (b) are believed to aid the student's self-confidence (Zimmerman, 1989: 333). To improve on self-understanding, the student does what is called self-judgement.

### **Self-judgement**

Self-judgement involves comparing one's performance with some standard (Schunk, 1991: 89; 1990: 73). It should be noted that without set standards for students to measure their performance, there would be no basis for judging how they were performing. It is believed that positive judgements by students enhance self-efficacy and motivation (Schunk, 1994: 2). Self-judgement is determined to a high degree by the value attached by the student to goal accomplishment because if the student does not care much about how she performs, she may as well not evaluate her work nor even study hard (Schunk, 1991: 90).

### **Self-reaction**

Self-reaction follows on the heels of self-judgement. Self-reaction is when a student makes a choice to switch over to a different learning strategy. This is based on her self-observation as well as self-judgement (Zimmerman *et al.*, 1992: 188; 1989: 344; Schunk 1991: 90). Self-reaction helps the student to attain her own stated goals.

There are three classes of self-reaction:

- behavioural self-reactions (such as learning strategies), which are used by students to optimise learning;
- personal self-reactions (such as metacognitive learning strategies in particular), which help students seek their personal process (such as understanding their course map); and
- environmental self-reactions (such as the student's arrangement of her study area) that are conducive to learning (Zimmerman, 1989: 334; Zimmerman, *et al.*, 1992: 188).

The three subprocesses are considered to constantly interact with each other (Zimmerman, 1989: 331). Students may keep a record of their academic achievements; they may observe acceptable standards that motivate the students as they judge themselves to be managing effectively and self-efficaciously. The student becomes motivated to work even harder. On the other hand, if they perform poorly, they may try other learning strategies so that they may improve to reach some acceptable academic achievement (Zimmerman, 1989: 331; Zimmerman, et al., 1992: 188).

### ***2.3.2.3 RESOURCE MANAGEMENT LEARNING STRATEGIES***

Resource management learning strategies help students in managing their environments as well as other resources that are available to them (Pintrich, 1989: 133 Weinstein, 1987: 593).

These strategies help the students create and maintain a climate conducive to their learning (Weinstein, et al., 1993: 4; Weinstein, 1987: 593). Some examples of resource management learning strategies are:

- management of the study environment;
- management of available time for learning; and
- other social support learning strategies (Pintrich, 1989: 133; Weinstein, 1987: 593).

Resource management learning strategies involve perseverance in whatever the student does. Actually these learning strategies help the student adapt and adjust (Sternberg, as quoted by Pintrich, 1989: 133).

### **2.3.2.3 (a)     *MANAGEMENT OF THE STUDY ENVIRONMENT***

Arrangement of the study environment must be such that it is free of distractions, both visual and auditory (Zimmerman, 1989: 133; Pintrich, 1989: 134; Weinstein, 1987: 593). Any form of noise is likely to divert the student's concentration from learning. Students should be encouraged to study in an area least likely to have distractions, for example the library. Actually any quiet place is a good environment for studying. The students need to organise the environment in such a way as to increase attention (Mathebula, 1992: 32).

### **2.3.2.3 (b)     *MANAGEMENT OF AVAILABLE TIME***

Time is a crucial self-management activity in the learning situation. Different stages of time management exist (Pintrich, 1989: 133; Weinstein, Mayer & Van Mater Stone, 1993: 4). It is important that students schedule their time for accomplishment of the learning task. An example is the setting of a time table for learning and adhering to it strictly. Anyhow, study time tables must have room for adjustment whenever it is necessary, for example when students need more time in one area where they have problems. It should be possible to adjust the time table accordingly so that they spend more time where it is due. Weekly time schedules are advocated as they facilitate timeous feedback and re-scheduling of the time table (Weinstein *et al.*, 1993: 4). However more time should be set aside for tests and examination time (Pintrich, 1989: 143).

Weinstein *et al.* (1993: 4) purport that the students' self-awareness may influence their time management skills. Self-awareness refers to the students' knowledge about

themselves as learners, their strengths as well as their weaknesses have to be fully understood by each individual after doing thorough introspection. In other words, the student needs to be clear of what they really are (self-concept). Once a student develops self-concept, an image of what they really are, and an ideal self, an image of what they would like to be (Kalat, 1993: 550), then they can manage their learning activities effectively (Weinstein, et al., 1993: 4). An example is that the student must be aware of what time of the day is best for the concentration on intellectual subjects. One would find that some students prefer to study the respiratory system in the early morning hours, when it is still very quiet and when the student is fresh from sleep. Other students would prefer to study the same area during the day. Of prime importance is that the student should identify the best time of the day or night when their concentration is greatest and then utilise that time for learning.

#### **2.3.2.3 (c)     *MANAGEMENT OF SUPPORT STRATEGIES***

Students need to know who their support systems are and how to obtain the help they require (Pintrich, 1989: 134; Zimmerman, 1989: 333). This support system includes the following:

- teachers;
- other adults;
- peers; and
- the library.

Good students know when they need help and where to get assistance (Pintrich, 1989: 134). Mathebula (1992: 39) contends that students who performed poorly in an earlier examination attributed their poor academic achievement to low effort and lack of

course-specific knowledge, rather than a general ability deficit. Such students were much more likely to seek help than their counterparts, who attributed their poor performance to lack of interest, the difficulty of the examination or the facilitator. This, according to this same source, is attributed to the students' motivational patterns.

#### **2.3.2.3 (d) *MANAGEMENT OF EFFORT STRATEGIES***

Effort management is closely related to the student's motivation (Pintrich, 1989: 135). This involves the students' general management of the selves as well as events around their learning. A good student knows exactly when to increase effort and persist at a task, as well as when maximal effort is not required (Pintrich, 1989: 134). The same source goes on to state that an effective student also knows that effort alone may not result in success, but that effort plus various learning strategies may be needed. It all depends on the task at hand. Effort management is one of the most important learning strategies (Mathebula, 1992: 40). This relates to the common saying that "failure to plan is planning to fail". Effort management is actually interaction between the students' cognition and motivation.

#### **2.3.3 CONCLUSION**

Learning strategies can take many forms, ranging from simple to the most complex, but of importance is that the main factor underlying each of them is the active involvement of the student (Weinstein, et al., 1993: 8; Weinstein & Underwood, 1985: 242-243). Active involvement is important for meaningful learning, because passive students cannot attain the accepted academic achievement (Weinstein, et al., 1993: 9).

The following are roles of both the student and teacher in independent learning:

The student is an active, responsible participant. Active rather than passive involvement of the learner has long been recognised as desirable (Markle, 1987: 13). Markle further states that "it is not what is presented to the student but what the student is led to that results in learning". If one believes that learning is a lifetime process and that nursing requires a practitioner who can think and make decisions independently, then active involvement is crucial in the educational preparation of the nurse (De Tornyay & Thompson, 1987: 187).

The teacher's role in ILS is different from those of teachers using the traditional methods. Various authors (Clark, 1981: 596-598; Cross, 1976: 205-208; Rogers, 1980: 103-126) have summarised the teacher's role in these approaches (see par. 2.3.2.2 (c)).

## CHAPTER 3

### 3. THE RELATIONSHIP BETWEEN INDEPENDENT LEARNING AS A LEARNING STRATEGY AND ACADEMIC ACHIEVEMENT

#### 3.1 INTRODUCTION

Independent learners are self-regulated learners who are metacognitively, motivationally and behaviourally active participants in their own learning process (Zimmerman, 1989: 329). Metacognitively, self-regulated learners organise and plan their learning. Motivationally, they have an intrinsic interest in learning a task. Behaviourally, independent learners use independent learning as a learning strategy by monitoring and regulating their efforts or actions so as to reach acceptable academic achievement (Paris & Winograd, 1989: 2; Jacobs & Paris, 1987: 256). Monitoring and regulating one's learning activities is referred to as metacognition (Bondy, 1984: 234-235). Metacognition is not the main ingredient of the cognitive approach to learning but is also seen as an essential component of the cognitive approach to learning whereby a student embarks on the executive control of learning and applies planning (see par. 2.3.2.2 (b)), monitoring (see par. 2.3.2.2 (a)) and regulating so as to improve their academic achievement (Paris & Winograd, 1984: 4). Metacognition (see par. 2.3.2.2) encourages independent learning (Paris & Winograd, 1989: 2; Cross & Paris, 1988: 131).

Independent learning as learning strategy influences academic achievement (Cross & Paris, 1988: 132; Paris, *et al.*, 1993: 293).

If a student utilises independent learning as a learning strategy, the student is motivated (see par. 2.2.1.2), refers to various sources for task clarification as well as mastering learning and all that is likely to enhance academic achievement.

### ***3.2 INDEPENDENT LEARNING AS A LEARNING STRATEGY***

Independent learning as a learning strategy incorporates Carl Roger's model of experiential learning. Rogers, as quoted by Marjoribanks (1991: 83), contrasts associative learning, which was said not to change individuals, with experiential learning, which was said to change people, both cognitively (see par. 2.3.2.1) and affectively. The same source explains that independent learning strategy is self-initiated by the learner, even when an impetus may be involved. Marjoribanks (1991: 83) purports that independent learning as a learning strategy is pervasive in that it is important to the learners' behaviour, attitudes and sometimes their personalities. It is again evaluated by the learners themselves and its essence is meaning.

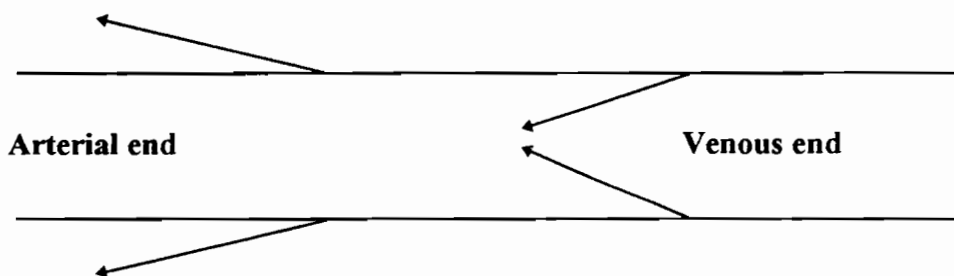
Independent learning as a learning strategy, as its main premise, assumes that each student is capable of optimum academic achievement. This implies that independent learning allows the highest level of student academic achievement (De Tornyay & Thompson, 1982: 128). The father of independent learning as learning strategy, Skinner, purports that it is better to learn something correctly the first time than to make mistakes which must be corrected and re-learnt (Raybould, 1975: 33). The same

source comments on the immediate knowledge of results as reinforcer. When reinforcement comes too late, for example, one finds that it may not be as useful as it would have been earlier on.

The teacher in this type of learning strategy gives students self-study packages with self-study units (see page 57 and Figure 3.1 respectively) to work on at their own pace. The other advantage is that each student responds to each unit. It is important to note that soon after responding to the questions, the student turns over to the back of the page (see Figure 3.1). The students compare their response with that given, hence the results are immediately known.

#### **FIGURE 3.1 SELF-ACTIVITY**

**OSMOTIC PRESSURE THEREFORE DRAWS WATER INTO THE CAPILLARIES, WHILE BLOOD PRESSURE FORCES WATER OUT OF THEM. WHETHER WATER ENTERS OR LEAVES A CAPILLARLY AT ANY POINT DEPENDS ON WHICH OF THE TWO PRESSURES IS THE STRONGER.**



**THE ARROWS IN THE DIAGRAM ABOVE SHOW THAT WATER LEAVES THE CAPILLARY AT THE ARTERIAL END, AND ENTERS IT AT THE VENOUS END.**

**Questions**

- a) AT WHICH END OF THE CAPILLARY IS THE BLOOD PRESSURE STRONGER THAN THE OSMOTIC PRESSURE?
- b) AT WHICH END IS THE OSMOTIC PRESSURE STRONGER THAN THE BLOOD PRESSURE?

NB:

The following correct responses are written behind the learning activity, e.g. on the back of the book or page:

- (a) BLOOD PRESSURE IS STRONGER AT THE ARTERIAL END.
- (b) OSMOTIC PRESSURE IS STRONGER AT THE VENOUS END.

The student's role in independent learning as a learning strategy is one of an active and responsible participant (De Tornyay & Thompson, 1982: 129). An active rather than a passive involvement of the learner has long been recognised as one of the essential parts of learning (Dollard, Miller and Hillard, as quoted by De Tornyay & Thompson, 1982: 129). It is also said that "it is not what is presented to the student which matters in learning, but what the student is led to do that results in learning" (Ferron, 1989: 106), and hence to academic achievement.

The same source says that the "quality and quantity of learning achieved by the students is now the emphasis" in student learning. I for one believe that learning is a lifelong process and that nursing requires a practitioner who can think and make life-saving decisions independently, then a student's active involvement is crucial in the educational preparation of the nurse.

This approach to learning strategy entails that the teacher facilitates/guides the learning while students work on their own so as to determine academic achievement. Some synonyms of independent learning are self-study, self-instruction, self-directed study and tutorial study. This does not however imply isolation of students. The students can work with others, for example in small groups and/or as pairs.

### **3.3 LEARNING WITH OTHERS**

Learning with others is believed to do the following:-

- Enhances co-operative effort and democratic participation,
- Prevents isolation of the learner,
- Increases motivation and interest,
- Enhances development and analytic problem-solving skills,
- Increases a sense of responsibility for shared learning,
- Broadens the exposure to their ideas and ways of thinking,
- Increases confidence in the individual student,
- Broadens the knowledge base through collective participation, and
- Provides practice in integrating information from various sources.

### **3.4 THE RELATIONSHIP BETWEEN INDEPENDENT LEARNING AS A LEARNING STRATEGY AND ACADEMIC ACHIEVEMENT**

Independent learning as learning strategy influences academic achievement, because if a student does the work on her own, she is more committed to the learning task.

Independent learning as a learning strategy relates to continued task interest and task persistence (Cross & Paris, 1988: 132; Paris, *et al.*, 1993: 293).

Education is rightly regarded as the key to national prosperity and welfare. It is one of the most important forms of national investment. The skills that it generates are not only highly valued by society but they are also indispensable for various occupations.

Every student is the exchequer for which the taxpayer ultimately has to foot the bill. If the student fails or is unable to achieve better grades, it means that the meagre resources of the country have been wasted. Failure in education is costly. It is more so in a developing country with very limited funds at its disposal like South Africa.

It is certain that, judged solely by the test of future productivity, a community that neglects education is as imprudent as a community that neglects material accumulation.

It is this critical factor in life which has led to the invention of the very apt expression, "HUMAN CAPITAL" which implies that higher education holds the key to the formation of human capital (Sinha, 1970: 10). Considering the diverse needs of a complex modern society, higher education should be held in high esteem.

Spencer, as quoted by Shawinsky (1988: 6), defines achievement as "a task oriented behaviour that allows the individual's performance to be evaluated according to some internally or externally imposed criterion which involves the individual in competing with others, or that otherwise involves some standard of excellence."

The explanation by Cooper (1983: 157-168) is more comprehensive in that it illustrates the complex nature of achievement.

Achievement is a multi-factor variable that involves motivation (see par. 2.2.1.2), plus the effort that the students expend on the task at hand, their emotional and physical health, their general skills, how they think, and above all, emotional relationships which exists between students and the educators.

This study focusses on academic achievement within an educational set-up. Coopers' definition will be useful especially when it refers to evaluation of task-oriented behaviour according to some externally imposed criterion. In this study the externally imposed criterion is the student's test percentage marks, with 50% being considered at Mmabatho College of Nursing as the accepted academic achievement standard.

The following authors supported the idea that academic achievement is influenced by the student's socialization: Morrow and Wilson, 1961: 502; Hendin, 1972: 131; Baker, 1975: 4; Naude, 1975: 25; Krige, 1976: 1291; Venture, 1983: 19 and Lottering as quoted by Shawinsky, 1988: 7.

Academic achievement in this study must be viewed in the light of how it is influenced by learning strategies (see par. 2.3), and especially independent learning as a learning strategy (see par. 3.2). It takes into account the two extremes of achievement, that is, the high, accepted academic achievement (>50%) and the low academic achievement (<50%).

As quoted by Shawinsky (1988: 9), Lottering divided his research into the following three arbitrary groups;

- above average academic achievers (>70%),
- average academic achievers (50-60%) and
- poor academic achievers (<49%)

Some authors, such as Cooper (1983: 160), distinguish between successful and unsuccessful students, rather than between high and low achievers, as most authors do. The same source goes on to say that a successful student is a student who is able to pass all the courses for a given year. Shawinsky (1988: 9) also uses the term 'successful student'. This source arbitrarily decides to make cut-off points to differentiate 'successful' from those 'students at risk'. A successful first-year student is the one who obtains a minimum of 90 credit points at the University of Potchefstroom (PU for CHE). However, at Mmabatho College of Nursing the accepted pass mark is a minimum of 50%.

Venter and Monteith, as quoted by Shawinsky (1988: 9), reviewed studies which had set no criterion for either high or low academic achievement. What they agreed on

was that there is no commonly accepted criterion to distinguish high from low or underachievement.

Barett referred to underachievers as those who have the ability, but are not using it, (Shawinsky, 1988: 10). The same source said the underachieving student "has the capacity but not the motivation (see par. 2.2.1.2) for the acquisition of knowledge". Hendin "believes that although underachievers consciously want success, they fail; because they believe themselves to be inadequate" (Paris & Winograd, 1989: 22). These students are also underachievers or fail to achieve according to minimal expectations.

The following are three types of underachievers:

- Those with high intelligence quotient (IQ) who drop out of school, college or university,
- Those who have high qualities to achieve but are inhibited from developing their potential maximally and
- Those who cannot achieve successfully because they feel inferior (Scott, 1991: 39; Shawinsky, 1988: 9; and Paris & Winograd, 1989: 22).

Baker went on to say that defining the problems of these students as underachievers is therapeutically useless. The same source prefers to define the problem as one of a student who, for whatever reasons, is failing to succeed. For the purpose of this study, a definition of this category of students will be adopted, namely;

- Above average academic achievement (>70%)
- Average academic achievement (50-60%) and
- Poor academic achievement (<49%)

The above criteria are according to the Mmabatho College of Nursing and the University of the North West Agreement Document.

Pintrich (1987: 6) says that independent learning as learning strategy is used by the University of the North West Agreement Document.

Pintrich (1987: 6) says that independent learning as learning strategy is used by the learner as motivation, engage to cognitive activities like information processing (see Figure 2.4) and to control the student's cognitive activities. The same source further states that the students use this learning strategy to improve their academic achievement.

Mnemonics (see par. 2.3.2.1 (b)) are used by some students and such students recall information better than those who do not use them. Students who underline sentences in a passage for example, are able to recall substantially more information than those who read passages without underlining (Rikars and August, as Quoted by Mathebula, 1992: 40).

The same source reports that, if students are experiencing difficulties in studying a section from a high school science textbook, those students who adopt repetition strategies might try to re-read the difficult part, until they achieve their goal, whereas those who do not use any strategy are likely going to give up more easily. Elaboration learning strategies, such as generating images of self-questioning, may influence the student's academic achievement (see par. 2.3.2.1 (b)). Self-questioning learning as a learning strategy is believed to be a powerful elaboration technique in student learning.

It is believed that students who use these learning strategies achieve far more than those students who do not use them all (Mathebula, 1992: 41).

A student may metacognitively engage in actions such as planning, regulating and evaluating in order to attain accepted academic achievement (see par. 2.3.2.2 (a)) (Paris *et al.* 1993: 321). Such students who use independent learning as a learning strategy are referred to as trouble-shooters because they are resourceful at repairing their own problem-solving capacities (Paris & Winograd, 1990: 8).

### **3.5 CONCLUSION**

The goals that students set become the driving forces towards their academic achievement (Schunk, 1991: 99). On the other hand, metacognition (see par. 2.3.2.2) promotes positive self-perception and motivation because when the students encounter problems, they may revisit the study unit once more. All these things help them monitor their academic achievement (see par. 2.2.1.2) (Winograd, 1989: 13). When these students manage to solve their problems, they acquire new knowledge (see par. 2.2) and hence attain academic achievement (see par. 3.3).

The use of independent learning as a learning strategy informs students on how to improve their learning skills for more acceptable academic achievement (Jacobs & Paris, 1987: 256).

Active cognitive involvement is important for meaningful learning, because passive students cannot attain acceptable academic achievement (Weinstein *et al.*, 1993: 9). Finally, learning strategies can take many forms, ranging from simple to complex (see par. 2.3.2); but the most common factor that underlies each of them is the active involvement of the student and hence improvement of the academic achievement.

## **CHAPTER 4**

### **4. METHOD OF RESEARCH**

#### **4.1 INTRODUCTION**

In the previous chapter of this dissertation, a theoretical frame of reference was developed. This dealt with how students learn (see par. 2.2.1). Attention was also given to what guidance entails (see par. 13). An in-depth description of independent learning as a learning strategy (see par. 2.3.2 (c)) and academic achievement (see par. 3.3) was given.

This chapter involves the actual collection of research data and the preparation of those data for analysis. The formulation of the following research question seems fitting at this point: Which of the experimental or control group will attain the better academic achievement?

The above dimensions embody educational criteria as well as guidance. This implies that the research question stated above calls for an experimental endeavour.

This chapter will proceed as follows: The aim of the research is stated in paragraph 4.2 Paragraph 4.3 gives the setting (see map 4.1) and paragraph 4.4 sets out the population and the sample. The independent learning as learning strategy package used in this study is described in paragraph 4.5. The test that was used is explained (see Appendix 3). The variables used are set out in paragraph 4.6, followed by the experimental design par. (4.7) the statistical technique in paragraph 4.8 and the procedure in paragraph 4.9.

## ***4.2 AIM OF THE RESEARCH***

The aim of the research (see par. 1.2) was to determine the influence of independent learning as a learning strategy (see par. 2.3.2. (c)) on the academic achievement (see par. 3.3) of the first year SFN 100 nursing students.

## ***4.3 SETTING***

The study was conducted at Mmabatho College of Nursing. The College was established in July, 1986. It is situated in Mmabatho, the capital city of the North-West Province of the Republic of South Africa, in an area called Unit 2 just next to the University Airport road (see map 4.1).

## ***4.4 POPULATION AND SAMPLE***

The population for this study embraced all first-year nursing students from Mmabatho College of Nursing doing Anatomy, Physiology, Applied Chemistry and Biophysics (N=90).

The subjects in this study were matriculants. All of these subjects had been out of school for at least one year. None of them were married and they were females. They all came from rural backgrounds and their ages ranged from 20 to 23 years.

In the process of selecting a portion of the group which could represent the entire population, the students' names were written in alphabetical order. Using a table of random numbers (see table 4.1), forty (40) elements were selected.

**TABLE 4.1 SMALL TABLE OF RANDOM DIGITS (Source Essentials of Nursing Research, Polit & Hunger 1985 - Lipincott, Philadelphia)**

46	85	05	23	26		34	67	75	83	00		74	91	06	43	45
69	24	89	34	60		45	30	50	75	21		61	31	83	18	55
14	01	33	17	92		59	74	76	72	77		76	50	33	45	13
56	30	38	73	15		16	52	06	96	76		11	65	49	98	93
81	30	44	85	85		68	65	22	73	76		92	85	25	58	66
70	28	42	43	26		79	37	59	52	20		01	15	96	32	67
90	41	59	36	14		33	52	12	66	65		55	82	34	76	41
39	90	40	21	15		59	58	94	90	67		66	82	14	15	75
88	15	20	00	80		20	55	49	14	09		96	27	74	82	57
45	13	46	35	45		59	40	47	20	59		43	94	75	16	80
70	01	41	50	21		41	29	06	73	12		71	85	71	59	57
37	23	93	32	95		05	87	00	11	19		92	78	42	63	40
18	63	73	75	09		82	44	49	90	05		04	92	17	37	01
05	32	78	21	62		20	24	78	17	59		45	19	72	53	32
95	09	66	79	46		48	46	08	55	58		15	19	11	87	82
43	25	38	41	45		60	83	32	59	83		01	29	14	13	49
80	85	40	92	79		43	52	90	63	18		38	38	47	47	61
80	08	87	70	74		88	72	25	67	36		66	16	44	94	31
80	89	01	80	02		94	81	33	19	00		54	15	58	34	36
93	12	81	84	64		74	45	79	05	61		2	84	81	18	34
82	47	42	55	93		48	54	53	52	47		18	61	91	36	74
53	34	24	42	76		75	12	21	17	24		74	62	77	37	07
82	64	12	28	20		92	90	41	31	41		32	39	21	97	63
13	57	41	72	00		69	90	26	37	42		78	46	42	25	01
29	59	38	86	27		94	97	21	15	98		62	09	53	67	87
86	88	75	50	87		19	15	20	00	23		12	30	28	07	83
44	98	91	68	22		36	02	40	08	67		76	37	84	16	05
93	39	94	55	47		94	45	87	42	84		05	04	14	98	07
52	16	29	02	86		54	15	83	42	43		46	97	83	54	82
04	73	72	10	31		75	05	19	30	29		47	66	56	43	82

**TABLE 4.2 ELEMENTS COMPRISING THE SAMPLE STUDY**

	EXPERIMENTAL GROUP			CONTROL GROUP
1			1	
2			2	
3			3	
4			4	
5			5	
6			6	
7			7	
8			8	
9			9	
10			10	
11			11	
12			12	
13			13	
14			14	
15			15	
16			17	
18			18	
19			19	
20			20	

The number of  
subjects in the  
study = 40

#### 4.5 INSTRUMENTATION

The pretest-posttest (before-after) instrument was administered to both groups, the rationale being to establish a baseline before the experimental group could be manipulated. The pre-test scores of both the control and the experimental group were recorded (see table 4.3).

**TABLE 4.3 SCORES AT THE BEGINNING OF THE STUDY**

	<b>EXPERIMENTAL (EGPR)</b>	<b>GROUP</b>	<b>CONTROL GROUP (EGPR)</b>
1.	59.00		56.00
2.	65.00		58.00
3.	52.00		52.00
4.	70.00		64.00
5.	72.00		62.00
6.	64.00		60.00
7.	54.00		58.00
8.	50.00		65.00
9.	55.00		58.00
10.	58.00		50.00
11.	56.00		58.00
12.	64.00		59.00
13.	54.00		56.00
14.	60.00		59.00
15.	50.00		56.00
16.	66.00		62.00
17.	58.00		52.00
18.	56.00		50.00
19.	59.00		58.00
20.	52.00		60.00

Soon after pre-test had been administered to both groups, the subjects were given the month's course map (see map 4.2 and table 4.3). Before proceeding with the study, the following preliminary steps were taken:

- Permission in writing was sought from the Department of Health and Development Social Welfare (see Appendix 2).
- Consent to undertake the study was obtained from each subject/element before the process of data collection was started.
- The purpose of the study was explained, as well as that participation had been entirely voluntary, and also that the subjects could terminate participation at any point during the course of the research if they so wished.
- Anonymity and confidentiality was assured throughout the study.
- No material benefit as a result of participation in the study was offered or promised.
- The control group was left to study the respiratory system on their own while the experimental group was exposed to treatment in the form of the independent learning as learning strategy package (see page 75 and Figure 3.1).
- The independent learning as a learning strategy packages were designed by researcher.

### **SCIENTIFIC FOUNDATIONS 100 (SFN100)**

### **ANATOMY, PHYSIOLOGY, APPLIED CHEMISTRY AND BIOPHYSICS COURSE**

#### **MAP 4.2 COURSE MAP FOR SFN 100**

BLOCK	MODULE	TOPIC	PERIODS	ANA	PHY	ACB
1A	SFN100	Introduction and Concepts	8	2	2	4
1A	SFN101	S.T. Units and Measurement	3	0	0	3
1A	SFN102	Body System and Cavities	2	2	0	0
1A	SFN103	The Cell	5	2	3	0
1A	SFN104	Basic Tissues	7	5	2	0
1A	SFN105	Nervous System	15	5	5	5

1A	SFN106	Blood	6	3	3	0
			46	19	15	12
1B	SFN107	Body fluids and Electrolytes	9	0	4	5
1B	SFN108	Skeletal System	8	6	2	0
1B	SFN109	Joints and Movement	10	5	2	3
1B	SFN110	Muscular System	10	4	3	3
			37	15	11	11
1C	SFN111	Cardio Vascular System	13	3	4	0
1C	SFN112	Lymphatic System	7	3	4	0
1C	SFN113	Respiratory System	17	7	5	5
			37	16	13	8
Total Periods			120			

A small-scale version, or trial run of the major study (Polit and Hungler, 1991: 62), was done with ten (10) different students, who volunteered and met all the criteria for selection. The function of the pilot study was to obtain information for improving the project or for assessing its feasibility. The pilot study revealed that revisions were needed in one or more aspects of the research. These were made in consultation with other subject experts as well as colleagues.

A test is valid if it measures what it purports to measure. Borg and Gall (1989: 250) state that validity is the degree to which a test is capable of achieving certain aims. This implies that validity is a specific job one wants a test to do, therefore a test is valid for a specific purpose (Legotlo, 1996: 38). The same source raised questions such as:

- Does the measuring instrument measure what the research wants to measure?

In research, validity is concerned with the soundness and the effectiveness of the measuring instrument. The main type of validity considered for this study was the content validity.

In validity, the instrument/tool/test items are concerned with the following questions:

- What is the measuring device really measuring?
- Is the abstract concept under investigation being adequately measured with this instrument?

These were some of the challenges and difficulties which the researcher encountered. In other words, the content validity is the degree to which a test samples the content area which is to be measured (Borg & Gall, 1989: 250). Just as this same source purports, the test need not cover all aspects of a specific course, but must cover a representative sample of the content.

In the light of this study, a panel of experts was asked to examine the content validity of the learning package. This was done against the course map (see course maps 4.2 and 4.3). Finally, the test items/questions (see Appendix 3 and its memorandum (see Appendix 4). All these entirely based on the literature review and experts' knowledge.

**TABLE 4.4 TIME TABLE FOR THE RESPIRATORY SYSTEM = 18****PERIODS**

DAY	DATE	08.00 08.45	08.45 09.30	09.30 10.15		10.30 11.15	11.15 12.00	12.00 12.45	
M O N D A Y	31	CIRCULATORY				RESPIRATORY			
	7	SOCIALIZATION			T	COMMUNICATION			L
	14	SOCIALIZATION				COMMUNICATION			
T U E S D A Y	21	LYMPATHIC			E	INTRO TO PEADS			U
	28	ONCOLOGY				NUTRITION			
	1	RESPIRATORY			A	CIRCULATORY			N
	8	TES : COMM				NOT LEGIBLE			
	15	COMM HEALTH				NOT LEGIBLE			C
	22	INTRO TO PEADS			T	LYMPHATIC			
	29	NUTRITION				ONCOLOGY			H
	2	CIRCULATORY			E	RESPIRATORY			
W E D N E S D A Y	9	PUBLIC HOLIDAY				PUBLIC HOLIDAY			
	16	MICROBIOLOGY			A	COMM HEALTH			L
	23	INTRO TO PEADS				RESPIRATORY			
	30	COUNSELLING				COUSELLING			U
	3	RESPIRATORY			T	CIRCULATORY			
T H U R S D A Y	10	SOCIALIZATION				COMMUNICATION			N
	24	RESPIRATORY			E	INTRO TO PEADS			
	31	COUNSELLING				COUNSELLING			C
	4	TEST : SFN			A	CIRCULATORY			
	11	TEST:SOC.SCIENCES				COMMUNICATION			H
F R I D A Y	25	ONCOLOGY				NUTRITION			
	31	TRAVELING DAY							

**MAP 4.3 COURSE MAP FOR THE RESPIRATORY SYSTEM****BLOCK: 1C****MODULE SFN 113: RESPIRATORY SYSTEM****PERIODS: 15****ANATOMY : 5**

1. Identify the organs forming the respiratory passageways in descending order until the alveoli are reached.
2. Describe the macroscopic structure of the nose.
3. Describe the macroscopic structure of the following organs:-
  - 3.1 Larynx
  - 3.2 Pharynx
  - 3.3 Trachea
  - 3.4 Bronchi
4. Describe the lungs using the following headings:-
  - 4.1 Position
  - 4.2 Macroscopic structure
  - 4.3 Microscopic structure

**PHYSIOLOGY : 5**

1. Describe the mechanism of inspiration & expiration
2. Describe the functions of the following:-
  - 2.1 Nose
  - 2.2 Larynx
  - 2.3 Pharynx
  - 2.4 Trachea

3. Describe the functions of the pleural covering
4. Describe how oxygen and carbon dioxide are transported in the blood
5. Describe cell respiration

#### **APPLIED CHEMISTRY AND BIOPHYSICS : 5**

1. State Charles Law
2. Explain the above law using either physiological nursing or clinical examples
3. State the following laws:-
  - 3.1 Boyle's law
  - 3.2 Dalton's law
  - 3.3 Henry's law

Explain the above laws using either physiological nursing or clinical examples.

The reliability of the test items/data collection tool indicates its accuracy with respect to stability and repeatability in collecting data. In other words, the reliability of an instrument is related to its ability to obtain the same data when repeated (Notter, 1983: 85). A perfectly reliable device produces the same results every time it is used for measuring the same thing. Reliability deals with matters of accuracy (Cates, 1985: 124). Ary et al. (1990: 51) purport that random error results in inconsistency of measurement and therefore affects the reliability of items. The same source goes on to say that rightly, all measurement of human qualities contain some error.

The following is an example of a unit of the independent learning as a learning strategy package. This unit expected the experimental group to study the respiratory system following some guidance.

**INDEPENDENT LEARNING AS A LEARNING STRATEGY PACKAGE**

<b>INSTITUTE</b>	<b>: MMABATHO COLLEGE OF NURSING</b>
<b>SUBJECT</b>	<b>: SCIENTIFIC FOUNDATIONS OF NURSING</b>
<b>COURSE</b>	<b>: COMPREHENSIVE NURSING</b>
<b>GROUP</b>	<b>: JANUARY 1995</b>
<b>LEVEL</b>	<b>: FIRST YEAR</b>
<b>LEARNING PACKAGE</b>	<b>: SFN 113</b>
<b>TOPIC</b>	<b>: RESPIRATORY SYSTEM</b>
<b>STRATEGY</b>	<b>: INDEPENDENT LEARNING</b>
<b>CONTACT PERSON</b>	<b>: MAMBANDA ELIZABETH GONDONGWE</b>

**INTRODUCTION**

Welcome to the last SFN learning topic - the respiratory system! It should be exciting because you are nearly a second year student. The respiratory system functions as an air distributor and gas exchanger. The system supplies oxygen to and removes carbon dioxide from the body's cells. Since most of our billions of cells lie too far distant from the air to exchange gases directly with it, gaseous exchange must take place between the blood and body cells. This calls for two systems, that is, the respiratory and cardio-vascular system (which has already been covered, see course map 4.2). All the parts of the respiratory system - except its microscopic-sized sacs called alveoli-function as air distributors. Only the alveoli serve as air exchangers.

The organs of the respiratory system are the nose, larynx, trachea, bronchi and lungs. Together they constitute the lifeline and the air supply line of the body. Knowledge of

the respiratory system will help you identify abnormalities in the ward or day to day life when you come across them.

Your package is divided into units, which you are required to study as individuals, pairs or even groups. The month's timetable is included at the end of this package so that you can time yourself. Fortunately we have eighteen (18) periods allotted for the respiratory system (see Table 4.4) while on the course map 4.3 the system has fifteen (15) periods. This means we have extra time. Remember again that you have free afternoons every day, disregarding the weekends, which you also use to study SFN 100. God bless you once more in your studies. Remember; "Whatever you ask in prayer, believe that you have received it and it will be yours!" Mark 11:24.

## **Unit 1 the Trachea**

### **Introduction**

The trachea or wind pipe is a thin-walled tube. It stretches through the neck to the thorax. It is about the diameter of an average garden hose (hose-pipe). What does it do in our bodies? Let us go through the unit.

### **Prerequisite knowledge**

Revise the following for your background information:

- smooth muscle tissue,
- connective tissue, and
- cartilaginous tissue.

**Objective/pre-test**

At the end of this study unit, you should be able to:

- identify the trachea on a chart or model,
- describe the trachea, and
- state the vital functions of the trachea.

**Learning Activities**

Read your prescribed book - Marieb, 1989 Chapter 23: 730-731.

Read your recommended book - Ross & Wilson, 1981 Chapter 7: 97-98.

Visit the college librarian and ask for the simulation room where you will find charts on the respiratory system. They will assist your unit study. Are you able to identify and label the trachea on a diagram, at the end of your study unit? Make your own notes.

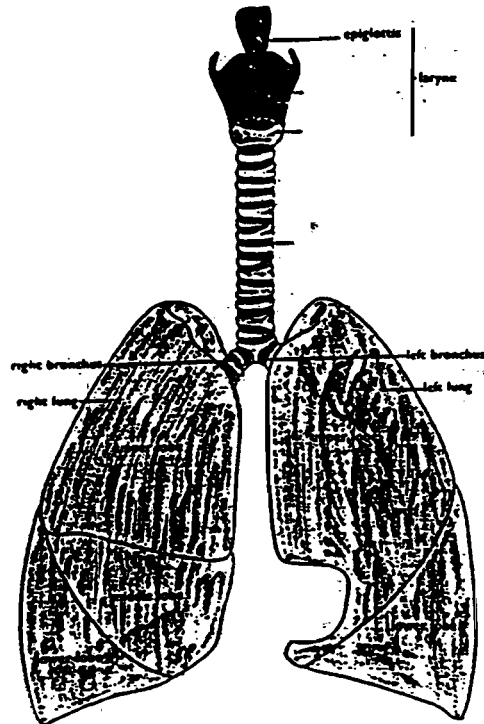
If you have covered the objectives/pre-test, answer the following post-test. It is a must that you do it. Check your mastery of the learning unit. If you get anything wrong, go back to the objectives and repeat the exercise. Ensure that you are able to do the post-test well. If you have any problem consult your contact person for guidance.

**Post-test**

1. Identify the trachea on a diagram which shows the lungs and the respiratory passages.
2. Describe the structure of the trachea.

## Answers to unit 1: The Trachea

### 1. Labelling the trachea on a diagram showing the lungs and respiratory passages:



### 2. Describing the trachea:

- tube about the side of a garden hose,
- it stretches through the neck to the thorax,
- it is lined with ciliated membrane,
- it is a smooth muscle, in which are embedded C-shaped rings of cartilage at regular intervals,
- the cartilaginous rings are interrupted at the back where the trachea is adjacent to the oesophagus (that is, they are incomplete on the posterior surface.)

- the cartiliginous rings give firmness to the wall, preventing it from collapsing. Can you imagine what will happen if this tube would collapse? Disaster! Why? Because no air would proceed to the necessary parts and the person would die. Can you see the works of the Almighty? Everything has been designed for a purpose. Let's not forget to praise the Lord for the wonderful word He did.

### 3. Stating the vital function of the trachea

The trachea performs a simple but vital function. It furnishes part of the open passageway through which air can reach the lungs from the outside world.

#### **NB:**

Obstruction of this airway for even a few minutes causes death from asphyxiation. So let us watch out. Save lives as much as possible.

If you have managed to respond as above, then you have mastered unit 1. You can proudly proceed to unit 2 - best of luck.

The rest of the independent learning as learning strategy package is what the experimental group worked on independently. At the end of that month both groups wrote a test (see Appendix 3). The test memorandum (see Appendix 4) was used to obtain the following post-test scores (table 4.5)

**TABLE 4.5 POST-TEST SCORES FOR BOTH GROUPS**

EXPERIMENTAL GROUP (EGPO)		CONTROL GROUP (CGPO)
1.	75.00	57.00
2.	68.00	60.00
3.	78.00	50.00
4.	72.00	65.00
5.	80.00	63.00
6.	75.00	65.00
7.	60.00	60.00
8.	62.00	69.00
9.	68.00	60.00
10.	74.00	52.00
11.	70.00	64.00
12.	78.00	65.00
13.	69.00	58.00
14.	68.00	60.00
15.	62.00	61.00
16.	82.00	60.00
17.	75.00	50.00
18.	64.00	58.00
19.	70.00	62.00
20.	68.00	68.00

The following presents the differences between the pre-test scores and post-test scores within the groups.

**TABLE 4.6 DIFFERENCE IN PRE-TEST SCORES AND POST-TEST SCORES WITHIN THE GROUPS (SCD IFF) (SCDIFF)**

<b>EXPERIMENTAL GROUP DIFFERENCE (EGD)</b>		<b>CONTROL GROUP DIFFERENCE (CGD)</b>
1.	16.00	1.00
2.	3.00	2.00
3.	26.00	8.00
4.	2.00	1.00
5.	8.00	1.00
6.	11.00	5.00
7.	6.00	2.00
8.	12.00	2.00
9.	13.00	2.00
10.	16.00	2.00
11.	14.00	6.00
12.	14.00	6.00
13.	15.00	2.00
14.	8.00	1.00
15.	12.00	5.00
16.	16.00	-2.00
17.	17.00	-2.00
18.	8.00	8.00
19.	11.00	4.00
20.	16.00	8.00

The next table (Table 4.7) presents all the data that was collected.

**TABLE 4.7 PRESENTATION OF ALL DATA COLLECTED**

	<b>egpr</b>	<b>egpo</b>	<b>cgpr</b>	<b>cgpo</b>	<b>egd</b>	<b>cgd</b>
1.	59.00	75.00	56.00	56.00	16.00	1.00
2.	65.00	68.00	58.00	60.00	3.00	2.00
3.	52.00	78.00	52.00	50.00	26.00	8.00
4.	70.00	72.00	64.00	65.00	2.00	1.00
5.	72.00	80.00	62.00	63.00	8.00	1.00
6.	64.00	75.00	60.00	65.00	11.00	5.00
7.	54.00	60.00	58.00	60.00	6.00	2.00
8.	50.00	62.00	65.00	69.00	12.00	2.00
9.	55.00	68.00	58.00	60.00	13.00	2.00
10.	58.00	74.00	50.00	52.00	16.00	2.00
11.	56.00	70.00	58.00	64.00	14.00	6.00
12.	64.00	78.00	59.00	65.00	14.00	6.00
13.	54.00	69.00	56.00	58.00	15.00	2.00
14.	60.00	68.00	59.00	60.00	8.00	1.00
15.	50.00	62.00	56.00	61.00	12.00	5.00
16.	66.00	82.00	62.00	60.00	16.00	-2.00
17.	58.00	75.00	52.00	50.00	17.00	-2.00
18.	56.00	64.00	50.00	58.00	8.00	8.00
19.	59.00	70.00	58.00	62.00	11.00	4.00
20.	52.00	68.00	60.00	68.00	16.00	8.00

#### **4.6 VARIABLES USED IN THE STUDY**

Independent variable = independent learning as learning strategy

Dependent variable = academic achievement in Anatomy, Physiology, Applied Chemistry and Biophysics of first year nursing students (SFN 100).

#### **4.7 EXPERIMENTAL DESIGN**

A (before-after) pretest-post-test experimental design was used. This was to determine the influence of independent learning as a learning strategy and academic achievement in Anatomy, Physiology, Applied Chemistry and Biophysics for first year nursing students (SFN 00).

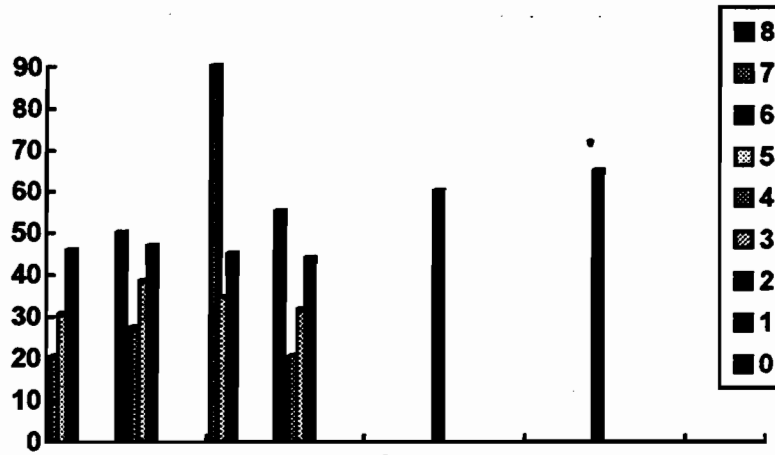
#### **4.8 STATISTICAL PROCEDURES**

To determine the score for both groups after a month's study, after guidance had been given to the experimental group while the control group had been left to learn on their own in any way they chose, the POSCORE (table 5.1) by group was done. This was done by the use of the Mann - Whitney U - Wilcoxon Rank Sum, W Test (see Appendix 5). At the same time the PRSCORE (see Figure 4.1) was computed for both groups. The differences in the scores for both groups before and after manipulation (SCDIFF) (see table 4.6) were calculated (see Appendix 5) for all the above computations.

To determine the pre- and post-test scores for both groups (EGPO with EGPR) and (CGPO with CGPR) the Wilcoxon Matched-Pairs Signed-Ranks Test was used (see Appendix 5).

The Leven's Test for equality of variances where  $F = 3.541$  and  $P = .068$  was used to calculate the tests for independent samples of the groups. The Spearman Correlation coefficients and Kendall correlation coefficients were also used to find the significance of the study.

**FIGURE 4.1 PRE-SCORE (PRSCORE) FOR BOTH GROUPS**



### PRSCORE

In order to determine the educational significance, a t-test was used (see par. 5.6).

The following is the t-test equation:

$$t = \frac{\bar{X}_A - \bar{X}_B}{\frac{\sum X_A^2 + \sum X_B^2 \left( \frac{1}{n_A} + \frac{1}{n_B} \right)}{n_A + n_B - 2}}$$

Where  $n_A$  and  $n_B$  are the group sizes and

$$X_A = X_A - \bar{X}_A,$$

$$X_B = X_B - \bar{X}_B,$$

with  $\bar{X}_A$  and  $\bar{X}_B$  the group means of groups A and B.

Non -parapmetric tests such as the Wilcoxon Matched-Pairs Signed-Ranks/Sign Test and the Wilcxon/Mann Whitney Tests were used to determine significance of the study.

#### **4.9 PROCEDURE**

The researcher carried out the study at Mmabatho College of Nursing in the North West Province of South Africa (see Map 4.1). This was done with all first year nursing students studying Anatomy, Physiology, Applied Chemistry and Biophysics, which are collectively known as Scientific Foundations of Nursing (SFN 100). The aim of the study was explained to the subjects so that they were fully informed of the purpose. They were also aware that participation was voluntary and that they had the right to withdraw at any point, if they so wished. The study commenced at a time when the country had just attained its democracy and there were problems in schools in general. The researcher feared that students could boycott the research study, but fortunately there were no such hindrances. When the subjects realised that they would benefit from the research study, they became eager to participate. The subjects were enthusiastic about the study throughout the project.

The researcher tried to minimise mistakes by explaining as much as possible every step from the beginning of the project up to the end before the subjects tackled the tasks. At the end of the eighteen periods (one month's study) (see table 4.4) both groups wrote the same evaluative test (see Appendix 3). The test was written under the same conditions at the same time. The researcher administered the test (see Appendix 3) and when the time was up, all the test scripts were collected and marked by the researcher using a memorandum (see Appendix 4). The scores are the ones analysed in Chapter 5.

MAP 4.1 MAP FOR MMABATHO AREA TO SHOW WHERE MMABATHO COLLEGE OF NURSING IS SITUATED



Mmabatho College of Nursing

University of The North-West

Mmabatho High School Hostel

UNIT 5

UNIT 2

UNIT 7

UNIT 12

UNIT 15

UNIT 10

Cemetery

Water Tower

CENTRAL

MMABATHO

MOTLHABENG

Tebelo Primary

Tebelo Middle School

Mokopo Reserve

Agrico Training Centre

SETLOGELO

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

Mmabatho High

Mmabatho High

Mmabatho High

Mmabatho High

Mmabatho High

Mmabatho High

Mmabatho High

Mmabatho High

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

SETLOGELO

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

SETLOGELO

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

SETLOGELO

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

SETLOGELO

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

SETLOGELO

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

MOKALE

MOTLHABENG

MOTSEGALE

#### **4.10 CONCLUSION**

The method of research was described in this chapter. The main aim of the empirical research was to gather data to be used to determine the influence of independent learning as a learning strategy on academic achievement of first year nursing students doing Anatomy, Physiology, Applied Chemistry and Biophysics.

The population and sample used were described in paragraph 4.4. The independent learning as a learning strategy package was discussed in Figure 3.1.

**NB:**

The experimental design was explained in paragraph 4.7 while the statistical analysis and techniques were discussed in paragraph 4.8. The procedure followed was described in paragraph 4.9 while the conclusion was given in paragraph 4.10.

## CHAPTER 5

### 5. STATISTICAL ANALYSIS AND INTERPRETATION OF RESULTS

#### 5.1 INTRODUCTION

As was indicated in paragraph 1.2 the aim of this research was to determine whether there is a relationship between independent learning as a learning strategy and academic achievement of first year SFN 100 nursing students. The aim of the research formed the basis of the hypotheses which were tested. The hypotheses are listed in paragraph 5.2. The procedure overview which was followed to test the hypothesis is given in paragraphs 5.3 and 5.4. Summary statistics and graphics are given in paragraph 5.5, while conclusions regarding the hypotheses testing are in paragraph 5.6.

#### 5.2 HYPOTHESES

The following five hypotheses were tested in order to achieve the aim of the research:

##### Hypothesis 1

There is an increase in the mean academic achievement of the control group after one month, that is, for Mcgp, Megpr and Mcgd. This is the control group test and experimental group, pretest and difference between the post-experimental group and pretest mean scores:

$$H_0 : Mcgpo = Mcgpr \quad (Mcgd = 0).$$

$$H_0 : Mcgpr > Mcgpr \quad (Mcgd > 0).$$

## Hypthesis 2

There is a relationship between the mean academic achievement scores of the experimental scores of the experimental group and the control group at the beginning that is,

- before manipulation by the independent learning as a learning strategy exposure.

This is for  $M_{egpr}$  and  $M_{cgpr}$ , that is, the experimental and control group pre-test means:

- $H_0 : M_{egpr} = M_{cgpr}$
- $H_a : M_{egpr} \neq M_{cgpr}$

## Hypothesis 3

The mean academic achievement scores of the experimental group after the treatment/ exposure to independent learning as a learning strategy is larger than the mean academic achievement scores of the control group after one month, that is,

- $H_0 : M_{egpo} = M_{cgpo}$
- $H_a : M_{egpo} > M_{cgpo}$

## Hypothesis 4

The change in the experimental group's mean academic achievement score is larger than that of the control group's mean academic achievement score at the end of one month (the experimental group having been subjected to guided learning/independent learning as a learning strategy while the control group was left to learn in any way they chose), that is,

- $H_0 : M_{egd} = M_{cgd}$
- $H_a : M_{egd} \neq M_{cgd}$

### Hypothesis 5

There is an increase in the mean academic achievement score of the experimental group after the treatment/exposure to independent learning as a learning strategy exposure and the mean academic achievement score of the same experimental group before the manipulation, that is:

- Ho :  $M_{egd} = M_{egpr}$  ( $M_{egd} = 0$ )
- Ha :  $M_{egpo} > M_{egpr}$  ( $M_{egd} > 0$ ).

### 5.3 OVERVIEW

The underlying belief is that students may perform better if they are given some guidance, for example, when given guiding material and a teacher or facilitator is available to assist them.

This study is based on the respiratory system. The experiment was performed by selecting a random sample of 40 students from a class of first year SFN 100 nursing students. All students were of similar background and of matriculation standard. Each had matric Biology and any one of the following three natural science subjects:

- Physical Science,
- Geography, and
- Agriculture.

Of these, 20 had Agriculture, 8 Physical Science and 12 Geography. Their ages ranged between 20 and 23 years. All were females.

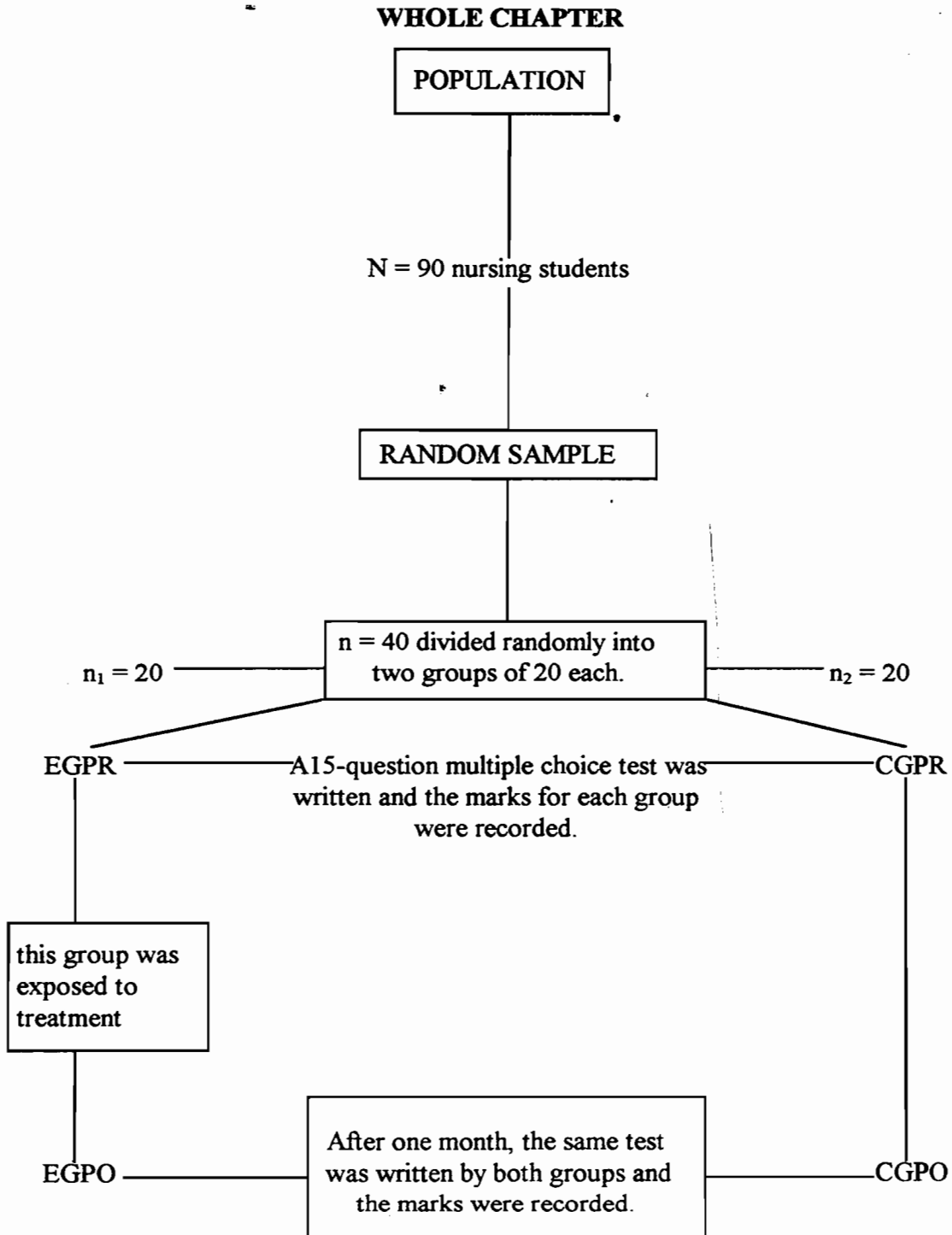
The 40 sampled students were randomly divided into two groups with 20 students each, that is, an experimental group (EG) and a control group (CG) (see par. 4.4 table 4.1. and 4.2. respectively).

Both groups wrote a 15 - question multiple choice test (see Appendix 3). The same test was marked by the researcher according to the test memorandum (see Appendix 4). The group marks were recorded as EGPR and CGPR. This was to indicate the performance before the one month of experimentation. The EG was then exposed to some guidance on the respiratory system, while the CG was not given any guidance but were left to study the respiratory system on their own, utilizing any learning strategy they chose.

After one month, the two groups sat for the same test. The marks were then recorded as EGPO and CGPO (see table 4.5).

The following (see Figure 5.1) is a diagrammatic presentation of the whole chapter overview.

**FIGURE 5.1 CHAPTER OVERVIEW**



**Variables**

- EGPR** : scores of students obtained in the test before they were given guiding study methods (exposure to treatment); these students belonged to the experimental group.
- EGPO** : scores of students obtained from the same test written after one month, during which the guided method was applied; experimental group.
- CGPR** : scores of control group before one month
- CGPO** : scores of control group after one month
- EGD** : the change in the experimental group  
(=EGPO-EGPR).
- CGD** : the change in the control group  
(=CGPO-CGPR).
- PRSCORE** : score of first-time testing for all 40 students
- POSCORE** : score of second-time testing for all 40 students (see Table 5.1 below)

**TABLE 5.1**                    **SCORES OF POST-TEST FOR ALL STUDENTS**  
**(POSCORE)**

	EXPERIMENTAL	EXPERIMENTAL	CONTROL	CONTROL	CHANGES	CHANGES
	PRE-TEST egpr	POST-TEST egpo	PRE-TEST cgpr	POST-TEST cgpo	EXP'AL egd	CONTROL cgd
1	59.00	75.00	56.00	57.00	16.00	1.00
2	65.00	68.00	58.00	60.00	3.00	2.00
3	52.00	78.00	52.00	50.00	26.00	8.00
4	70.00	72.00	64.00	65.00	2.00	1.00
5	72.00	80.00	62.00	63.00	8.00	1.00
6	64.00	75.00	60.00	65.00	11.00	5.00
7	54.00	60.00	58.00	60.00	6.00	2.00
8	50.00	62.00	65.00	69.00	12.00	2.00
9	55.00	68.00	58.00	60.00	13.00	2.00
10	58.00	74.00	50.00	52.00	16.00	2.00
11	56.00	70.00	58.00	64.00	14.00	6.00
12	64.00	78.00	59.00	65.00	14.00	6.00
13	54.00	69.00	56.00	58.00	15.00	2.00
14	60.00	68.00	59.00	60.00	8.00	1.00
15	50.00	62.00	56.00	61.00	12.00	5.00
16	66.00	82.00	62.00	60.00	16.00	-2.00
17	58.00	75.00	52.00	50.00	17.00	-2.00
18	56.00	64.00	50.00	58.00	8.00	8.00
19	59.00	70.00	58.00	62.00	11.00	4.00
20	52.00	68.00	60.00	68.00	16.00	8.00

#### **5.4 COMPARISON**

The following hypotheses are worth considering. Two sample comparisons are discussed to make a sensitive analysis between the two groups. This will be important so as to assess the effect of the treatment since it is expected that EG must perform better than CG after the given guidance. Another analysis determining changes that occur within the groups themselves between, before and after (that is, the change during one month) will also be presented.

##### **5.4.1 Comparison within the Control Group (CG): Before and after one month**

This measures the effect of changes that occurred due to the passing of a one month period within the control group itself.

##### **5.4.2 Comparison of the Control Group (CG) and Experimental Group (EG) :**

###### **Before one month**

In this case, one would expect that due to the random division into the groups, there is no difference between the two groups in their performance at the first time of writing the test. The perceivable variations in the marks may only be attributed to style of previous learning, or individual understanding due to matric experience from different exposure backgrounds to the matric natural science subjects.

### **5.4.3 Comparison of the Control Group (CG) and Experimental Group (EG):**

#### **After one month**

The EG is expected to yield higher marks on the average than the CG. The comparison is important for this study. The aim is to test this statistically to determine if the differences is significant or not. If it is significant, then it could be a good indication that the experiment was effective.

### **5.4.4 Comparison of the (EGD=EGPO - EGPR) and (CGD = CGPO - CGPR):**

#### **After one month**

The two measures, that is, the EGD and CGD, depict important changes in the groups. This comparison has stronger properties than 5.4.3, which indicate improvements that were made by the respective groups. The improvement of the Experimental Group (EG) is expected to be higher than the improvement of the Control Group (CG), hence it is stronger than 5.4.3. since it incorporates 5.4.1. and 5.4.5.

**5.4.5 Comparison of the Experimental Group : Before and After one Month (see table 5.1)**

**5.5 DATA SUMMARIES AND GRAPHICS**

**POPULATION PARAMETER**

**SAMPLE**

**STATISTICS**

N = population size

n = sample size

N = 90

n = 40

n<sub>1</sub> = 20

n<sub>2</sub> = 20

**THEORETICAL**

**SAMPLE**

**MEANS**

**AVERAGES**

Megpr

Xegpr = 58.7

Megpo

Xegpo = 70.90

Mcgpr

Xcgpr = 57.65

Mcgpo

Xcgpo = 60.35

Mcgpd

Xegd = 12.12

Mcgd

Xcdg = 2.7

X prescore = 58.18

X poscore = 65.63

## OTHER STATISTICS

VARIABLE	MEDIAN	MODE	SD	CV
EGPR	58	50	6.37	11%
EGPO	70	68	6.20	9%
CGPR	58	58	4.21	7%
CGPO	60	60	5.27	9%
PRSCORE	58	58	5.35	9%
POSCORE	65	60	7.80	12%
EGD			5.47	45%
CGD			3.01	112%

SD : standard deviation

CV : coefficient of variation

### 5.6 HYPOTHESES TESTS

All of the following hypotheses used the students' t-test (paired as well as two-group) and the conclusions are based on a 5% level of significance.

The assumptions of normality is verified and adopted in section 5.5 of this chapter.

The assumption of independence is guaranteed by the sampling procedure used, that is:

- the random sampling method, and
- the allocation of students to two mutually exclusive groups. The assumption of equality of variances is tested by Levene's test (see Appendix 5).

The following hypotheses tests the comparison discussions of section 5.4 of this chapter.

The purpose with a two group t-test is to compare the means of two groups of data with each other in order to determine whether the differences between the means should be attributed to chance factors or whether they represent a true difference (De Wet, et al., 1981: 212). The following conditions for the use of a t-test are stipulated by De Wet et al. (1981: 213). These are:

- the distribution in the population does not deviate far from normal,
- the measurement in the two groups are independent and use is made of random sampling, and
- the variance in the groups appear to be reasonably homogeneous.

The data and measurements obtained in this research claim to meet the above conditions (Sedibe, 1991: 70), hence their use.

## **CHAPTER 6**

### **6. SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION**

#### ***6.1 INTRODUCTION***

This chapter outlines the summary of the research study. The problem is stated in paragraph 6.2. The literature review is summarised in paragraph 6.3, followed by an explanation of the research methodology in paragraph 6.4. The results are summarised in paragraph 6.5. Some limitations and recommendations are given in paragraph 6.6 and 6.7, respectively. A concluding note is presented in par. 6.8.

#### ***6.2 STATEMENT OF THE PROBLEM***

The educator who facilitates the learning of Anatomy, Physiology, Applied Chemistry and Biophysics, namely Scientific Foundations of Nursing, at Mmabatho College of Nursing is faced with the problem of teaching students to become independent learners, in order to improve their academic achievement. The teacher's problem is aggravated by students who regard the subject to be difficult and the curriculum to be too advanced for their purpose (as nurses). Some students adopt this stance because they inherited it from their predecessors, while others regard the subject as difficult because they lack the motivation of independent learning as a learning strategy that ensures acceptable academic achievement (see paragraph 2.1.2 and paragraph 2.3). Students do not know how much effort to apply in order to achieve better academically.

### **6.3 REVIEW OF THE LITERATURE**

#### **6.3.1 The relationship between independent learning as a learning strategy and academic achievement**

Learning strategies (see par. 2.3) are explained as thoughts and behaviours that a student engages in during learning that are intended to influence the encoding process (see Figure 2.4). Learning strategies may include rehearsal (see par. 2.3.2.1 (a)), elaboration (see par. 2.3.2.1 (b) and organisational (see par. 2.3.2.1 (c)) of information to be learnt. Students who use independent learning as a learning strategy are able to simplify and recall information better than those who do not engage in these procedures. The literature also revealed that students who engage in metacognitive planning do monitor, plan, regulate and evaluate their work (see par. 2.3.2.2 (a))

Students who utilise independent learning as a learning strategy judge themselves by using a learning strategy to improve their understanding and also to find out if they have enough knowledge to perform the task that is required. Social cognitive theorists believe that independent learning as a learning strategy involves three classes of sub-processes, viz. self-observation, self-reaction and self-judgement (see par. 2.3.2.2 (c)). Independent learning as a learning strategy focuses on individual learning needs and styles and hence allows the highest level of academic achievement.

Independent learning as a learning strategy is a goal that many nurse educators have been working towards for several years (see par. 2.3.2.2 (c)). This strategy is not yet fully utilised because it needs major changes in the traditional philosophies and procedures of nursing. Major characteristics of independent learning as a learning

strategy (see par. 2.3.2.2 (c)) are said to influence the academic achievements of students. Self-observation is informative of the progress that independent learners are making towards their goals. Self-reaction follows on the heels of self-judgement and self-observation. Self-reaction is when a student makes a choice to switch over to a different form of independent learning as a learning strategy. It is believed that self-reaction helps the student to attain her own stated goals.

Independent learning as a learning strategy has been used by the learner to identify when learning goals have been met or not and whether comprehension failures have occurred or not. They may keep a record of their academic achievement and observe acceptable standards. This motivates students as they judge themselves to be managing effectively and self-efficaciously. The students become motivated to work even harder. On the other hand if they perform poorly, they may try other learning strategies so that they may improve and reach some acceptable academic achievement. It is believed that students cannot succeed in identifying and correcting learning facilities without the use of independent learning as a learning strategy.

Independent learning as a learning strategy trains the student to assume responsibility for their own learning and to manage their own learning, that is, they become self-regulated learners (see par. 2.3.2.2 (c)). When students have accepted responsibility for their own learning, they learn more effectively and develop an enduring interest in learning.

Meta-cognition as part of independent learning as a learning strategy (see par. 2.3.2.2) means the conscious awareness of thinking.

A meta-cognitive student is aware of her gaps and knows what to do and when to do it in order to improve understanding and academic achievement. Self-efficacy is defined as a student's expectation that she is capable of performing some behaviour that will produce outcomes in a particular situation. Students with high self-efficiency believe and participate actively in their learning, yet those who have low self-efficiency believe they may avoid working hard. Students who utilise independent learning as a learning strategy do their school work on their own and are task-persistent, compared to their counterparts.

## **6.4 METHOD OF RESEARCH**

### **6.4.1 SUBJECTS**

All first year nursing students at Mmabatho College of nursing doing the course SFN 100 (Anatomy, Physiology, Applied Chemistry and Biophysics) in the North-West Province - South Africa, constituted the population for this study.

Through random sampling procedure, a sample of 40 students was selected. From those selected by tossing a coin, the first elements of either the control or experimental group were chosen. This was done using the Kth method where  $K=2$ . Therefore, every second element fell into either group. The ages of the subjects ranged from 20 - 23 years. they were all females, unmarried and came from rural areas. They all had been out of school for at least a year and they were matriculates with at least one of the following natural science subjects taken in matric (Physical Science, Biology and Geography).

### **6.4.2 INSTRUMENTATION**

The control group was left to learn the respiratory system using any learning strategy of their choice while the experimental group was given guidance in the form of independent learning as a learning strategy package (see Figure 3.1). At the end of one month both groups were exposed to the same test (see Appendix 3). Both groups wrote the said test under the same conditions, that is, in the classroom, at the same time and with the invigilation done by the researcher.

### **6.4.3 PROCEDURE**

The test was corrected by the researcher using the memorandum (see Appendix 4). The before-after treatment (pre-post test) marks were recorded (see table 4.3 and 4,5). The difference in pre-test and post-test scores within the groups (see table 4.6) was done. Table 4.7 presents all the data that was collected. The same data was processed with the mainframe of the Statistical Department of the University of the North-West. To determine the educational significance of the difference between the two groups means, a T-test was used (see par. 4.8).

## **6.5 RESULTS**

The following hypotheses were tested:

Hypothesis 1, that there is a relationship between academic achievement scores of the control group after one month (see par. 1.4) exists. The observed T-test statistics is 4.01, greater than the critical T-test value of 1.729 at a 5% significance level with 19 degrees of freedom. The null hypothesis is thus rejected and we may conclude that the

control group has also improved. The improvement could be attributed to the fact that the students were writing the same test after one month, hence they could have done revision.

Hypothesis 2, that there is a relationship between academic achievement scores of the experimental group and the control group at the beginning, that is, before manipulation, in other words, the independent learning as a learning strategy exposure. Assumption of test of equality of variances yields an F value of 3.541 and a P value of 68/1000. The assumption is not rejected, hence the variances are pooled. The observed T-test statistics of 0.62 is neither greater than 2.093 nor smaller than -2.093, at a 5% significance level, with 19 degrees of freedom. This two-tailed tests yields a probability of rejecting null hypothesis when it is in fact true of 0.543. The null hypothesis is not rejected and this could just confirm the idea that the two groups are sampled from the same population and have no particular differences, which might have some bearing on the outcome of the experiment.

Hypothesis 3, that there is a relationship between academic achievement scores of the experimental group after the treatment/independent learning as a learning strategy exposure and the academic group after one month. The assumption T-test of equality of variances yielded an F-value of 1.253, and a P-value of 0.27 by Levene's test (see Appendix 5). Thus there is no indication from the data that the variances are unequal. The observed T-test statistics is 5.79, which is greater than 1.686 at a 5% significance level with 38 degrees of freedom. The null hypothesis is simply rejected and one can conclude that there is a significant variance between the performance of the two groups. the experimental group did indeed yield a higher average academic

achievement than the control group. This is an indication that the guiding material was effective.

Hypothesis 4, that there is a relationship between the changes in the experimental group's academic achievement scores and the control group's academic scores at the end of one month (the experimental group having been subjected to guided learning in independent learning as a learning strategy, while the control group was left to learn in any way they choose). The assumption of equal variances is accepted with an F-value of 3.66 and a p-value of 63/1000. The purpose of this T-test was to test a very subtle change between the two groups. The observed value is similarly significant. The effective guiding students was determined. The guided group showed an improvement which is significantly higher on a 5% level than the improvement of the control groups, since 6.8 is larger than the critical value of 1.686. The improvement of the experimental group may be attributed to experiencing the same test again, together with the guidance which they were given while the improvement of the control group may be attributed to experiencing the same test again.

It may seem obvious that if one were to rewrite the test, one could be expected to perform better, considering the length of time (one month) during which to review the material.

Hypothesis 5, that there is a relationship between the academic achievement scores of the experimental group after treatment/independent learning as a learning strategy exposure and the academic achievement scores of the same experimental group before the manipulation/independent learning as a learning strategy exposure. This seems to

ignore the presence of the control group. It is also significant. The treatment of giving students guidance was effective and the improvement of the two groups seem to agree with realistic assumptions.

## **6.6 LIMITATIONS**

The decision to conduct the study at Mmabatho College of Nursing only rendered a small sample, even though the sample (20%) represented the total population of first year nursing students doing SFN 100. The ideal situation would have been a sample from both a rural and an urban college of nursing (Excelsius in Klerksdorp) in the North-West Province. Due to time and financial constraints (the research was researcher funded), this was not possible.

The selection of students through random sampling resulted in an uneven distribution of students according to age and possibly level of intelligence. This could also be attributed to the sample consisting of only females, yet the total population consists of 18% males and 82% females.

Another limitation is that the subjects may also have lacked knowledge of independent learning as a learning strategy, especially metacognitive awareness, goal setting, planning and time management, as well as the influence of these factors on academic achievement.

## **6.7 RECOMMENDATIONS**

The recommendations which flow from the research findings are as follows:

- Some educational guidance on learning strategies, particularly independent learning as a learning strategy, should start at primary school level so as to prepare the learners for a future in which self-regulated learning strategies, motivation, task commitment and a sense of responsibility will to a large extent determine the academic achievement of individuals in life.
- There is a need for the introduction of a specialised course even at diploma or certificate level in the preparation of all educators at tertiary level. This will be for educator trainers and other experienced personnel who are interested in guidance. The course should have Guidance and Education as major subjects.
- A thorough study needs to be made of nursing syllabi and the situation at other education departments so that a model can be designed for all colleges of nursing, with the considerations of this research.
- The structuring of a guidance syllabus for colleges of nursing should be in line with the needs of the students as expressed by the students and educators themselves. All communication media such as the radio, television and newspapers should be engaged in propagating the importance of guidance in general and educational guidance in colleges of nursing in particular.
- Students need to be taught to evaluate themselves by means of Self-Testing Strategies so that they have sound knowledge of their strengths and weaknesses as students or as learners and also of the variables that influence their learning. Such knowledge is important to enable students to self-regulate their learning as independent learners (see par. 2.2.1) responsible for their learning. Students must be taught independent learning strategies, such as selecting main ideas, and use of study aids, such as mnemonics (see par. 2.3.2.2 (b)), to help them achieve better in

Anatomy, Physiology, Applied Chemistry and Biophysics. Students must also be taught that they must set realistic goals that they will always be able to achieve. Realistic goals motivate students to excel, hence attaining more acceptable academic achievement.

Independent learning as a learning strategy must be explained to students so that students know how to utilise it to improve their academic achievement in SFN 100. These self-regulated learning strategies must be imparted to students especially by a school guidance expert. This person must involve all the subject educators so as to follow up on how to employ or apply specific learning strategies in the different courses.

## **6.8 CONCLUSION**

In light of the above, it remains a constant and continual challenge for educators and policy makers to make a concerted effort to:

- Identify the educational needs of nursing students and help them meet these needs through guidance
- Prepare students with selfless dedication through purposeful educational guidance
- Help, guide and enable students to become what their capabilities allow them to be
- The two nursing colleges in the North-West Province should study this research and implement it in their province so as to see to what extent the recommendations made in this study may enhance their students' SFN 100 academic achievement.

Lastly, it is hoped that if students use independent learning as a learning strategy, their academic achievement will also improve.

## **THE SOURCE LIST**

ABEY, P. & SHAYER, M. 1994. Really raising standards: Cognitive intervention and academic achievements. London: Routledge.

ARY, D.J. & RAZAVIECH, A. 1976. Introduction to researching education. Atlanta: Holt, Rinehart and Winston.

ARY, D. J., JACOBS, L.C. & RAZAVIECH, A. 1990. Introduction to research in education. Fourth Edition. Tokyo: Harcourt Brace Jovanovich College Publishers.

ATKINSON, R.L., ATKINSON, R.C., SMITH, E.E., SMITH, E., & BEM, D.J. 1993. Introduction to psychology. Eleventh Edition. Toronto: Harcourt Brace Colledge Publisher.

AUSUBEL, D. 1968. The facilitation of meaningful verbal learning in the classroom. Educational Psychologist, 12:162-178.

BANDURA, A. 1986. Social foundations of thought and action: A social cognitive theory. Englewood Cliffs; N.J.: Prentice-Hall.

BANDURA, A. 1985. Cognitive learning theory. (In Feist J. Theories of personality. New York: Holt Rinehart and Winston. pp. 262-294.)

BECK, A. T., RUSH, A.J., SHAW, B.F., EMERGY, G. 1979. Cognitive theory of depression, New York: Guilford.

BEST, J.W. & KAHN, J.V. 1986. Research in education: Fifth Edition. Englewood Cliffs, N.J.: Prentice-Hall.

BEST, T.W. & KAHN, J.V. 1993. Research in education: Seventh Edition. Englewood Cliffs, N.J.: Prentice-Hall.

BONDY, E. 1984. Thinking about thinking: encouraging children's use of metacognitive processes. Childhood Education, 60(4):234-238.

BORG, W.R. & GALL, M.D. 1989. Educational research - An introduction. New York: Longman.

BROWN, G. 1984. Metacognition: New insight into old problems? British Journal of Educational Studies, 22(3):213-219.

CATES, W.M. 1985. A practical guide to educational research: Englewood Cliffs; N.J. Prentice-Hall.

CHRISTIE, P. 1986. The right to learn. Cape Town: Galvin and Sales.

CHUENYANE, M.Z. 1990. School guidance and counselling: A liberating force. Cape Town: Blackshaus.

CLARK, M.D. 1981. Individualizing education. In Chickering, A.W. (ed.). The modern American college. San Francisco: Jossey-Bass. p. 582-599.)

CLAXTON, G. 1990. Teaching to learn, a direction for education: London: Cassell.

COOPER, S.S. 1983. The practice of continuing education in nursing. Rockville: Aspen.

CORNO, L. 1987. The metacognitive components of self-regulated learning. Contemporary Educational Psychology. 11(1):333-346.

CROSS, K.P. 1976. Accent on learning: San Francisco : Jossey - Bass.

CROSS, D.R. & PARIS, S.G. 1988. Development and instructional analysis of children's metacognition and reading comprehension: Journal of Educational Psychology; 80(2):131-142.

DAVIS, A.J. & AROSKAR, M.A. 1983. Ethical dilemmas and nursing practice. Second Edition. Connecticut: Appleton Century Crofts.

DEMBO, M.H. 1991. Applying Educational Psychology in the Classroom. New York: Longman.

DE TORNYAY, R. & THOMPSON, M.A. 1982. Strategies for teaching nursing. Second Edition. New York: Wiley Medical.

DE WET, J.J., MONTEITH, J.L. de K., VENTER, P.A. AND STEYN, H.G. 1981. Navorsingmetodes in die opvoedkunde: inleiding tot empiriese navorsing. Durban: Butterworths.

ELSHOUT-MOHR, M. & HOUT-WOLTERS, B.H.A.M. 1995. Actief leren en studeren Acht soorten in Structieleer Episodes Pedagogische Studien, 72:273-300.

ENGLBRECHT, P. 1990. Cognitive and metacognitive base for remediation. Pedagogiejoernaal, 11(1):55-64.

FERRON, O.M. 1989. Senior primary mathematical didactics. Durban: Butterworths.

FASSENDEN, R.J. & FESENDEN, J.S. 1984. Basic chemistry for Health science. Boston: Allyn and Bacon.

FLETSH, R.J. & BOLEN, K.B. 1989. Toward the cutting edge with strategic planning and featuring techniques. London: Longman.

FISHER, E. 1984. Psychology for nurses and the health team. Applied social sciences for degree integrated and post basic diplomas. Fifth Edition. Cape Town: Juta.

GAGNE, R.M. 1974. Essentials of learning for instruction. Hinsdale: Dryden Press.

GAGNE, R.M. 1985. The conditions of learning and theory of instruction. Japan: Holt, Rinehart and Winston.

GALLOWAY, D. 1970. Pupil welfare and counselling. An approach to personal and social education across the curriculum. London: Longman.

GARNER, R. 1987. Metacognition and reading comprehension. Norwood, N.J.: Ablex.

GEORGE, R.L. & CHRISTIAN, T.S. 1986. Counselling theory and practice. Second Edition, Eglewood Cliffs, N.J.: Prentice-Hall.

GIBSON, R.L. & MITCHELL, M.H. 1990. Introduction to guidance and counselling. Third Edition. New York: Macmillan.

GINOTT, H.G. 1969. Between parent and teenager. New York: Macmillan.

GROSS, R.D. 1987. Psychology: Science of mind and behaviour. London: Hodder and Stoughton.

HANSEN, J.C., STEVIE, R.R. & WARNER, W.R. 1986. Counselling: Theory and process. Fourth Edition. Boston: Allyn and Bacon.

HARKER, J. 1991. Beyond apartheid. Human Resources for a new South Africa. Report of a commonwealth expert group prepared for the heads of governments meeting at Harare. Portsmouth: N.H. Heineman.

HENDERSON, V. 1979. Preserving the essence of nursing in a technological age. Part 1. Nursing Times: 2012-13, Nov. 22.

HILGARD, E.R., ATKINSON, R.C. & ATKINSON, R.L. 1979. Introduction to psychology. Eleventh Edition. Toronto: Harcourt Brace College Publishers.

HINWOOD, I.M. 1989. Integrated science applied for nurses. London: Bailliere Tindal.

HOFMEYER, I.M. 1989. Applied science for nurses. Stellenbosch/Grahamstown University Publishers and Booksellers.

INGLES, T. 1976. The physicians view the evolving nursing profession 1973 - 1913. Nursing Forum, 15(2):141-2.

JACOBS, J.E. & PARIS, S.G. 1987. Children's metacognition about reading: Issues in definition, measurement and instruction. Educational Psychology, 23 (3 & 4):255-78.

JAROS, S.G. & BREUR, H. 1990. Physics and Chemistry for nurses. London: Bailliere Tindal.

KALAT, J.W. 1993. Introduction to psychology: Third Edition. S.I.: Cole.

KELLY, L.Y. 1981. Dilemmas of professional nursing. Fourth Edition. New York: Macmillan.

KLAUER, K.J. 1988. Teaching for learning-to-learn: A critical appraisal with some proposals. Instructional Science, 17:351-367.

KUBISZYN, T. & BORICH, G. 1984. Educational testing and measurement. Classroom application and practice. Glenview: Scott, Foreman and Co.

LEGOTLO, M.W. 1996. Somé elements of research. A student handbook. Mmabatho: University of North West. (Thesis - Ph.D.)

LINDHARD, N., DHLAMINI, N., BARNARD, W. 1987. Guidance to the classroom. Pinelands: Maskew Miller.

LONGMAN, D.G., ATKINSON, R.H. 1988. College learning and study skills. New York: West Publishing Company.

MARIEB, E.N. 1989. Human anatomy and physiology. New York: The Benjamin Cummings Publishing Co.

MARJORIBANKS, K. 1991. The foundations of students' learning: Cognitive style and learning. Oxford: Pergamon Press.

MARKLE, S. 1987. Teaching conceptual networks. Journal of Instructional Development; 1(1):13-17.

MATHEBULA, M.J. 1992. The influence of self-efficiency, attributions and learning strategies on academic achievement of Standard 7 Vatsonga students. Potchefstroom: PU vir CHO. (Dissertation - M.Ed.)

MAYER, R.E. 1988. Learning strategies: Issues in assessment, instruction and evaluation. New York: Academica.

MAYER, R.E. 1989. Preparing objectives for programmed instruction. San Francisco: Fearon Publishers.

MELISH, J.M. & BRINK, A. 1990. Teaching practice of nursing. Durban: Butterworths.

MEYERS, I.M. AND PARRS, S.G. 1978. Children's metacognitive knowledge about reading. Journal of educational psychology, 70(5):680-690.

MORSE, J.M. 1991. Qualitative nursing research: A contemporary dialogue. Revised edition. New Delhi: Sage Publications.

NASH, E., STOCK, B. & HARPER, G. 1990. Human behaviour. Cape Town: Juta.

NAUDE, G.W. & BODIBE, R.C. 1986. Manual for guidance teachers. Pretoria: UNISA. (Dissertation - M.Ed.)

NEWMAN, S.E., COOPER, M.H., BARKER, K.O., SIDDEN, J.A., GONDER-FREDERICK, L.A., MODREFIELD, K.M. & NELSON, P.A. 1982. Some tests of the encoding specificity and semantic integration hypothesis. American Journal of Psychology, 95(3):103-128.

NICKERSON, R.S. & ADAMS, M.J. 1979. Long term memory for a common object: Cognitive psychology, 11(1):287-307.

NOTTER, L.E. 1983. Essentials of nursing research. Third Edition. New York: Springer Publishing Company.

NURSE, G. 1980. Counselling and the nurse. Second Edition. England: HM and M Publishers.

PARIS, S.G. & OKA, E.R. 1986. Children's reading strategies, metacognition and motivation. Developmental review, 8(3):25-58.

PARIS, S.G. & WINOGRAD, P. 1989. How metacognition can promote academic learning and instruction. (In Jones, B.F. & Idol, L, eds. Dimensions of thinking and cognitive instruction. Hillsdale, N.J.: Lawrence Erlbaum. p. 22-51).

PARIS, S.G. & NEWMANN, R.S. 1990. Developmental aspects of self-regulated learning. Educational psychology, 251:97-102.

PARIS, S.G. & WINGRAD, P. 1990. Promoting metacognition and motivation of exceptional children. Remedial and special education, 1(1):6-15.

PARIS, S.G., LIPSON, M.Y. & WILSON, K.K. 1993. Becoming a strategic reader. Contemporary educational psychology, 2(8):293-316.

PASK, G. 1976. Styles and strategies of learning. British Journal of educational psychology, 46:128-48.

PATTERSON, L.E. & EISENBURG, S. 1983. The counselling process. Third edition. Dallas: Houghton Mifflin.

PATTON, M.Q. 1990. Qualitative evaluation and research methods. Newbury Park, California: Sage Publications.

PETA, A. & MOYA, J. 1987. The curriculum in nursing and education. Pinelands: Longman: Chapman and Hall.

PINTRICH, P.R. 1987. Motivated learning strategies in the college classroom. Inscriptal: 2-38.

PINTRICH, P.R. 1989. Dynamic interplay of student motivation and cognition in the college classroom: Advances in motivation and achievement. Motivation enhancing environment, 6:117-160.

PINTRICH, P.R. & De GROOT, E.V. 1991. Motivation and self-regulated learning components of the classroom. Longman: Chapman and Hall.

POLIT, D.F. & HUNGLER, B.P. 1991. Nursing research: Principles and methods. Fourth Edition. Philadelphia: J.B. Lippincott.

PRESSLEY, M. & GHATALA, E.D. 1990. Self-regulating: Monitoring learning from text. Educational Psychology, 25(1):119-143.

QUINN, F.M. 1988. The principles and practice of nurse education. Second Edition. London: Groom - Helm.

ROBINOWTZ, M. 1988. On teaching cognitive strategies: The influences of accessibility of coceptual knowledge. Contemporary educational psychology, 13:229-235.

RAMSDEN, P. 1988. Improving learning: New perspectives. Page: Kogan.

RAYBOULD, E. 1975. A guide for teacher for nurses: Programmed learning strategies. Oxford: Blackwell Scientific Publications.

ROBERTS, M.B.V. 1976. Biology: A functional approach. Second edition. London: The English Language Book Society and Nelson.

ROGERS, R.C. 1962. The interpersonal relationships: The core of guidance. Harvard Educational review, 32:428.

ROGERS, S. 1976. Testing the R.N. student's skills. Nursing Outlook, 24:446-449.

ROGERS, R.C. 1980. The way of being. Boston: Houghton Mifflin.

ROSS, J.S. & WILSON, K.J.W. 1981. Foundations of anatomy and physiology. Fifth Edition. Edinburgh: Churchill Livingstone.

ROWETT, H.G.O. 1992. Basic anatomy and physiology. Third edition. London: Burtler and Tanner.

SACK, M.G. 1989. An evaluation of a group of students of the highly professional biological sciences with regard to their passivity in academic achievement. New York: Plenum Press.

SCHMECK, R.R. 1988. Learning strategies and learning styles. New York: Plenum Press.

SCHMECK, R.A. & WEINSTEIN, C.E. 1985. *Learning strategies and learning styles*. New York: Plenum.

SCHUNK, D.H. 1990. Goal-setting and self-efficacy during self-regulated learning. *Educational Psychologist*, 25(1):71-86.

SCHUNK, D.H. 1991. *Learning theories: An educational perspective*. New York: Macmillan.

SCHUNK, D.H. 1991. Goal setting and self-evaluation. A social cognitive perspective and self regulation. (In Maerh, M.L. & Pintrich, P.R. eds. *Advances in motivation and achievement*. Greenwich, C.T.: JAI Press. p. 85-113).

SCOTT, M. 1991. Goals, attributions and self-efficacy as related to course choice and academic achievement of first year university students. Potchefstroom: PU vir CHO. (Thesis - D.Ed.)

SEARLE, C. 1987. *Professional practice: A South African perspective*. Durban: Butterworth.

SEDIBE, E.M. 1991. *Educational guidance and counselling in Bophuthatswana high schools*. Pretoria: Vista University. (Dissertation - M.Ed.)

SEYMER, L.R. 1956. *A general history of nursing*. Fourth edition. London: Faber and Faber.

SHAWINSKY, C. 1988. *Family dynamics and academic achievement*. Potchefstroom: Potchefstroom University. (Dissertation - Magister Artium - MA.)

SHERTZER, B., STONE, B. & STONE, S.C. 1996. *Foundation of counselling*. Boston: Mifflin Compony.

SHERTZER, B. & STONE, S.C. 1981. *Foundation of guidance*. Fourth edition. Boston: Houghton Mifflin Company.

SINHA, D. 1970. *Academic achievement and non-achievers: An analysis of some factors associated with success and failures in university education*. India: United Publishers.

SMITH, R.M. 1984. *Learning how to learn: Applied theory for adults*. Milton Keynes: Aspen University Press.

SOLOMON, E.P. & DAVIS, P.W. 1983. *Human anatomy and physiology*. Philadelphia: Saunders College Publishing Company.

SOOBIAH, C. 1988. The quality of oracy in the learning environments as a determinant of quality of thinking. *In* Kapp, C.A. *ed.* *The development of learning and thinking skills in students*. Stellenbosch: University of Stellenbosch.

THE HOLY BIBLE. 1985. *New International Version*. Cape Town: Bible Society of South Africa.

THE OXFORD THESAURUS 1993. *An A-Z Dictionary of Synonyms*. Oxford: Clarendon Press.

TULVING, E. & THOMPSON, D.M. 1973. Encoding specificity and retrieval process in episodic memory. *Psychological review*, 80(1):352-367.

VESTER, T.L. 1986. *Educational themes in time perspective*. Part 2. Durban: Butterworths.

VAN DER WESTHUIZEN, G.J. 1989. Metakognisie en die maak van opsommings. *Suid-Afrikaanse tydskrif vir opvoedkunde*, 9(3):564-569.

WADE, S.E. & TRATHEN, W. 1989. Effects of self-selected study methods on learning. Journal of educational psychology, 81(1):40-47.

WEINSTEIN, C.E. 1987. Fostering learning autonomy through the use of learning strategies. Journal of reading, 32(7):590-595.

WEINSTEIN, W. 1992. Psychology: Themes and variations. Second edition. California: Books/Cole Publishing Company.

WEINSTEIN, C.E. & UNDERWOOD, J.D. 1985. Learning strategies. The how of learning. (In Segal, J.W., Chipman, F.F. & Glasser, R. eds. Thinking and learning skills. Hillsdale, N.J.: Erlbaum. p. 241-258).

WEINSTEIN, C.E. & MAYER, R.E. 1986. The teaching of learning strategies (In Wittrock, M.C. ed. Handbook of research on teaching. Third edition. New York: Macmillan. p. 305-325).

WEINSTEIN, C.E., GOETZ, T. & ALEXANDER, P.A. 1988. Learning and study. Study strategies. London: Academic Press.

WEINSTEIN, C.E. & MCDONALD, J.D. 1988. Why does a school psychologist need to know about learning strategies? Journal of school psychology, 24(1)220-305.

WEINSTEIN, C.E., MEYER, D.H. & VAN MATER STONE, G. 1993. Student learning strategies and the implications for college teaching.

WENDEN, A.L. 1989. Review of metacognition: An expanded view on the cognitive abilities of L2 learners. Applied linguistics, 7(2):573-597.

WORTMANN, C.B., LOFTUS, E.F. & MARSHALL, M.E. 1992. Psychology. Fourth edition. New York: McGraw-Hill.

ZIMMERMAN, B.J. 1988. A social cognitive view of self-regulated academic learning. (A paper presented as part of a symposium entitled "Self-regulated learning 1: Theories and models of self-regulation" presented at the annual meeting of the American Educational Research Association. New Orleans, L.A.: April 1988).

ZIMMERMAN, B.J. 1989. A social cognitive view of self-regulated academic learning. Journal of educational psychology, 81(3):329-339.

ZIMMERMAN, B.J. 1990. Self-regulated learning and academic achievement: An overview. Educational Psychology, 25(1):3-17.

ZIMMERMAN, B.J., BANDURA, A. & MARTENEZ-PONS, M. 1992. Self motivation for academic attainment. The role of self-efficacy, beliefs and personal goal setting. American educational research journal, 29(3):663-676.

**APPENDIX 1**

**COPY OF LETTER REQUESTING PERMISSION TO  
CONDUCT A RESEARCH ON STUDENTS**

**• Mmabatho College of Nursing  
Private Bag X2178  
MMABATHO  
2735**

**The Secretary,  
College Management Committee,  
Mmabatho College of Nursing,  
Private Bag X2178,  
MMABATHO  
2735**

Sir/Madam,

**RE: REQUESTING PERMISSION TO CONDUCT RESEARCH ON  
STUDENTS.**

I am requesting permission to conduct research on First Year Comprehensive Nursing and Midwifery students. The study intends looking at the possible influences of independent learning as a learning strategy on student academic achievement. This is in pursuit of my Master's Degree (M.Ed: Guidance and Counselling) at Porchefstroom University (PU vir CHO).

My interest got prompted by the general trend in poor academic achievement of nursing students.

Thanking you in anticipation.

Yours sincerely



---

**MAMBANDA ELIZABETH GONDONGWE (NURSE EDUCATOR)**

**APPENDIX 2**

**PERMISSION TO CONDUCT A RESEARCH ON  
STUDENTS**

**MMABATHO COLLEGE OF NURSING**

**PRIVATE BAG X2178  
MMABATHO  
2735  
0140841123/48/57/69  
Fax: 0140841257**

**23 September 1996  
Mambanda Elizabeth Gondogwe  
BOPCON  
Mmabatho  
2735**

**RE: PERMISSION TO CONDUCT RESEARCH.**

Madam,

1. Your undated letter refers:
2. The college management has accepted your request to conduct research on first year Comprehensive Nursing and would like you to give a written report at the end of your research.
3. Good luck.



**PULE M M E  
VICE PRINCIPAL  
for: BOPCON PRINCIPAL  
/vr**

## **APPENDIX 3 SFN 100 TEST**

### **MMABATHO COLLEGE OF NURSING**

**TEST** : SFN 100

**MARKS** : 15

**DURATION** : 30 minutes

#### **INSTRUCTIONS:**

Various possibilities are given as answers to the questions /ways of completing the statements which follow. Indicate the correct answer by making a cross (x) over the relevant letter box on the answer sheet.

1. The bulk of CO<sub>2</sub> is transported in arterial blood as:-
  - A. Dissolved CO<sub>2</sub>
  - B. Carbonic Acid
  - C. Carbaminohemoglobin
  - D. Bicarbonate
  - E. Carboxyhemoglobin
  
2. The oxygen required by the respiratory muscles would be increased by all of the following EXCEPT....
  - A. A decrease in lung compliance
  - B. A decrease in airway resistance
  - C. An increase in the rate of respiration
  - D. A decrease in the rate of respiration
  - E. A decrease in the production of pulmonary surfactant
  - F. An increase in tidal volume
  
3. The concentration of CO<sub>2</sub> is the lowest in ....
  - A. The anatomical dead space at an inspiration.

- B. The anatomical dead space at end expiration.
  - C. The alveoli at end inspiration.
  - D. The blood in the pulmonary veins.
4. Complete transection of the brain-stem above the pons would
- A. Result in cessation of all breathing movements
  - B. Prevent any voluntary holding of breath
  - C. Prevent the central chemoreceptors from exerting any control over ventilation
  - D. Prevent the peripheral chemoreceptors from exerting any control over ventilation
  - E. Abolish the Hering-Breuer reflex
5. A deficiency of pulmonary surfactant would .....
- A. Decrease surface tension in the alveoli.
  - B. Decrease the change in intrapleural pressure required to achieve a given tidal volume
  - C. Decrease the lung compliance
  - D. Decrease the work of breathing
  - E. Increase functional residual capacity (FRC)
6. Measurement of the Lecithin-sphingomyelin (L-S) ration in amniotic fluid assesses
- A. The placenta's ability to oxygenate the fetus
  - B. Fetal adrenal function
  - C. Fetal kidney development
  - D. Fetal brain development
  - E. Fetal lung maturity
7. When the respiratory muscles are relaxed, the lungs are at ....
- A. Residual Volume (RV)
  - B. Expiratory Reserve Volume (ERV)
  - C. Functional Residual Capacity (FRC)
  - D. Inspiratory Reserve Volume (IRV)

- E. Total Lung Capacity (TLC)
8. During a forced expiration, actively contracting muscles include the
- A. Sternocleidomastoid
  - B. Diaphragm
  - C. Abdominal muscles
  - D. External intercostal
  - E. Scalene
9. All the following are characteristics of the lung (EXCEPT ....
- A. The interstitial colloid oncotic pressure is about 15mm Hg.
  - B. Filtration is continuous along the length of the alveoli capillary
  - C. The hydrostatic pressure in the pulmonary capillaries is the same as in the systematic capillaries
  - D. Filtered  $H_2O$  is removed by the lymphatics
  - E. The intestinal hydrostatic pressure is sub-atmospheric
10. The percentage of haemoglobin saturated with oxygen will increase if ...
- A. The arterial  $PCO_2$  is increased
  - B. The haemoglobin concentration is increased
  - C. The temperature is increased
  - D. The arterial  $PO_2$  is increased
  - E. The arterial pH is decreased
11. Which of the following will increase as a result of stimulating parasympathetic nerves to the bronchial smooth muscles?
- A. Lung compliance
  - B. Airway diameter
  - C. Elastic work of breathing
  - D. Resistive work of breathing
  - E. Anatomic dead space

12. Hyperventilation may be produced by stimulation of all
- A. Peripheral chemoreceptors
  - B. Irritant receptors
  - C. Peripheral pain receptors
  - D. Pulmonary stretch receptors
  - E. J(juxta capillary) receptors
13. During a normal inspiration, more air goes to the alveoli at the base of the lung than to the alveoli at the apex of the lung because ...
- A. The alveoli at the base of the lung have more surfactant
  - B. The alveoli at the base of the lung are more compliant
  - C. The alveoli at the base of the lung have higher V/Q ratios
  - D. There is more negative intra-pleural pressure at the base of the lung
  - E. There is more blood flow to the base of the lung
14. The following are respiratory system organs EXCEPT ...
- A. Lungs, pharynx, nose
  - B. Diaphragm, alveoli, trachea
  - C. Bronchial tree, airsacs, left lung
  - D. Squamous epithelium, ciliated columnar epithelium, nasal cavity
  - E. Heart, oral cavity, abdominal muscles and brain
15. In an acclimatised person at high attitudes, oxygen delivered to the tissues may be adequate at rest because of ...
- A. An increase in haemoglobin concentration
  - B. The presence of an acitosis
  - C. A decrease in the number of tissue capillaries
  - D. The presence of a normal arterial pressure of oxygen
  - E. One of the above

**GOOD LUCK!!!**

# MARK SHEET

GROUP: .....

	A	B	C	D	E
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					

**APPENDIX 4 SFN 100 TEST MEMORANDUM**

**ANSWER SHEET (MEMORANDUM)**

	A	B	C	D	E
1.				X	
2.		X			
3.	X				
4.		X			
5.			X		
6.					X
7.			X		
8.			X		
9.			X		
10.				X	
11.				X	
12.				X	
13.		X			
14.				X	
15.	X				

**TEST ITEM ANALYSIS AND RATIONALE THEREOF FOLLOWS:**

### ITEM 1

The bulk  $\text{CO}_2$  is transported in arterial blood as ..... The answer is D, which is bicarbonate.

Carbon dioxide is transported in arterial blood in three forms: As physically dissolved  $\text{CO}_2$  (about 5%) in combination with the amino groups of haemoglobin as carbaminohemoglobin (about 5%) and as bicarbonate in  $\text{HCO}_3^-$  (about 90%).

The amount of  $\text{CO}_2$  actually carried as  $\text{H}_2\text{CO}_3$  is negligible. Carboxyhemoglobin refers to the combination of carbon monoxide (CO) and hemoglobin (Hb). There was a correct response from all forty students (both groups).

### ITEM 2

The oxygen required by the respiratory muscles would be increased by all of the following EXCEPT ... The answer is B, which is a decrease in airway resistance. Respiratory muscles consume oxygen in proportion to the work of breathing, which can be divided into resistance work and compliance, or elastic work. Resistance work includes work to overcome tissue as well as airway resistance. A decrease in the amount of pulmonary surfactant would decrease lung compliance and increase the elastic work of breathing. An increase in respiratory rate would increase both types of the work of breathing. 75% had correct response whereas the remaining 25% had varying incorrect responses. Of these 75%, 40% were from the control group whereas 35% were from the experimental group.

### **ITEM 3**

The concentration of CO<sub>2</sub> is the lowest in ...? The answer is A, which is, the anatomic dead space at end inspiration. The anatomic dead space, which includes the trachea, bronchi, and bronchioles, is filled with fresh room air at the end of an inspiration and with expired, or alveolar, gas at the end of an expiration. Room air contains very little CO<sub>2</sub> (0,03%) as a result of gas exchange in the lungs. The PCO<sub>2</sub> of alveolar air does fluctuate to some extent with each breath because it is diluted with fresh air during inspiration. The PCO<sub>2</sub> of blood in the pulmonary veins is in equilibrium with that in the alveoli. 90% from the experimental group responded correctly. The remaining students had varying wrong answers.

### **ITEM 4**

Complete transection of the brainstem above the pons would ...

The answer is B, which is, prevent the central chemoreceptors from exerting any control over ventilation. Transection of the brainstem above the Pons would prevent any voluntary changes in ventilation by cutting the pathways from the higher centres. Breathing would continue because the pontine-medullary centres that control rhythmic ventilation would be intact. Inputs to the brainstem from the central and peripheral chemoreceptors that stimulate ventilation and from lung stretch receptors that inhibit inspiration (Hering-Breuer reflex) would also be intact and these reflexes would be maintained. Both groups had a 100% failure on this item.

### **ITEM 5**

A deficiency of pulmonary surfactant would .... The answer is C, which is, decrease lung compliance. Because of the inherent elasticity of the lung, the alveoli tend to collapse during expiration. This tendency is explained by Laplace's law, which relates the radius (R) and surface tension (T) of an elastic bubble to the pressure (P) required to distend it, as follows:  $P=2T/R$ . If T were constant, the pressure required to distend alveoli would increase markedly during expiration as the radius decreased. This does not occur in normal lungs because the unique properties of surfactant result in reduced surface tension as the alveolar lining is compressed with the decrease in the alveolar radius during expiration. Thus, surfactant prevents alveolar collapse at end-expiratory intra-alveolar pressures that otherwise would lead to atelectasis. A deficiency of surfactant would therefore induce a greater change in intrapleural pressure and greater work to maintain ventilation would be required. 50% of the control group responded correctly whereas 48% of the experimental group responded correctly too. The rest had varying wrong answers.

### **ITEM 6**

Measurement of the lecithin-sphingomyelin (L-S) ratio in amniotic fluid assesses? The answer is E, which is fetal lung maturity, lecithin increases as the fetus matures and the lungs are prepared for expansion. Surfactant, a lipoprotein mixture, prevents alveolar collapse by permitting the surface tension of the alveolar lining to vary during inspiration and expiration. Thus, measurement of the lecithin-sphingomyelin (L-S) ratio in amniotic fluid provides an index of fetal lung maturity. Twenty-one percent (21%) of the experimental group and 20% of the control group responded correctly. The rest chose not to respond.

### **ITEM 7**

When the respiratory muscles are relaxed, the lungs are at -? The answer is C, which is, functional residual capacity (FRC). The lungs tend to recoil inward, whereas the chest tends to recoil outward. When the respiratory muscles are all relaxed, these two opposing forces are balanced. The volume of gas in the lungs at this point is the relaxation volume, or functional residual capacity (FRC). 50% of the experimental group and 54% of the control group responded correctly. The rest had varying wrong answers. Only 2% of the control did not respond.

### **ITEM 8**

During a forced expiration, actively contracting muscles include the -? The answer is C, which is, abdominal muscles. Expiration is normally a passive process that does not require the involvement of any muscles. In a forced expiration the internal intercostal muscles contract, pulling the rib cage downward. The abdominal pressure pulls the rib cage downward and inward. The scalene and sternocleidomastoid muscles, which assist in expanding the chest wall during inspiration, are important accessory muscles of respiration. All students got this item correct from both groups, that is, 100% correct response.

### **ITEM 9**

All the following are characteristics of the lung EXCEPT -? The answer is C, which is, the hydrostatic pressure in the pulmonary capillaries is the same as in the systemic

capillaries. The pulmonary circulation is a low pressure system. Thus the hydrostatic pressure in the pulmonary capillaries is about 10 mmHg and is less than in the systemic capillaries. It is greater at the base of the lung than at the apex because of increased hydrostatic pressure at the base. The colloid osmotic pressure in the pulmonary capillaries is about 25 mmHg and that in the interstitial space is estimated to be about 15 mmHg. The interstitial space hydrostatic pressure is estimated to be slightly negative. Thus the balance of these forces favours continuous filtration out of the capillaries into the interstitial space. This continuous flow of fluid is removed by the very efficient lymphatic system in the lungs. 30% of the control group responded correctly and 256% of the experimental group responded correctly. The rest had varying responses that were incorrect.

#### **ITEM 10**

The percentage of hemoglobin saturated with oxygen will increase if -? The percentage of hemoglobin saturated with oxygen depends on the level of  $PO_2$  in the blood and on other factors that affect the position of the oxyhemoglobin dissociation curve. Factors that shift the curve to the left, such as a decrease in  $PCO_2$ , and an increase in pH, or a decrease in temperature, would increase the percentage of hemoglobin saturated with oxygen, as would an increase in  $PO_2$ , provided that the percentage of saturation was not already at 100%. At a given  $PO_2$ , increasing the concentration of hemoglobin would not affect the percentage of saturation but would increase the oxygen content of blood. Seventy-six percent (76%) of the control group responded as expected whereas 79% of the experimental group got the items correct. Twenty-four percent (24%) of the control group did not respond at all. Twenty-one percent (21%) of the experimental group got the item wrong.

## APPENDIX 5 NON-PARAMETRIC TESTS

### Non-Parametric test

- Wilcoxon Matched-Pairs Signed Ranks/Sign Test
- Critical Value :-  $z_c = 1.64$  at 5%  
Wilcoxon 60  
Sign Test 5
- Observed Statistic :-  $z = 2.968$   
Wilcoxon 25.5  
Sign test 3
- Conclusion : significant
- Wilcoxon/Mann Whitney U
- Mean Ranks  
20.13  
20.88
- Critical Value :-  $W_c = 337$  reject if  $W > 337$   
 $U_c = 127$  reject if  $U < 127$   
 $Z_c = 1.96$  reject if  $z > 1.96$

- Observed Statistic :-  $W = 402.5$   
 $U = 192.5$  (p-value 0,8410)

- Conclusion : Do not reject and accept that the two samples are from the same population.

- Wilcoxon/Mann Whitney

- Mean Ranks

EGPO 28.58

CGPO 12.43

- Critical Value :-  $W_c = 348$  reject if  $W > 348$   
 $U_c = 138$  reject if  $U < 138$

$$Z_c = 1.64$$

- Observed Statistic :-  $W = 571.5$  reject  
 $U = 38.5$  reject  
 $z_a = 4.384$

- Conclusion : significant

- Wilcoxon/Mann Whitney

- Mean ranks

EGD 29.27

CGD 11.73

- Critical Value :- 337  
1.64

- Observed Statistic :-  $W = 585.5$   
 $Z = 4.767$

- Conclusion : Significant

#### Wilcoxon Matched Pairs Signed-Ranks

- Critical Value :-  $z_c = 1.64$   
Wilcoxon 60  
Sign Test 5

- Observed Statistic :-  $z = 3.92$   
Wilcoxon 0  
Sign Test 0

- Conclusion : significant

Note

All the non-parametric tests agree with their corresponding parametric tests.

Mann-Whitney U - Wilcoxon Rank Sum W Test

POSCORE by GROUP

Mean Rank	Cases
28.58	20 GROUP = 2.00
12.43	20 GROUP = 1.00
	40 Total

		Exact	Corrected for ties	
U	W	2-Tailed PZ	2-Tailed P	
38.5	571.5	.0000	-4.3836	.0000

Mann-Whitney U - Wilcoxon Rank Sum W Test

PRSCORE by GROUP

Mean Rank	Cases
20.13	20 GROUP = 2.00
20.88	20 GROUP = 1.00
	40 Total

U	W	Exact 2-Tailed P	Corrected for ties Z	2-Tailed P
192.5	402.5	.8410	-.2040	.8384

Mann-Whitney U - Wilcoxon Rank Sum w Test

SCDIFF by GROUP

Mean Rank	Cases
29.27	20 GROUP = 2.00
11.73	20 GROUP = 1.00
	40 Total

U	W	2-Tailed P	Z	Exact 2-Tailed P	Correcting for ties
24.5	585.5	.0000	-4.7670	.0000	

Wilcoxon Matched-Pairs Signed-Ranks Test

CGPO with CGPR

Mean Rank	Cases
10.85	17 - Ranks (CGPR LT CGPO)
8.50	3 + Ranks (CGPR GT CGPO)
	0 Ties (CGPR EQ CGPO)
	20 Total

Z = -2.9679      2-Tailed P = .0030

Wilcoxon Matched-Pairs Signed-Ranks Test

EGPO with EGPR

Mean Rank	Cases
10.50	20 - Ranks (EGPR LT EGPO)
.00	0 + Ranks (EGPR GT EGPO)
	0 Ties (EGPR EQ EGPO)
	20 Total

Z = -3.9199      2-Tailed P = .001

Sign Test

CGPO with CGPR

Cases

17 - Diffs (CGPR LT CGPO)

3 + Diffs (CGPR GT CGPO)

0 Ties

20 Total

(Binomial)

2-Tailed P= .0026

Sign Test

EGPO with EGPR

Cases

20 - Diffs (EGPR LT EGPO)

0 + Diffs (EGPR GT EGPO)

0 Ties

20 Total

(Binomial)

2-Tailed P = .0000

**t-tests for Independent Samples of GROUP**

Variable	Number of Cases	Mean	SD	SE of Mean
PRSCORE				
GROUP 1	20	58.7000	6.367	1.424
GROUP 2	20	57.6500	4.209	.941

Mean Difference = 1.0500

Levene's Test for Equality of Variances: F=3.541 P= 0.68

t-test for Equality of Means

95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	.62	38	.542	.542	1.707(-2.405, 4.505)
Unequal	.62	32.94	.543	.543	1.707(-2.422, 4.522)

Variable	Number of Cases	Mean	SD	SE of Mean
POSCORE				
GROUP 1	20	60.3500	5.274	1.179
GROUP 2	20	70.9000	6.206	1.388

Mean Difference = -10.5500

Levene's Test for Equality of Variances: F=1.253 p= .270

**t-test for equality of Means**

95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	-5.79	38	.000	1.821	(-14.237,-6.863)
Unequal	-5.79	37.04	.000	1.821	(-14.240,-6.860)

### t-test for Independent Samples of GROUP

Variable	Number of Cases	Mean	SD	SE of Mean
SCDIFF				
GROUP 1	20	2.7000	3.011	.673
GROUP 2	20	12.2000	5.473	1.224

Mean difference = -9.5000

Levene's Test for Equality of Variances: F=3.660 P= .063

### t-test for Equality of Means

95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	-6.80	38	.000	1.397	(-12.328, -6.672)
Unequal	-6.80	29.53	.000	1.397	(-12.355, -6.645)

### t-test for Paired Samples

Variable	Number of pairs	Cort	Sig	2-tail	Mean	SD	SE of Mean
CGPO					60.0000	4.668	1.044
CGPR	20		.771	.000	56.9000	4.166	.932

### Paired Differences

Mean	SD	SE of Mean	t-value	df	2-tail Sig
3.100	3.024	.676	4.58	19.000	
95% CI	(1.685, 4.515)				

Variable	Number of pairs	2-tail	CorrSig	Mean	SD	SE of Mean
EGPO					70.9000	6.206 1.388
EGPR	20	.621	.003	58.7000	6.367 1.424	

### Paired Differences

Mean	SD	SE of Mean	t-value	df	2-tail Sig
12.2000	5.473	1.224	9.97	19	.0000
95% CI	(9.638, 4.762)				

**Correlation Coefficients**

	EGPO	EGPR	CGPO	CGPR
EGPO	1.0000 (20) P=.	.6212 (20) P=.003	.2577 (20) P=.273	.0167 (20) P=.944
EGPR	.6212 (20) P=.003	1.0000 (20) P=.0	.1443 (20) P=.544	.3750 (20) P=.103
CGPO	-.2577 (20) P=.273	.1443 (20) P=.544	.8214 (20) P=.0	1.0000 (20) P=.0
CGPR	.0167 (20) P=.944	.3750 (20) P=.103	.8214 (20) P=.0	1.0000 (20) P=.0

(Coefficient / (Cases) / 2-tailed Significance)

---SPEARMAN CORRELATION COEFFICIENT---

EGPR .6013  
 N( 20)  
 Sig .005

---

CGPO -.1548 .0952  
 N( 20) N( 20)  
 Sig .515 Sig .690

---

CGPR .0933 .3708 .8165  
 N( 20) N( 20) N( 20)  
 Sig .695 Sig .107 Sig .000

---

EGPO EGPR CGPO

(Coefficient / (Cases) / 2-tailed Significance)

-----KENDALL CORRELATION COEFFICIENTS----

EGPR .4765  
 N( 20)  
 Sig .005

---

CGPO -.1247 .0838  
 N( 20) N( 20)  
 Sig .467 Sig .621

---

CGPR .0686 .3213 .6744  
 N(20) N(20) N(20)  
 Sig .691 Sig .060 Sig .000

EGPO EGPR CGPO

(Coefficient / (Cases) / 2-tailed Significance)

**t-test for Independent Samples of GROUP**

Variable	Number of Cases	Mean	SD	SE of Mean
<b>SCORE</b>				
GROUP 2	20	70.9000	62.206	1.388
GROUP 1	20	60.3500	5.274	1.179

Mean Difference = 10.5500

Levene's Test for Equality of Variances: F=1.253 P=.270

**t-test for Equality of Means**

95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	5.79	38	.000	1.821	(6.863, 14.237)
Unequal	5.79	37.04	.000	1.821	(6.860, 14.240)

Variable	Number of Cases	Mean	SD	SE of Mean
<b>SCDIFF</b>				
GROUP2	20	12.2000	5.473	1.224
GROUP 1	20	2.7000	3.011	.673

Mean Difference = 9.5000

Levene's Test for Equality of Variances:

F=3.660 P=.063

**t-test for Equality of Means**

95%

Variances	t-value	df	2-Tail Sig	SE of Diff	CI for Diff
Equal	6.80	38	.000	1.397	(6.672, 12.328)
Unequal	6.80	29.53	.000	1.397	(6.645, 12.355)

**GENERAL FACTS:**

File = EGPR

Observations = 20

Minimum = 50

Maximum = 72

Range = 22

**DISPERSION:**

Variance = 40.53683 ( 38.51 )

St. Dev. = 6.366854 ( 6.205642 )

Coef. of Var. = 10.8 ( 10.6)

Avg. Dev. About Mean = 5.07000†

Avg. Dev. About Median = 5

**CENTRAL TENDENCY :**

Mean = 58.7

Median = 58

Geom. Mean = 58.38102

1st Quartile = 54

2nd Quartile = 58

3rd Quartile = 64

**SKEWNESS AND KURTOSIS:**

2nd Moment = 38.51

3rd Moment = 125.8859

4th Moment = 3517.459

Skewness = 0.527 (Pearson Beta 1)

Kurtosis = 2.372 (Pearson Beta 2)

No Outliers Detected

Note : Standard deviation using N instead of N-1 shown in parentheses.

**t-test for Paired Samples**

Variable	Number of pairs	Corr	2-Tail Sig	Mean	SD	SE of Mean
CGPO				60.3500	5.274	1.179
	20	.821	.000			
CGPR				57.6500	4.209	.941

**Paired Differences**

Mean	SD	SE of Mean	T-value	df	2-tail Sig	95% CI
2.700	3.011	.673	4.01	19	.001	(1.291, 4.109)

Variable	Number of pairs	Corr	Sig	2-tail Mean	SD	SE of Mean
EGPO				70.9000	6.206	1.388
	20	.621	.0003			
EGPR				58.7000	6.367	1.424

---

**CONCLUDING NOTE**

**EVERY GOAL IS ACHIEVABLE IF ONLY WE CLIMB WITH**

**CARE AND CONFIDENCE;**

**BUT NOTE THAT**

**FAILURE TO PLAN IS ACTUALLY PLANNING TO FAIL.**

**THANK YOU LORD.**

---