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LEARNING STRATEGIES AND ACADEMIC SUCCESS OF UNDERGRADUATE ARTS STUDENTS

David Culverwell

Thesis submitted to the Faculty of Arts, University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the degree of Master of Arts.

Johannesburg, 1989

I hereby declare that this thesis is my own work and that it has not been submitted for a degree at any other university.

D. Culverwell

Financial assistance granted by the Human Sciences Research Council for this research is gratefully acknowledged. Views expressed or conclusions drawn in this thesis are those of the author and do not necessarily reflect those of the Human Sciences Research Council.

ACKNOWLEDGEMENTS

I would like to express my gratitude to the following people:

- Dr N. Cloete, my supervisor, for all his support, encouragement and sound advice.

- Rai Turton, my friend and colleague, for his sound statistical advice and assistance.

- Jonathan Cook, for his unwavering support and indulgence - thanks.

- Claire Pickard-Cambridge, for her momentous effort in proof reading and editing.

- The Human Sciences Research council for its financial assistance.

CONTENTS

PAGE

Declaration i
Acknowledgements iii
Contents iv
List of Tables ix
List of Appendices xi
CHAPTER 1 - INTRODUCTION 1
1.1 The Context of Academic Prediction 2
1.2 Intelligence and Individual Differences 3
1.2.1 The Genetic Position 4
1.2.2 Heritability of Intelligence 9
1.2.3 Race and Intelligence 11
1.2.4 The Environmentalists' Position 13
1.3 Towards Culture-Fair Intelligence Testing 17
1.3.1 Culture-Fair Testing 19
1.4 Intelligence and academic prediction 22
1.5 Summary and Conclusions 26

CHAPTER 2 - RESEARCH TRENDS IN ACADEMIC SELECTION AND PREDICTION 29
2.1 Introduction 29
2.2 Methodological Considerations 30
2.3 School Performance and Academic Prediction 31
2.3.1 School performance and Academic Prediction in The South African Context 33

2.4 Non-Cognitive Factors In Academic Prediction 36
2.5 Alternative Approaches to Intelligence and Academic Prediction 39
2.6 Summary and Conclusions 44
CHAPTER 3 - TOWARDS AN INFORMATION PROCESSING PARADIGM 46
3.1 Introduction 46
3.2 Approaches to Student Learning 47
3.3 Information Processing and Phenomenology 51
3.4 Information Processing and Learning Strategies 54
3.4.1 Learning Style vs Learning Strategy 55
3.4.2 Learning Strategies 57
3.5 The Context of Learning 63
3.5.1 Learning and Awareness of the Learner 66
3.6 Learning Strategies and Academic Performance 68
3.7 Aims of the Present Study 70
3.8 Statement of Hypothesis 74
CHAPTER 4 - METHODOLOGY 75
4.1 Introduction 75
4.2 Operationalising Learning Strategies for Academic Prediction 78
4.3 Design 83
4.4 Sample 84
4.4.1 Description of the Sample 85
4.5 The Variables 87
4.5.1 Predictor Variables 87
4.5.2 School Results 87
4.5.3 Deductive Reasoning Test 88
4.5.4 Learning Strategies 90

4.5.5 Criterion Variables 91
4.5.6 Number of Credits Achieved 91
4.5.7 Average Mark Achieved 92
4.6 Procedures 94
4.7 Testing Conditions 96
4.8 Statistics 96
CHAPTER 5 - RESULTS 99
5.1 Introduction 99
5.2 Restatement of Hypothesis 99
5.3 Mid-Year Results 100
5.4 Summary of Mid-Year Findings 106
5.5 Final First-Year Results 108
5.6 School Performance and Academic Success at the End of First Year 112
5.7 Summary of First-Year Findings 113
5.8 Intellectual Functioning and Academic Success 115
5.9 Learning Strategies and Academic Progress 115
CHAPTER 6 - DISCUSSION AND CONCLUSIONS 119
6.1 Introduction 119
6.2 Discussion of Results 119
6.3 Implications of Learning Strategies for Academic Prediction 122
6.4 Implications for Traditional Intelligence Testing and Academic Prediction 125
6.5 Implications for Current Research Trends in Academic Prediction 128
6.6 Implications for Disadvantaged Students 129

6.7 Implications of the Learning Processing Paradigm for University Teaching Methods and Compensatory Academic Support Programmes 131

6.8 Limitations of Present Study and Future Research 135

6.9 Conclusions 140

REFERENCES 141

APPENDICES 152

LIST OF TABLES

TABLE 1 Student learning strategies 60
TABLE 2 Relationship between approaches to learning and studying, and examination performance 69
TABLE 3 Level of approach and degree result 69
TABLE 4 Relationship between strategy and academic performance ... 69
TABLE 5 Summary of attributes and their operationalisation 80
TABLE 6 Distribution of attributes according to strategy 82
Table 7 Distribution of sample by sex 86
TABLE 8 Distribution of sample by age 86
TABLE 9 Matric rating conversion table 87
TABLE 10 Distribution of all learning strategies 90
TABLE 11 Distribution of combined learning strategies (LS)..... 90
TABLE 12 Summary of predictor variables 91
TABLE 13 Summary of criterion measures and their abbreviations 93
TABLE 14 Frequency distribution of learning strategies by credits obtained after mid-year 100
TABLE 15 Anova between learning strategy (Comb) and mid-year average (Javerage) 101
TABLE 16 Frequency distribution of LS and Jcredits1 102
TABLE 17 Frequency distribution of LS by Jcredits 103
TABLE 18 Anova between learning strategies (LS) and mid-year average (Javerage) 104
TABLE 19 Pairwise comparisons between categories of learning strategies at mid-year 105
TABLE 20 Correlations of matric rating with mid-year credits and mid-year average 105

TABLE 21 Ancova between learning strategies (LS) and mid-year average (Javerage) controlling for the effects of matric 106

TABLE 22 Relationship of learning strategies (Comb) to final-year credits and final-year average 108

TABLE 23 Frequency distribution of LS and Fcredits1 109

TABLE 24 Anova between learning strategies (LS) and mid-year average (Javerage) 110

TABLE 25 Pairwise comparisons between categories of learning strategies at the end of first year 111

TABLE 26 Correlations of matric rating with end-of-year credits and end-of-year average 112

TABLE 27 Ancova between learning strategies (LS) and mid-year average (Javerage) controlling for the effects of matric .. 113

TABLE 28 Correlations between DRT and criterion measures 115

TABLE 29 Anovas between learning strategies and academic progress 116

TABLE 30 Declining relationship between learning strategies and academic performance 117

TABLE 31 Frequency of learning strategies with 9 or more credits after 3 years of study 117

LIST OF APPENDICES

APPENDIX A Test administrators' instructions for the Deductive Reasoning Test 152

APPENDIX B Sample of items from the Deductive Reasoning Test..... 155

APPENDIX C Learning Strategies reading exercise and questions 157

ABSTRACT

The present study set out to try and identify those students who have the academic resources to succeed at university. It was proposed that the search for alternative predictors of academic success other than school matriculation results could best be facilitated by using a qualitative method of classifying student learning strategies within a learning processing paradigm.

The learning processing paradigm stands in direct opposition to traditional and culture-fair approaches to intelligence testing. The traditional approaches both explicitly and implicitly adopt a static view of intelligence, whereas the learning processing paradigm stresses the modifiability of student learning strategies and consequent performance. Current research trends in tertiary academic prediction have generally produced disappointing results and this is attributed to the fact that most of the research is predicated on the model of traditional intelligence testing. Current research has indicated that school results remain the best single predictor of academic success. The information processing paradigm stands in opposition to these approaches to prediction in that these measures are usually an indication of manifest performance (Products of Knowledge) which do not alert us to the processes involved in the acquisition of knowledge (Process).

A sample of advantaged students in the Faculty of Arts were tested at the beginning of the academic year on a test of intellectual functioning and a learning strategies text. The test of intellectual functioning was found

to be an invalid predictor of university success, and matric results were found to explain only a small percentage of the variance in academic success. The classification of student learning strategies was found to be significantly related to measures of academic success up to the end of the second year of university study.

The results thus successfully extend the learning processing paradigm into the realm of tertiary academic prediction. In addition, the results provide a strong critique of traditional intelligence testing and tertiary academic prediction.

Finally it was shown that learning strategies can contribute to an understanding of the constituents of success while simultaneously establishing predictive validity. Thus allowing selection, remediation and teaching to be on a continuum rather than existing as three separate and discrete categories.

GLOSSARY OF TERMS

The effects of a society structured by apartheid have brought about terms which are not universal. The use of certain terms in this study which might not have universal application will be defined below.

1. Black students: This relates to all students who are classified within South Africa as either African, Indian or Coloured.

2. Advantaged students: This relates to all white students in South Africa as well as those black students who have attended private school.

3. Disadvantaged students: This refers to all students who have matriculated from black schools in the country.

CHAPTER 1

INTRODUCTION

The aim of the present study is to examine the relationship between learning strategies and university performance. Traditional attempts at predicting university success from intelligence and aptitude tests have not met with much success. (Dalton, 1976; Hartman & Bell, 1978; Houston 1983; Slack & Porter, 1980). In addition, the single best predictor worldwide of academic sucess is that of school results, but problems have been experienced in the lower ranges of this measure to reliably predict tertiary academic success (Entwistle, N., Percy, K.A., & Nisbet, J. (1977). In the South African context school results have found not to be predictors of tertiary academic success for black students (Shochet, 1986). There is thus general consensus that alternative predictors need to be found to enhance the reliability of selection procedures.

The present study proposes that a new approach to selection based on the underlying strategies intrinsic to the process of learning is needed in order that selection be more rigorous and that those with the potential to succeed with intervention from university educators, are not excluded.

The focus of selection would then not merely be a method of exclusion but rather an understanding of the processes underlying successful learning. The examination of these processes would enhance deficit identification

and point to subsequent intervention through student academic support programmes.

1.1 THE CONTEXT OF ACADEMIC PREDICTION

The focus of this chapter is to critically examine historic and current approaches to prediction of tertiary academic success. Research in this area can be broadly categorized into three major areas. The first approach encompasses the area of traditional intelligence testing. The assumption underlying this approach is that there is a fundamental relationship between intelligence (as tested by tre tests) and academic performance. This approach has also been instrumental in the development of aptitude testing in the selection of students. The second approach focuses on the manifest performance level of students applying for university admission. The prime thrust of this approach has been to examine the relationship between school results and university performance. The third approach to prediction has as its main concern the examination of the cognitive processes underlying studying and learning and the relationship of these processes to academic performance. It is to this approach that the present study aligns itself.

This chapter will deal with traditional approaches to intelligence and intelligence testing as well as attempts at 'culture-free' testing. The relationship and implications of these approaches to tertiary academic prediction will also be discussed.

The high failure rate of first year university students has long been a concern of educationalists and university administrators.

This concern was highlighted by the South African Committee of University Principals in 1978.

Tertiary academic prediction studies have mostly focused on the use of traditional psychometric procedures. These studies usually attempt to predict university success with measures of 'intelligence'. Generally these studies have met with little success. (Dalton, 1976; Evans and Waites, 1981; McDonnell, 1975; Shochet, 1986; Slack & Porter, 1980). However, the need to find rigorous selection criteria has ensured the continuation of these studies as more and more people compete for places at university. In order to examine why attempts at relating intelligence to tertiary academic success have not been particularly successful, it is necessary to examine the history of the concept of intelligence. In addition, the present study proposes a new methodological paradigm which is a departure from the above in terms of examining indicators of tertiary academic success.

1.2 INTELLIGENCE AND INDIVIDUAL DIFFERENCES

Notions of intelligence have essentially been informed by two major approaches, namely the geneticists and the environmentalists. Although there are theorists today who argue against this polarisation (Anastasi, 1976; Sattler, 1974), calling rather for an interactionist position, in terms of the present study it is crucial to examine the debates set forward by these approaches as they remain the most important influences upon current ideas of intelligence: furthermore both approaches inform the interactionist's position in varying degrees .

1.2.1 THE GENETIC POSITION

Traditional notions of intelligence originated in the early 19th Century with the work of Galton, Pearson and Cattel (Sattler, 1982). The notion of a general intellective factor 'g' was most actively propounded through the work of Spearman (1863-1945), (Cited in Vernon 1979). The notion of 'g' is basically a statistical construct which explains the co-variation between test scores. Spearman proposed a genetically based two factor interactive theory of intelligence to explain the intercorrelations between group intelligence tests (Sattler, 1982).

His view was that a general factor 'g' (which was genetically inherited) and a factor specific to the test accounted for performance on intelligence tests. Thus abilities as tested by different tests (for example, memory, vocabulary,etc) were functions of a general 'g' loading and another specific factor. He argued that the various sub-tests which collectively made up IQ tests would contain differing levels of 'g'loadings. The combined effect, however, would reveal a good estimate of 'g' as the specialised factors would cancel each other out and the resultant aggregate would be a reasonable measure of 'g' comprising the IQ score (Sattler, 1982). A consequence of this correlational view of intelligence was that in its operalization intelligence then became what the test measured.

Spearman thus conceptualised the 'g' factor as representing general mental activity which occurred throughout a variety of mental tasks; the more 'difficult' of which contained higher loadings of 'g'. The essence of this approach, which has been taken up in various guises by theorist such as

(Eysenck, 1981; Jensen, 1979a; and Vernon, 1979) is as follows:

i) Intelligence or 'g' is a recognisable attribute which is responsible for differences among people;

ii) Intelligence is essentially innate and biologically determined. It remains stable throughout life and is essentially impervious to efforts at attempting to increase its presence; and

iii) Intelligence or 'g' occurs throughout a variety of different tasks and can be measured by IQ tests.

According to Vernon (1979) there have been many studies which have confirmed Spearman's position. These include those of the two most seminal and prolific theorists in the field namely Eysenck and Jensen. Eysenck (1981) argued that intelligence or 'g' could be identified and quantified by means of IQ tests, while Jensen (1979a) asserted that the 'g' factor was an index of general mental ability or intelligence. It represented the inventive as contrasted with the reproductive aspect of mental ability. (Cited in Sattler, 1982).

Jensen (1972) later advanced the idea of differential intelligence loadings in intelligence tests. He argued for the dichotomisation of what he termed level one and level two tests of intelligence. In accordance with Spearman's notion of a 'g' factor, Jensen argued that certain tasks had a higher 'g' loading than others. Tests with high 'g' loadings involved conscious and complex mental effort whereas those with low 'g' loadings were less complex involving processes such as recognition, recall

and visual-motor tasks.

Cattel (1963) proposed two types of intelligence - 'fluid' intelligence and 'crystallised' intelligence. He argued that Fluid intelligence was an intrinsic capacity independent of experience, while he saw crystallized intelligence as all acquired knowledge. Although this implied the existence of environmental influences on intelligence, he was later to argue that fluid intelligence was essentially the primary determinant of intelligence and that crystallised intelligence was basically contingent to, and determined by fluid intelligence. Cattel's theory therefore ultimately reinforced notions of 'g' as being genetically determined and impervious to environmental influences.

The concept of 'g' has continued to be a major influence on theorists in the field (Brand & Deary, 1982; Herrnstein, 1973; Vernon, 1979a; 1979b). According to Boring (1963), one of the major weaknesses of the genticists conceptions of IQ is that intelligence, by nature of its definition, becomes what the intelligence tests measure. This process of defining a concept by an operational definition has met with considerable criticism from many theorists (Block & Dworkin, 1977; Evans & Waites, 1981; Kamin, 1974). Block and Dworkin (1976) argue that operational definitions of intelligence are not based on solid theoretical principles and that "you cannot measure intelligence by finding items which correlate with it, unless you already have a way of measuring it". (p 147).

Critics of genetic conceptions of 'g' contend, that far from being an inviolate objective essence, intelligence is dependent on the specific IQ test which is used. As evidence of the elusiveness and lack of

agreement on the essential nature and constituents underlying the concept of 'g'; Evans and Waites (1981) went on to argue that

> "IQs as assessed by different IQ tests, are far from perfectly correlated, even when allowance is made for the imperfect 'reliabilities' of the tests." (p 117)

Evans and Waites contend that the theory that different IQ tests measure the same thing but with varying degrees of reliability has statistically not been proved.

The theory put forward by Thurston (1938), attempted to get away from the concept of 'g'. Thurston maintained intelligence could not be conceived as a general unitary concept but rather as a composite collection of multiple factors. His method involved multiple-factor analysis based on inter-test correlations. He argued that these factors were of equal importance and covered mental abilities such as deductive reasoning, verbal abilities, rote memory and spatial perception. However, he was later to explain the moderate intercorrelations between the major factors as

> " the existence of a second-order factor that was most likely related to 'g'." (Cited in Sattler, 1982)

Thus once again psychometric attempts at defining intelligence through statistical observations led circularly back to the concept of 'g'.

Evans and Waites (1981) criticise the statistical basis to notions of 'g' and argue that differences between individuals should be seen as a spread

of cognitive skills rather than in terms of a few general skills. They point at the inability of neuropsychological efforts to establish any physiological basis to 'g' as further evidence of the elusiveness of the concept of 'g'.

Shochet (1986), who did an extensive survey into research on the nature of 'g' concluded that "the exact nature and form of this 'substance' of intelligence still remains undefined and unclear after nearly sixty years of searching." (p 57)

The implications for the present study are aptly summed up in concluding comments by Borkowski (1985):

> " The history of the psychometric approach to intelligence conveys a harsh fact, Spearman's 'g' is a creature of statistics, possessing no theoretical import. It fails to yield explanatory insight. It provides little or no direction for future research or for theory construction." (p 221)

The major criticism of geneticist notions of intelligence in terms of the present study is that notions of intelligence based on statistical correlations - whether advocating a generalised concept of 'g' or a multi-factorial model of mental abilities - are predicated on operational definitions of intelligence which ignore the cognitive skills and processes underlying performance on the tests. Furthermore this view assumes that as these processes are fundamentally dependent on the genetic inheritance of the 'substance' 'g', it is irrelevant to attempt compensatory educational programmes.

1.2.2 HERITABILITY OF INTELLIGENCE:

The notion of comparing general intelligence assumes at its most fundamental level that valid measures of intelligence can be obtained through IQ tests. As we have already seen, the notion of "g" and testing for its occurrence is fraught with theoretical and methodological difficulties. The theory that intelligence is predominantly inherited has occupied a large section of the intelligence debate. It is beyond the scope of the present study to examine all facets of this controversial area. However it remains essential to critically examine the major research findings and their implications for the present study.

Researchers such as Jensen, 1969; Herrnstein, 1973; and Eysenck, 1971, who have been the most vociferous in claiming that hereditary rather than environmental differences account for IQ differences among individuals, have long claimed that the former is the principal determinant of educational and occupational success. This static view of intelligence assumes that;-

i) Intelligence is inherently stable over time and environmental influences;

ii) Differences in average IQs between social classes and between races are genetically determined; and

iii) Intelligence, being inherently stable, will not respond to compensatory educational programmes.

The above claims arose out of a vast number of kinship, twin and parenting studies. It is unnecessary for the purposes of the present study to examine all the studies which have been instrumental in reaching the above assumptions. It should be noted that a large proportion of these studies have been the centre of much controversy between the so called environmentalists and geneticists and some of the studies have been cited as evidence of support for both positions (Schochet, 1986).

According to Sattler (1982), a polygenic model is the most useful concept for understanding the heritability of intelligence. The polygenic model assumes that intelligence is the "result of the combined action and influence of many genes. Techniques of biometrical genetics clearly indicate that intelligence is under polygenic control." (p 49) An estimate of heritability is defined by Sattler (1982) as "being the proportion of the variation of a trait in a given population that is directly attributable to genetic differences in that population." (p 49)

The greatest weight in terms of heritability estimates for intelligence was obtained through kinship studies by correlating the performance of separated monozygotic and dizygotic twins on intelligence tests (Burt, 1966; Hogarth, 1974; Jensen, 1970; Newman, Freeman & Holzinger, 1937; Shields, 1962). However, the findings of these studies failed to establish any degree of corsensus on the proportion of intelligence which was felt to be directly heritable.

Estimations of the heritability of intelligence among European and American populations ranged between 0,40 and 0,80. (Sattler 1982). The most active proponents of the heritability of intelligence, Jensen (1970,

1979b) and Burt (1966), argued that the evidence pointed to hereditary explaining approximately 80 percent of differences in IQ scores, while Jinks and Fulker (1970) estimated that heritability for three IQ measures ranged between 71 per cent and 86 per cent. Some of the most substantial claims on the heritability of intelligence (including the work of Jinks & Fulkner) was based on the work of Cyril Burt. But most of this work was shown by Kamin (1974) to be fraudulent. It is interesting that even as late as 1979, Vernon used Burt's data to establish the validity of heritability estimates, and only later, reluctantly admitted most of Burt's work was unscientific and fraudulent.

1.2.3 RACE AND INTELLIGENCE

It is beyond the scope of this study to present all the literature surrounding the geneticist's position on the relationship between race and intelligence. However a brief examination of the debate is essential as the present study has implications in terms of tertiary academic prediction for disadvantaged communities.

The geneticists' position advocated by theorists such as Jensen (1969, 1973, 1980) and Eysenck (1981) basically asserts that different race groupings score consistently better on IQ tests than others. They argue that these differences are accounted for by genetic rather than environmental factors.

Jensen (1981) argued that "if IQ has high heritability, then to attribute the difference in average IQs between blacks and whites to genetic differences is reasonable." (cited in Evans & Waites 1981, p 174)

A figure of 15 IQ point differences between American whites and blacks was quoted by Eysenck (1981). He attributed these differences to 'g' loadings on the IQ tests, rejecting any cultural or environmental influences on the findings

After examining a number of studies conducted by Morton, (1972), Loehlin et al. (1975) and Jensen (1977), Vernon (1979) concluded that there was a fairly close convergence of genetic inheritance of around 65 per cent. As with studies into the heritability of 'g', there was no agreement or consensus on the specific amount of racial disparity in IQ scores. In response to criticisms of racist and ideological interpretations of racial mean IQ differences, Jensen (1980) dismissed claims of test bias and cultural relativity in the construction of IQ tests. He insisted that arguments along these lines were overstated and scientifically unsound. He also agitated against the standardising of IQ tests by providing specific population norms. His contention being that special norms did not change the individual or groups' relative positions or differences (Jensen 1980).

The implications of the above arguments for the present study would be that as there are racial differences in intelligence we would expect blacks in South Africa to score lower on IQ tests than whites, and in as much as intelligence is predominantly inherited, these differences could not be due to environmental influences or test bias.

In addition, as IQ is related to academic performance it would be senseless to examine the underlying processes involved in learning and the acquisition of knowledge. Further it would be meaningless to devise

compensatory educational programmes to deal with academic deficits.

The above section has dealt with the geneticists' position on intelligence and its implications for tertiary academic selection and prediction. The following section will deal with the counter arguments to this position.

1.2.4 THE ENVIRONMENTALISTS' POSITION

The environmentalists do not present themselves as a unified theoretical school, indeed they have mostly assumed reactive positions to the geneticists and subsequently have failed to produce a coherent and systematic alternative to genetic theories of intelligence. This is most evident in attempts to develop culture-fair tests where the underlying notions of 'g' were not challenged but merely adapted. The behaviourists, although creating a new theory of psychology primarily based on environmental experiences, failed to directly address notions of intelligence and have therefore remained essentially peripheral to the debate.

Basically the environmentalist position contends that measures of group or individual performances on IQ tests cannot be divorced from social, economic and cultural influences (Bloom, 1974; Bruner, 1975; Kamin, 1974 Karnes and Teska, 1970). One of the major objections of the environmentalists to the genetic notions of intelligence concerned the atheoretical and arbitrary conception of what constituted 'g'. Despite fundamental criticisms that intelligence tests might not be measuring intelligence, environmentalists continued to respond to specific issues

within the geneticists' position. Shochet (1986) argues that:

> " Instead of explaining away black-white differences in IQ as if they were differences in intelligence, they (the environmentalists) ought to have been building an alternative model of intelligence rather than simply reacting to the geneticists' energetic defences." (p 67)

Despite fundamental objections to notions of intelligence, a vast number of studies proliferated in which the impact of environmental influences on measures of intelligence were demonstrated. A number of these studies were concerned with the debate surrounding the heritability of intelligence. Studies by Levenstein (1970), Karnes and Teska (1970) and Bronfenbrenner (1970), demonstrated that through direct intervention, so called fixed and immutable IQ scores could be increased by as much 20 points (cited in Vernon, 1979). A longitudinal study by Hanson (1975) revealed that a number of home environmental variables were significantly related to Stanford-Binet IQ scores. These variables were demonstrated to be consistent and stable over three different age samples in the experimental condition. Hanson found evidence that environmental influences such as parental involvement with children, emphasis on school achievement, and freedom to explore the environment were found to be related significantly to intelligence in each of the three age groups sampled.

Evans and Waites (1981) point out that by far the most compelling evidence for the heritability of intelligence was based on twin studies. However, they argue that the issue of correlated environments was never adequately taken into account. Examination of the twins studies by no means revealed

large differences in environments; in fact a large proportion of the sample were reared by a close relative or friend. Evans and Waites (1981) argue that the only study which seemed to overcome the problem of correlated environments was that of Cyril Burts and this had been demonstrated to be fraudulent. Adoption studies were similarly criticised by Kamin (1974) and McAskie & Clarke (1976) in terms of the selective placement of wards by agencies into matched environments. They argue that if separated twins or adoption wards were randomly distributed among environments then heritability conclusions might be valid. Instead they contend that selective placement would "guarantee the development of a non-genetic correlation between adopted child and biological mother". (p 154).

In support of the environmentalists' position Sattler (1981) cites numerous studies demonstrating the effects of birth weight & nutrition, socio-economic status, parental harmony, father absence, paternal nurturance and punishment regimes on measures of intelligence (p 56).

A study by Scarr and Weinburg (1977), looking at how black children reared by white families compared to white adoptees and the biological children of these parents, yielded a heritability of around 0,45. Using Scarr and Weinberg's data, Jensen (1974) claimed the heritability figure that should have been derived from this data was around 0,80. Amongst Jensen's criticisms of the original researcher's methodology were "selective biasing", that is, that technically eligible families did not volunteer for the study, that the use of partial correlations and regressions were wrong statistical choices, and that although Scarr and Weinburg's data did not prove 0,80 heritability, neither did it rule it out. This same data

under scrutiny of Kamin (1981) was shown to be able to yield a heritability of 0,0. According to Kamin, anomalies in the Scarr and Weinburg study included the following: i) the researchers used educational level when referring to natural parents of the adopted children, whereas in the case of adoptive parents IQ scores were used; ii) that black adopted children may not reap the home environment advantages that a white child would; and iii) that the researcher's division into 'early adoptee' and 'late adoptee' at one year old did not take into account the differences between an adoptee at, say, one month old, and a child adopted at eleven months.

Commenting on the vast body of literature concerning the heritability of intelligence Kamin (1981) concludes that:

> Whatever the "experts" may say there is no compelling evidence that the heritability of IQ is 80 percent or 50 percent or 20 percent. There are not even adequate grounds for dismissing the hypothesis that the heritability of IQ is zero (p.155).

The implications for the present study are that as it has been established that heritability studies are ambiguous and that environmental milieu can dramatically effect intelligence scores, it follows that 'intelligence' can be changed by compensatory educational programmes. Furthermore, as there is a relationship between 'intelligence' and academic performance so too could academic performance be improved by educational intervention.

1.3 TOWARDS CULTURE FAIR INTELLIGENCE TESTING:

The current study is concerned with the academic prediction of predominantly white students, it is therefore not essential to present all aspects of the debate surrounding culture-fair approaches to intelligence testing and academic selection and prediction. However inasmuch as the present study argues for a new theoretical approach to selection and prediction which has implications for disadvantaged communities; the major issues will be examined.

The environmentalists reacted vigorously against racial interpretations of group differences in IQ measures, arguing that that these differences were a function of environmental effects and cultural bias in IQ test construction. As IQ tests were culturally biased it followed that using IQ tests for selection purposes was fundamentally discriminatory to different cultural and racial groups.

Arguments by the environmentalists were based on many of the counter heritability studies which demonstrated that IQ scores could be dramatically improved (Levenstein, 1970; Karnes and Teska, 1970; Bronfenbrenner, 1970). Objections were simultaneously raised about the cultural bias in test items and familiarity with test materials. Test items widely used in the Stanford-Binet and Wechsler tests included vocabulary subtests which called for definitions of words such as vesper, chattel, traduce and parterre.

Evans and Waites (1981) point out the obvious social class and cultural bias to these questions and contend that:

> "Test questions often reflect the white middle-class academic milieu of their constructors rather than any culture-free conception of human cognition" (p 169).

Anastasi (1976) pointed to the language and motivational factors that need to be taken into account when testing ethnic minority children. She argued that failure to take these into account could severely effect the validity of the tests (p.73).

Evans and Waites (1981) argue that testing is a social event and that it is prone to influences from a variety of personal, motivational and socio-cultural factors. In an intensive examination of a number of heritability studies Taylor (1980) noted that most of the data was based on whites and therefore estimates on black heritability were primarily inferential.

The contention that the non-verbal sub-test items are less culturally biased than verbal sub-tests and therefore not significant, is disputed by Evans and Waites (1981). They assert that as the verbal subtests account for fifty percent or more of the total IQ score:

> "It seems ridiculous to suppose that the overall IQ scores for these tests are not culturally biased, or to put forward a genetic explanation for differences of 15 points in the average scores of different social classes and ethnic groups " .(p 131)

1.3.1 CULTURE-FAIR TESTING

From the late 1960's there was a growing anti-test movement. A number of lawsuits based on American civil rights legislation had been brought by groups seeking to ban various educational uses of the tests on the grounds that they discriminated against blacks and other minority groups. A major test case conducted in California in 1979 on the issue of using tests to decide which children would be placed in classes for the mentally retarded ruled that:-

> "Defendants have utilised standardised intelligence tests that are racially and culturally biased, have discriminatory impact against black children, and have not been validated for the purpose of essentially permanent placements of black children into educationally dead-end, isolated, and stigmatising classes for the so called educable mentally retarded." (cited in Evans and Waites, 1981, p 10)

Accepting the principal of cultural bias, a number of efforts aimed at producing culture-fair intelligence tests were attempted. Shochet (1986) argued that these approaches all implicitly invoked a static concept of intelligence as a measurable and stable 'substance', thus unwittingly adopting the concept of 'g' which they claimed to reject. He argued that statistical manipulations involving the creation of special norms by re-standardising the tests with different groups or cultures was essentially misguided because by simply altering the norms the conventional test was kept intact. Furthermore all that changed was the ranking of the raw score of the testee in terms of the population on which

it was normed (p 75). In addition, Anastasi (1976) argued that reliability and validity coefficients established on one population could not simply be adapted to other populations.

The assumption that non-verbal tests such as the Raven's Progressive matrices or the Leiter International Performance Scale are less culturally biased than verbal tests has been vigorously disputed by Blum (1978). Sattler (1982) states that attempts at the development of culture-fair tests by emphasising non-verbal tasks involving pictorial, spatial or figural content have generally been unsuccessful. Sattler argues that in fact some of the non-verbal tests proved to be more culturally problematic than the verbal tests (p.382).

A major problem in the design of culture-fair tests has been their validation in terms of correlations with other established IQ tests like the Stanford-Binet and Weschler. Thus inherent biases in the original tests are simply replicated in the new tests inasmuch as they correlate well. Blum concludes by stating that more than thirty years after the publication of Raven's progressive matrices "unequivocal evidence of its predictive validity is still lacking."

In a review of most international comparisons of IQ, Lynn (1978) concludes that cultural explanations for the observed differences cannot be ignored. According to Evans and Waites (1981), the reason for this is that after years of the nature-nurture debate it is becoming obvious that it is not possible to devise tests that do not depend heavily on knowledge which varies greatly between cultures. They argue that intelligence or knowledge is not a reified entity that can be divorced or detached from the cultural

and class influences which inform it. Scarr (1978) observed:

> " Intelligence tests are not tests of intelligence in some abstract, culture-free way. They are measures by virtue of knowledge and skills in the culture of which they sample." (p.339)

The failure of culture-fair testing, especially in prediction studies, has been attributed by Evans and Waites (1981) to the lack of any articulated theory about cognitive processes upon which to base them (p 181).

In an extensive examination into various models of culture-fair approaches to academic prediction, Schochet (1986) concluded that all attempts essentially used intelligence tests in a static form and treated the tests as though they were measuring intelligence. Thus although the environmentalists have argued that measures of Intelligence or cognitive ability cannot be separated from social and class determinants, they have not relinquished the idea of a static 'g'. Instead they argue that 'g' can be culturally, educationally and environmentally influenced.

Attempts at culture-fair testing have consequently been concerned primarily with making the tests more appropriate to different socio-cultural groupings by various adaptive procedures such as item and language changes and statistical manipulations such as re-standardisation. In all cases the tests (and this includes derivatives of IQ tests, for example Raven's progressive matrices) remain essentially intact. Thus unwittingly the environmentalists return to the same position as the geneticists in that it is the end product (knowledge) that is examined,

not the underlying cognitive skills and processes involved in acquisition of knowledge that is important.

It is precisely the contention that scores on IQ tests are the products of environmental determinants that is vital. In traditional academic prediction studies it is this end product (knowledge or 'g' as the geneticists would have it) that has been correlated to criterions of university success. The present study is in line with information processing theories which advocate that it is the process by which the product (knowledge) is acquired that is meaningful when examining academic performance. In addition by examining the processes of knowledge acquisition and the constituents of successful learning, the focus is not merely prediction but understanding. Miller (1989) emphasises this point by argueing that " ..an explanation, as opposed to a description, of a psychological process can only be achieved through a disclosure of its genisis, its causal dynamic base or what today are commonly referred to as generative mechanisms." (p 13)

1.4 INTELLIGENCE AND ACADEMIC PREDICTION

As stated previously, attempts at relating intelligence to tertiary academic success have generally met with failure (Dalton, 1976; Hartman & Bell, 1978; Houston 1983; Slack & Porter, 1980). According to Entwistle et al (1977), the reason for this is that these approaches are generally not based on any underlying cognitive theory. Furthermore, these approaches are product orientated and geared toward current student functioning and thus do not elucidate the processes involved in successful performance at university. Intelligence testing and its successor 'aptitude' testing have

been shown to have immense problems of socio-economic and cultural bias. It is thus inevitable that these biases are inherent in most of the studies on predictors of tertiary academic success. In the main, intelligence and aptitude tests have proved poor predictors of academic success. (Aleamoni & Oboler, 1983; Houston, 1983). As aptitude testing has mainly replaced traditional IQ tests in prediction studies, it is important to trace their development.

The development of aptitude tests grew out of the general intelligence testing movement (Anastasi,1976). According to Jencks and Crouse (1982), the idea that aptitude tests were developed to select students on the basis of future potential rather than current levels of performance was false. They asserted that aptitiude tests such as the American Scholastic Aptitude Test (SAT) were in reality achievement tests which have their origins in traditional intelligence testing.

Anastasi (1976) pointed out that aptitude tests were developed due to the failure of general intelligence tests to accurately predict future academic success. Aptitude tests were seen as a positive development as they were not based on a single global measure such as IQ but on a set of scores demonstracing the individual's characteristic strengths and weaknesses. The theoretical underpinnings of aptitude testing, like intelligence testing, were based on statistical correlations, namely factor analysis.

Vernon (1960), a major proponent of the multiple aptitude approach to testing, still argued that Spearmans' 'g' was the major and determinate factor in his model of hierarchical organisation of abilities (p.22). He

listed second-order factors as incorporating verbal, number, mechanical, spatial and manual abilities. According to Schochet (1986) this approach has continued to inform the area of aptitude testing in that performance on these tests is considered to be a function of innate abilities. Anastasi points out that factorial research has produced a 'bewildering multiplication of factors' and notes that the number of cognitive factors reported to date by different investigators exceeds one hundred. According to Entwistle et al (1977), this lack of consensus on what constitutes aptitude is due to the lack of a strong theoretical rationale underlying notions of ability and ability testing.

Anastasi (1976) argues that the reason for the lack of consensus in the development of factorial-based aptitude tests is that separate abilities are seen as 'traits'and are fundamentally indentified through factor analysis. She argues that this approach reduces cognitive processes and abilities to:

> " simply an expression of correlation among behavior measures. They are not underlying entities or causal factors, but descriptive categories." (p.376)

The most widely used aptitude test in the selection of students has been the Scholastic Aptitude Test (SAT) of the College Entrance Examination Board in the USA. The SAT consists of two major factors, that is, a verbal and mathematical component. The SAT's efficacy in academic prediction has been vigorously contested.

Numerous studies (Baggaley, 1974; Brooks, 1972; Sedlacek, 1976) have demonstrated that the SAT is prone to a lack of predictive validity and cultural bias. Alternate aptitude tests such as the Ammons Quick test, the Chicago Tests of Primary Abilities (PMA) and the American College Test have been found to have even poorer predictive ability than the SAT (Aleamoni & Obler, 1978; Houston, 1983; Super, 1958). Schochet (1986) concludes after reviewing the research on the predictive validity of the SAT for tertiary academic prediction, that:

> "..the literature is equivocal concerning the validity of the SAT... At best one could say that the test predicts equally badly for white and black students. At worst the test has no bearing for black students and sometimes even a negative relationship." (p.129)

In terms of the predictive ability of most multiple-factor aptitude tests Anastassi (1976) suggests a number of reasons why they have been unsuccessful.

> "It is possible that differences in performance in specific courses depend principally on interests, motivation, and emotional factors... In terms of available data, however, multifactor batteries have fallen short of their original promise. (p.383)

A number of subsequent studies have attempted to correlate various individual measures of intellectual functioning with academic success.

Generally these studies have met with little success. A study by Leirer, De Petris and Furukawa (1980), found there was no relationship between a test of Deductive Reasoning and academic success. They in fact discovered a negative correlation between the top 'A" students and their scores on the test. A study by Cloete and Culverwell (1987) found no significant relationship between various sub-tests of the National Institute for Personnel Research's (NIPR's) High Level Battery and first Year grades. Schochet (1986) found no significant relationship between tests of Deductive Reasoning and a modified version of Raven's Progessive Matrices (The Pattern Relations Test) with academic grades in first-year university students. He in fact discovered that for the white sample the Deductive Reasoning test had a -0,04 correlation with academic success. Similarly the Pattern Relations Test (PRT) had a negative correlation of -0,06 with final-year average. Although both tests at least correlated positively with the Black sample, the coefficients were small (0,26 and 0,21 respectively) and not significant at the 5% level (pp. 235-237).

Shochet (1986) observes that the range of individual cognitive skills that can be assessed is extremely vast but asserts that it unlikely that one measure will provide the magical solution to academic prediction.

1.5 SUMMARY AND CONCLUSIONS

This chapter has examined issues surrounding the nature of intelligence, intelligence testing, culture-fair testing and academic prediction. This was done as the vast majority of research into predictors of academic success has concentrated efforts on the relationship between IQ and academic performance. As has been shown, there are major flaws in the

theoretical underpinnings of itelligence testing in terms of static models of 'g'.

Although environmentalists see cultural and milieu effects as paramount in terms of IQ scores, attempts at culture-fair tests and subsequent aptitude testing, are still predicated on a static measurable concept of intelligence. It has been shown that both traditional and cultural-free approaches to intelligence, aptitude testing, isolated cognitive abilities and academic prediction have generally been unsuccessful.

The present study is at variance with the above theoretical standpoints in that neither traditional IQ tests, nor culture-free tests, nor aptitude tests examine the underlying processes involved in performance; instead a global score is usually correlated with a criterion variable (university grades) and as such does not address the processes involved in the acquisition of knowledge. Traditional tests are concerned only with the end product of intellectual functioning and do not address underlying factors involved in the process of knowledge acquisition. They treat as an end point where learning processing begins.

Geneticists would assert that ability is fundamentally genetically determined and measurable using IQ tests. They would argue that one could correlate this innate ability or 'g' factor with academic criteria and thus select appropriate students. It has been shown that this assumption is false and that there is a poor relationship between intelligence, aptitude testing and academic performance (Dalton, 1976; Evans and Waites, 1981; Houston, 1986; McDonnell, 1975; Shochet, 1986; Slack & Porter, 1980).

The present study counter proposes that it is precisely the acquisition of ability which is important (and certainly environmentally determined). If we can understand how students approach their academic work and analyse the cognitive strategies and skills constituting effective learning, so too could we predict from these strategies those who are most likely to achieve academic success.

Secondly, this understanding would alert us to deficiencies in those students who were lacking in these learning strategies. The debate would then enter the realm of compensatory educational programmes which static innate conceptions of ability have failed to address.

CHAPTER 2

RESEARCH TRENDS IN ACADEMIC SELECTION AND PREDICTION

2.1 Introduction

It has long been the intent of educational researchers to find predictors of academic success. The vast body of research into this area has been given impetus by the pressing need to accurately select those students who are most likely to succeed at university level. McDonnel (1975) attributes this to a world-wide increase in tertiary educational institutions and a concomitant increase in the number of students competing for placement at these institutions. In South Africa it has been a major concern of university authorities as to the poor academic output and high failure rate among first year-university students (Committee For University Principals, 1978).

It was shown in chapter one that traditional approaches to IQ and aptitude testing are fraught with methodological and ideological problems in their application to tertiary academic prediction. This inability of traditional IQ and aptitude tests to accurately and reliably predict academic success has led to a large portion of research concentrating on a plethora of ability, and non-cognitive variables such as school performance, study skills, motivation, and personality factors. To date the single best predictor of academic success remains that of school performance which remains unsatisfactory, particularly in the lower ranges (Entwistle, 1977). This has lead to a call for the development of alternative

paradigms in student learning and academic prediction research. Although it is beyond the scope of the present study to present all the research in this area, some of the major approaches will be examined and the implications in terms of the present study assessed.

2.2 METHODOLOGICAL CONSIDERATIONS

The majority of research into academic success is based on what Anastasi (1976) terms criterion-related validity. She defines criterion-related validity as the:

> "effectiveness of a test in predicting an individual's behaviour in specified situations." (p 140)

Criterion-related validity (also known as predictive validity) thus relates to the way performance on a test is checked against a criterion, that is, a direct and independent measure of that which the test is designed to predict. In the case of academic prediction this is usually the first-year student's grade point average (GPA). Criticisms have been levelled at using the relatively short-term criterion of first-year GPA (Wilson, 1983). However inasmuch as subsequent university study is contingent on passing first year, it is generally accepted as a valid criterion measure (Entwistle et al, 1977).

Entwistle et al (1977) argue that a major problem endemic to predictive research based solely on correlational association with criterion measures, is that the theoretical basis to these studies is often not made explicit or is simply lacking. They describe what they call the 'grape

shot technique' whereby numerous variables are simply correlated against a criterion measure and the resultant matrix is used to generate ideas as to what are the statistically viable constituents of successful university study. They criticise this approach arguing that if sufficient variables are included in an analysis some of the variables are likely to be significant due to chance factors. Furthermore, this approach leads only to selection and rejection, without a theoretical understanding of the processes and factors underlying performance.

The present study argues that most of the research in this area has been predicated on static views of ability and performance which have their underpinnings in traditional views of intelligence and as such have not met with much success. The present study suggests that a new paradigm is needed if we are to understand the processes underlying student learning and achievement. According to Entwistle (1984), traditional research paradigms have resulted in researchers explaining student behaviour from "the outside ,as a detached, objective observer". (p 13). This leads one to the no' on that failure at university is the result of low ability or lack of organisation or application. Entwistle (1984) argues that this process has ignored the existence of individual differences in the process of knowledge acquisition and the context within which learning takes place.

2.3 SCHOOL PERFORMANCE AND ACADEMIC PREDICTION

There is general agreement in the literature that school performance remains the single best predictor of academic performance (Choppin et al, 1973; Entwistle et al, 1977; Entwistle, 1984; McDonnell, 1975; Murray,

1988; Shochet, 1986). A review of the research revealed that correlations generally explain roughly 20 percent of the variance in academic performance. (Entwistle et al, 1977; Darling, 1983).

Although school results correlate with academic success, Entwistle et al (1977) point out that the major proportion of variance essentially remains unexplained. Furthermore, the predictive ability of school results tend to decline in the lower ranges. A study by Nisbet and Welsh (1966) found that school results failed to discriminate among the crucial group of students with minimum entry qualifications where they might have been most useful.

In accordance with international findings, local research has found that there is a weak relationship between white school results and university achievement. In general the variance explained is small and loses its predictive power in the marginal ranges (Cowley 1977; Wits Senate Document, 1978; Shochet, 1985, 1986). Shochet (1986) concludes a review of the predictive ability of school results by stating that:

> "Using school results as the criterion still leaves tremendous room for false positives and false negatives in the selection procedure. The problem becomes more acute at the lower range of matric (usually the point of decision) where the relationship tends to break down completely. Thus there is widespread agreement to supplement school results with other predictors." (p 124).

In lieu of the above a number of studies have attempted to explain more of the variance in academic prediction by supplementing school results with aptitude tests. Moderate success was achieved by using the SAT to enhance school results in an American study (Scannell, 1960). However, when this approach was applied in Scotland and England, Entwistle (1984) concluded that:

> "correlations were disappointingly low (generally less than 0,15), and scores on aptitude tests added little to the accuracy of selection based on entry qualifications alone. (p 11).

A number of subsequent studies have since confirmed that aptitude tests do not significantly add to the variance explained by school results (Choppin et al, 1973; Houston, 1983; Slack & Porter, 1980). A study at the University of The Witwatersrand by Shochet (1986) found that traditional tests of aptitude did not significantly enhance the predictive power of school results in terms of the academic performance of Arts students. More importantly, however, were his findings that black school results had absolutely no relationship with tertiary academic performance.

2.3 SCHOOL PERFORMANCE AND ACADEMIC PREDICTION IN THE SOUTH AFRICAN CONTEXT

The problem outlined above becomes particularly acute in the South African context. It has been well documented that black education is in a crisis in South Africa (Hartshorne, 1983; Hartshorne, 1984; Molteno, 1984; Schochet, 1986). Auerbach (1977) has documented the grossly

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disproportionate per capita expenditures between white and black education. He demonstrates that as late as 1976, per capita expenditure on black education amounted to only 6.4% of the amount spent on white education. Black education in South Africa is currently under the jurisdiction of the Department of Education and Training (DET). Hartshorne (1983) has pointed out the myriad problems involving low expenditure, unqualified teachers, authoritarian teaching styles, and untenable pupil-teacher ratios in education falling under the DET administration. Evidence of the impoverishment of black education is demonstrated in the 1983 statistics of The South African Institute of Race Relations, whereby only 9.8% of DET candidates obtained matriculation exemption compared to 46.6% of candidates in white schools (Survey of Race Relations, 1983).

Hartshorne (1984) argues that the problem is even more severe than it seems at face value. He examines the black matriculation statistics for 1983 and concludes that only 4.9% of students obtained the requisite C aggregate usually required for admission to most open university faculties. He argues that this represents only 300 students in the entire country!

Given the vast disparity between white and black education in South Africa Schochet (1986) argued that:

> "Given the degree of disadvantage evidenced in black education and the concomitantly low matric results (particularly in African and coloured education), serious doubt can be placed on the use of these results for admissions to the university." (p 34).

Research has subsequently demonstrated the unreliability of black school results (Potter, Jamotte and Van der Merwe, 1983a; 1983b). Research conducted by Schochet (1985,1986), found 'disastrous' correlations between the matric ratings of DET students and university performance:

> "..correlations .. between matric rating and the average mark in the December exam for 52 DET students was 0,15 (p = 0,30). This is tantamount to a totally random statistic. Selecting on this basis would be the equivalent of pulling names out of a hat. Clearly other criteria for fair and accurate selection have to be found." (Schochet, 1985, p 91)

Thus the research findings are in general agreement that school results are insufficient in themselves to reliably and accurately predict academic success, particularly in the marginal ranges. In the South African context the problem becomes especially acute, in that research has demonstrated the astounding phenomenon of a complete lack of association between black matric results and tertiary academic achievement.

School performance prediction studies have been criticised for only focusing on the end product of learning and as such do not alert us to the learning processes involved in success at school. The consequence of this approach for selection is that certain top white students might do well at university whereas those in the lower ranges may do poorly or extremely well, but we are not certain about the particular reasons why this might be. This problem becomes even more acute when selecting students from the educationally disadvantaged DET system. There is thus a

pressing need to find predictors which are viable across both advantaged and disadvantaged co. munities.

2.4 NON-COGNITIVE FACTORS IN ACADEMIC PREDICTION

According to Entwistle et al (1977), the failure of traditional tests of intellectual functioning to reliably predict tertiary academic success resulted in a vast amount of research examining non-cognitive factors involved in performance at university. However, Entwistle et al argue that generally these approaches have contributed little to explaining the variance in tertiary academic prediction.

It is beyond the scope of the present study to present the myriad studies which have correlated an endless number of non-cognitive predictor variables with academic success. Schochet (1986) asserts that studies in this area of prediction are so vast that they make interpretation incoherent. General research trends have examined the effects of personality, biographical information, attitudes, socio-economic status, motivation and study habits in relation to prediction.

In a review of non-cognitive predictors, Lenning et al (1974), discuss a variety of research findings that seem to have a bearing on academic performance. These include parental characteristics and attitudes, ability to deal with anxiety in stressful situations, eg, examinations, levels of motivation, locus of control, perceived capabilities, emotional stability, and college environmental characteristics, eg, quality of residences, etc. A study by Tracey and Sedlacek (1987) examined seven non-cognitive

variables in relation to perseverance at university level. They found that the non-cognitive variable most associated with ongoing success for white students at university involved positive self concept. Positive self concept in combination with first semester grades seemed to best predict academic persistence. The same study when looking at black students revealed that the factors most predictive of long-term academic success involved, positive self-concept, realistic self appraisal, long term goals, and having some leadership experience. Tracey and Sedlacek (1984) argue that for black students particularly, non-cognitive variables could be used to do a better job of selection than traditional selection measures. (p 11)

Entwistle and Brennan (1968) described high-attainment students as being characterised by high motivation, good study techniques, introversion and high economic and political values. Low attainment types were characterised by low motivation, radicalism, poor study habits, extroversion and holding high social values. These findings were based on cluster analysis techniques and the authors acknowledged that it was extremely difficult to demonstrate the validity of the clusters.

A study by Sewell and Shah (1976) demonstrated a relationship between socio-economic factors and academic success, while Ornston (1979) found a relationship between parental attitudes to achievement and academic success. (cited in Lenning et al, 1974) Raaheim and Wankowski (1981) found that students who had clearly defined vocational goals tended to be more successful at university. Entwistle (1984) reviewed a number of studies into student motivation and academic success and concluded by stating that:

> "Levels of correlation with degree results have rarely exceeded 0,3 and are more commonly between 0,2 and 0,1. (p 11)

A number of studies have examined the relationship between study habits and academic success. Although some moderate success has been found by correlating study habits with academic success, Entwistle et al (1977) conclude a review of study habits and academic success by stating that "there appears to be no one set of procedures which will be right for every student". (p 4)

Ramsden, Beswick and Bowden (1986) argue that study skills courses have shown little relationship with improvements in academic performance - indeed they demonstrate how these courses can entrench minimalist performance. They argue that study skills programmes have limited relevance to the problem of improving student learning "because they do not take account of the interaction between students' intentions and the context of learning". (p 162) Cloete and Schochet (1985) argue that study skills programmes emphasize technicist skills at the expense of student understanding, and that this has led students to equate learning with memorisation and association techniques rather than understanding.

Lenning et al (1974) conclude that the area of non-cognitive factors in academic prediction has failed to produce a consistent body of research findings. Entwistle et al. (1977) argue that research in this area is unintegrated and has generally proved disappointing. They argue that the vast amount of ambiguous research findings suggest that new paradigms of student learning and achievement are called for.

2.5 ALTERNATIVE APPROACHES TO INTELLIGENCE AND ACADEMIC PREDICTION

Due to the failure of traditional research paradigms to provide reliable predictors of academic success, alternatives to traditional research paradigms are being developed. A promising approach which represents a fundamental change in paradigm toward intelligence and academic prediction which also directly addresses disadvantaged communities is that of LEARNING POTENTIAL theory. This approach to testing and prediction places emphasis on potential rather than manifest performance (Biesheuvel, 1972; Brown, 1979; Feuerstein, 1979; Murray, 1989; Shochet, 1986; Vygotsky, 1962).

Learning potential theorists stress [illegible] current [illegible] functioning but also ascertain the potential of [illegible] and [illegible] their ability to learn. The most systematic and documented work in this area has been done by the Israeli psychologist, Feuerstein (1979).

According to Feuerstein (1979) the learning potential approach was in direct opposition to genetic and static notions of intelligence as it emphasised the modifiability of performance and manifest levels of functioning. Biesheuvel (1972) argued that in terms of cross cultural testing the idea of adaptability was vital in that it stressed the notion of educability rather than innate manifest levels of functioning.

Feuerstein (1979, 1980) extended both the 'Piagetian' and the environmental model arguing that intelligence was not a static concept but the capacity to learn from exposure to stimuli. The capacity for learning he saw as being affected (but not determined) by the degree to which

the individual was exposed to what he termed 'mediated learning experiences'. By this he meant the process by which the mediating agent (usually a teacher or parent) transformed stimuli from the environment for the individual, thus allowing the individual to learn from direct exposure to stimuli.

Shochet (1986) argues that this theory stresses the importance of the mediator on intelligence, thus rejecting both genetic and environmental determinism. Feuerstein (1979) argues that deficient functioning could consequently be reversed by providing effective mediating learning experiences.

Theories of learning potential thus criticise genetic and environmental conceptions of intelligence, arguing that intelligence should be seen as a process not a product.

> "Static IQ tests, in whatever form, fail to measure the capacity for learning, and only measure the manifest level of functioning." (Feuerstein 1979, p 40)

Feuerstein (1979) criticised the environmentalists attempts at creating culture-fair intelligence tests by establishing special norms for different groups. He argued that this process of adaptation was essentially misguided in that results would always indicate that certain cultural groups were inferior to the comparison group. He argued that culture-fair intelligence tests thus implicitly supported the geneticists'

position.

In order to assess learning potential Feuerstein (1979) developed what he called the Learning Potential Assessment Device (LPAD), and argued that the aim of the LPAD:

> "is not to seek differences among individuals as their stable and immutable characteristics, but rather to search for the modifiability of these characteristics and concomitantly to look for strategies and modalities for the most efficient and economical way to overcome the barriers. (p 125)

From extensive work with the LPAD, Feuerstein developed the idea of the 'cognitive map'. "The cognitive map provided a description of the content of effective mediated learning experiences and equally an instrument for the diagnosis and definition of cognitive deficiencies' (Moll, 1986, p 8).

Feuerstein listed seven basic cognitive functions which comprised the cognitive map, and argued that a lack of appropriate mediated learning experiences (MLE) resulted in deficiencies in these cognitive resources.

In accordance with the above sentiments, Feuerstein (1979) developed what he called the Instrumental Enrichment Programme (IEP). The IEP was designed to correct intellectual deficiencies and provide for the creation of cognitive capacities equivalent to the result of normal mediated learning experiences (p 255).

Thus for Feuerstein, current levels of functioning were merely indicators of the extent to which the individual received appropriate mediated learning experiences. A crucial issue was the idea that appropriate mediated learning experiences could be designed (on the basis of the cognitive map) which would compensate for previous deficiencies. Thus compensatory educational programmes were seen to have a direct and remedial effect on current levels of intellectual functioning.

This has important implications for the present study in that this approach emphasises learning potential and modifiability, thus stressing the processes involved in the acquisition of cognitive skills rather than immutable conceptions of ability.

Although the Feuerstein model seems to hold promise, Slonimsky and Turton (1985) allude to a number of weaknesses in a programme conducted by Schochet (1985) for the Academic Support Programme (ASP) at the University of the Witwatersrand. They argue that the cognitive skills comprising Shochets' adaptation of the Instrumental Enrichment Programme were not readily transferable to general academic tasks;

> "The students regarded Feuerstein's instrumental enrichment (FIE) as having little to do with academic work and again there were problems of motivation. In addition, those students who seemed to benefit most from the FIE (in terms of improving their performances on FIE tasks) often did not improve academically. In other words, we did not observe an effective transfer of skills from the ASP (Academic Support Programme) situation to academic work." (p 62)

Murray (1988) found similar problems in the transfer of skills from the enrichment programme to other intellectual tasks. Slonimsky and Eaton (1985) further argue that Feuerstein's enrichment programme tends to focus on skills rather than meaning;

> " The layering of skills, however, is not the same thing as the layering of knowledge or concepts in academic disciplines. Similarly, the integration of a set of skills is not the same thing as the integration of knowledge, ideas or concepts (p 62).

Although it was never the intention that the LPAD be used for tertiary academic selection, a few studies in South Africa have attempted to adapt Feuerstein's approach to cognitive modifiability in terms of academic prediction and selection. (Shochet, 1986; Murray, 1988). Although more research is needed in this area, Shochet (1986) however has found that with disadvantaged students the degree of modifiability reflected in the testing process significantly enhances academic prediction. However Shochet makes the point that although it may be possible to obtain a measure of potential or modifiability, it is by no means certain that this potential will be actualised in the academic context.

Thus although Learning Potential Theory has broken the hegemony of traditional intelligence testing and static views of intelligence, it still remains a deficit model, predicated on a lack of appropriate cognitive skills. Ultimately the potential argument is founded on the capacity to acquire these skills. However, as pointed out, it is

not certain that the cognitive skills advanced by Feuerstein are in any way related to the processes of acquisition, integration and application of knowledge within the academic context.

2.6 SUMMARY AND CONCLUSIONS

This chapter has examined contemporary trends in tertiary academic selection and prediction. It has shown that internationally, school performance remains the single best predictor of tertiary academic success, but that the major proportion of variance still remains unexplained. It has demonstrated that in South Africa, school results tend to be the best predictor for white students, but this does not hold true for black disadvantaged students emerging from DET schools. The methodological criticisms of this approach to prediction is that the model is based on current manifest performance and consequently lacks a theoretical framework from which to make sense of these differences in performance.

Attempts to enhance the predictive ability of school performance by supplementing matric results with traditional aptitude tests have essentially been unsuccessful. It was also found that the area of non-cognitive factors in predictive research was so vast as to be unintegrated and incoherent. This had led to a disappointing lack of consistent findings in the field.

The failure of study habits and study skills courses to dramatically enhance academic performance and prediction has resulted in a call for a

paradigm shift that emphasises student learning processes and awareness rather than quick technicist solutions.

It would seem as if recent paradigm shifts away from traditional IQ and ability testing in favour of learning potential, while offering promise, ultimately appear to be trapped in the skill deficit model. To date this approach has not significantly enhanced academic prediction, although more research is needed in this area. Finally, doubt has been expressed about the capacity of the cognitive skills taught within the instrumental enrichment programme, to transfer appropriately to academic tasks.

CHAPTER 3

TOWARDS AN INFORMATION PROCESSING PARADIGM

3.1 INTRODUCTION

The previous chapter examined traditional research paradigms of academic prediction. It was argued that these paradigms essentially focused on the end product of learning and consequently had not developed a theoretical framework for understanding the processes involved in the acquisition and application of knowledge in higher education. Indeed, Entwistle (1984) argued that traditional prediction studies in higher education had created a research paradigm which was unable to provide solutions because they had not focused on the concept of learning (p 13).

A new approach to selection, intelligence testing and academic prediction was examined, namely Learning Potential Theory. It was argued that although Learning Potential Theory had broken the hegemony of traditional intelligence testing and static views of intelligence, it essentially remained an 'ability-deficit' model. Although more research was needed in this area, attempts so far at academic prediction had not met with much success. Problems were expressed concerning the transfer of cognitive skills - taught in the Instrumental Enrichment Programme - to academic work.

This study proposes that a new paradigm which examines learning from the learner's perspective and the processes underlying the acquisition of

knowledge, may provide some of the solutions to understanding student performance in higher education.

3.2 APPROACHES TO STUDENT LEARNING:

Just as traditional models of IQ and aptitude testing have informed the area of assessment and prediction in higher education, so has research into student learning been influenced by behavioural schools of psychology. It is beyond the scope of this study to present the historical development of the behavioural paradigm within psychology. However, as this paradigm has influenced contemporary ideas of student learning, the major trends and outcomes will be examined.

According to Svensson (1978), traditional approaches to student learning have been dominated and influenced by both intelligence theorists and behavioural schools of psychology which stress the directly observable and quantifiable aspects of human behaviour. According to Entwistle (1987) behavioural learning theory was predicated on the work of experimenters such as Thorndike, Pavlov, Ebbinghaus and particularly, Skinner. Traditional experimentation was based on observable animal, stimulus (S) and response (R) dimensions originally advocated by Pavlov. The Behaviourist notion of breaking down the process of learning into basic S-R categories, was developed further by Skinner (1968), who investigated the positioning of reinforcement in relation to the S-R bond. Skinner became convinced that not only animal behavior but learning and all human behaviour could be explained in terms of schedules of reinforcement on the S-R dimension.

However, attempts at applying behavioural principals in tertiary education did not fulfill the promise expected, and results have generally been mediocre (Biggs, 1978; Cloete, 1984; Entwistle, 1987; Marton & Saljo, 1984).

Entwistle (1987) states that this is partly due to the fact that the highly controlled artificial conditions of the laboratory do not generalise effectively to the exceptionally robust and complex factors involved in learning. Although experiments have become increasingly sophisticated in research design, Entwistle and Hounsell (1979) argue that essentially the vast majority of learning experiments are trivial in nature, often focusing on the memorisation of nonsense syllables, random presentation of meaningless symbols and solutions to mazes. Cloete (1984) argues that this is a direct consequence of perceiving learning as the "acquisition of associations, conditioned reflexes and stimulus-response bonds." (p 63)

Cloete and Shochet (1985) criticise the behavioural approach for leaving out what they see as the essential ingredient of learning, namely the intervening organism. They argue that the:

> "instance of this approach to study only observable stimuli and responses while ignoring the intervening person (organism) and the context of learning has resulted in equating learning with association or memorization." (p 42)

They demonstrate that the outcome of the behavioural psychology research paradigm has resulted in the generation of a wide variety of study skills

programmes which have as their main concern the acquisition of specific technical 'learning' skills. Cloete (1984) asserts that a major reason explaining the mediocre success of study skill courses to dramatically improve performance at university is that they attempt to teach unsuccessful students the skills employed by successful students in a mechanistic and technical fashion without the former grasping the cognitive and methodological constituents behind the process. Furthermore he argues the use of the S-R relationship as the basic unit informing study skills programmes has led to a concentration on recall and memorisation while excluding other aspects of learning. Cloete argues that this explains why mnemonics are often the only learning skill taught in many study skills programmes. (pp 63-64)

A review of the contents of over 20 popular study skills programmes by Main (1980) reveals that 80 percent of programmes deal primarily with memory, time usage and note taking. Dahlgreen and Saljo (1973) argue that most study skills programmes do not deal with the process of learning and that learning is usually depicted in an atomistic quantitative manner.

Similarly, Svesson (1978), points out that the main aim of behaviourist informed study skills programmes has been to make unsuccessful students behave similarly to successful ones. He contends that this has lead to an emphasis on study activities and not the cognitive proceses involved in studying. Selmes (1987) points out that the 'cookbook' approach to study skills courses often prescribes rigid generalised guidelines to learning which encourage 'doing' rather than 'knowing'. He gives an example of this approach whereby students are exhorted to:

1. Read the title page
2. Read the author's remarks, or preface.
3. Read the table of contents.
4. Leaf quickly through the entire book. (Selmes, 1987; p 8).

Selmes argues that study skills courses are generally superficially attractive in that they seem to describe well known 'facts'; however he asserts that:

> "..the inflexibility of the advice is likely to foster both dependence on the teacher and rigid study habits. It is hardly surprising that pupils experiencing such advice have not found it all that helpful." (p 9)

In a superb review of research on study skills, Gibbs (1981) argued that there was no evidence of a link between observable study behaviour and learning outcomes. In addition, Lafitte (1963) found that top students often did not waste time on 'good' study habits, while Maddox (1963) found that "poor students often had the most impeccable study habits". (cited in Biggs, 1978)

It is this crisis in attempts to come to terms with reliable and meaningful pedagogic and methodological learning theories which has resulted in the generation of new approaches to student learning. These approaches have focused on the cognitive processes intrinsic to the acquisition of knowledge and the phenomenological context of the learning strategies exercised by students in their studies.

3.3 INFORMATION PROCESSING AND PHENOMENOLOGY

During the last decade new approaches to learning have been advanced which are in direct contrast to the behaviourist learning paradigm. This is due to the growing realisation that behaviourist and psychometric approaches to learning which reduce the human being to either a 'bundle' of stimulus-respose reactions or a set of scores on tests or inventories, is essentially proving irrelevant to performance in higher education. (Entwistle & Hounsell, 1975; Entwistle, 1987). This realisation has brought about new formulations concerning both the focus of research and the methodology employed.

Recent research has focused on the institutional context within which students work, their perception of and response to assessment demands and teaching methods, and individual differences in the learning styles and strategies they adopt with particular learning tasks. This Phenomenological approach emphasizes:

i) The learner's own perspective on learning;

ii) The fact that learning always occurs in a specific context; and

iii) The learner is conscious of the learning act.

The phenomenological perspective thus emphasises understanding rather than prediction. Cloete (1984) argues that the behavioural paradigm is based primarily on finding instances of regularity, thereby concerning itself with 'how' events occur and thus neglects to address 'why' or 'how' things

happen. As argued in the previous chapter this approach relies essentially on correlation and has as its main task that of prediction. The phenomenological approach, however, seeks to "discover the connections between phenomena by acquiring knowledge of the underlying fundamental structures and mechanisms through which we constitute meaning." (Cloete, 1984; p 66)

Another major difference between the two paradigms is that whereas behaviourism insists that the subject be studied as objectively as possible, phenomenology calls for an understanding of learning from the learner's perspective. Thus the focus is "from the inside" rather than externalised observations. The consequences of this is that learning always occurs in a context, has a content and the learner is conscious of learning.

The implications of this conception for the present study is that by stressing the awareness of the learner, it implies that the methods and approaches utilised by students can be changed by intervention strategies. Thus the focus is not on static end-point conceptions of ability, where the sole aim is selection and prediction, but rather on intervention and understanding (Marton & Svensson, 1979; pp 72-73).

The phenomenological approach implies a change of methodological procedures. Whereas qualitative approaches stress the use of standardised psychometric tests, this approach has focused on how the learner approaches material to be learnt. In addition the research methodology employed within this research paradigm insists that the experiment resemble as closely as possible the natural setting of student learning.

Thus the content of the research is not mnemonics, nonsense syllables or mazes, but material that is as complex and similar as possible to that encountered in the educational environment.

According to Cloete (1984), a method that has been successfully applied is to request the learner to summarise complex and relevant educational material. He argues that:

> "Similar to a projective technique, this allows the learner to impose his/her own constraints on the order of recall and most important, it reveals the learner's subjective structuring of the material." (p 67)

Cloete argues that criticisms concerning subjectivity in terms of evaluation in this approach are invalid, as it is possible to achieve rigorous operationalization of concepts and acceptable levels of interrater reliability.

Marton and Svensson (1979) assert that the result of the new research paradigm is emancipation rather than symptomatic treatment by 'experts'. They argue that rather than prescribing trite rigid technicist procedures, an attempt should be made at raising the level of consciousness of the 'participants' in order to help prepare them better for future tasks. (cited in Cloete, 1984; p 69). Thus while behaviourist and neo-behaviourist paradigms emphasise the acquisition of skills, learning processing theory advocates awareness, purpose and emancipation.

3.4 INFORMATION PROCESSING AND LEARNING STRATEGIES

A major theoretical development within the information processing paradigm is that of approaches or strategies to learning. A review of this research, which has its roots in the phenomenological perspective described above, reflects an interest in describing not only the learner but also his/her institutional and extra-institutional environment; in other words the context of the learner. (Marton & Svensson, 1979). There is general consensus among most researchers that learning is a decision-making process in which the student chooses his/her method of studying, on the basis of a response to the conditions confronting him/her. (Entwistle, 1983). This idea of the availability of choices in approaches to learning has been supported by most contemporary researchers examining learning. (Biggs, 1979; Cloete, 1984; Pask, 1972; Marton & Svensson, 1979; Saljo, 1975; Svensson, 1976).

According to Marton and Svensson (1979) learning consists of three major dimensions, incorporating:

i) The notion that learning always occurs in a context and has idiosyncratic demand characteristics;

ii) The learner's own awareness of the act of learning; and

iii) that learning concerns itself with a specific content or subject matter.

Each of the above aspects of learning have developed into major research

areas in their own right. It is beyond the scope of this study to present the vast research findings into each of these areas. However, inasmuch as each area serves to highlight the paradigm shift that has occurred in research on learning - the main findings and implications for the present study will be examined.

3.4.1 LEARNING STYLE vs LEARNING STRATEGY

A number of theorists have attempted to describe a habitual framework from which students approach study material. Entwistle (1979) defines strategy as a way of choosing to tackle a learning task according to its perceived demands and 'style' as a broader characterisation of a student's preferred way. Pask (1976) draws a similar distinction between style and strategy. According to him the difference between the two terms can be described in terms of the conditions under which the two are exhibited. Strategy refers to the learning approach that a student employs when he/she works through a specific well-defined and structured learning material. On the other hand, style refers to more general procedures that a student adopts when studying. Thus behind a specific strategy lies a distinct learning style.

However, Pask developed this further arguing that some students show a 'predisposition' to adopt a specific strategy even though the task in question does not require that strategy. It is at this point that major differences between theorists emerge. Most researchers agree that students often exhibit a consistency of strategy across a range of everyday academic tasks and academic departments. (Cloete, 1984, 1989; Entwistle, 1984, 1987; Gibbs, 1981; Laurillard, 1979; Marton, 1979; Pask, 1976; Ramsden, 1979). This according to Entwistle (1987), has justified the notion of the existence of characteristic approaches to learning adopted by students. It is in the attribution of causality in describing habitual or characteristic approaches of students that differences between theorists have emerged. Pask (1976), for example, attributes the existence of a preferred learning style to a 'core' personality. According to him the core personality consists of stable, persisting traits. By implication cognitive or learning style is thus fixed and static, reflecting a predisposition to adopt a specific strategy or preferred way of learning because of fundamental personality dispositions.

This reductionist approach can be criticised for ultimately falling into static IQ type conceptions of ability. The logical outcome of this conception is that students would be unable to transcend their learning style. Thus, like the static IQ model, compensatory educational programmes would be irrelevant. Although advocating a consistancy in observed strategy, most theorists do not suggest that this is in any way immutable. Indeed as demonstrated above, strategy can be influenced by demand characteristics, learning context and student awareness. (Entwistle, 1987; Gibbs, 1981; Laurillard, 1979; Marton, 1979; Ramsden, 1979; Saljo, 1976).

Pask (1976) unwittingly implies that these habitual patterns inapproach to study are not immutable, by pointing to students who can move between learning styles depending on the particular context or demand of the task. He calls these students versatile learners. Unfortunately Pask does not elucidate on how these students come to be versatile in the first place. One can only conclude from his observations that some students can transcend these static fundamental personality dispositions.

3.4.2 LEARNING STRATEGIES

Ironically it has been the work of Gordon Pask in conjunction with the so called Goteborg group in Sweden that originally stimulated research into the learning strategies adopted by students in tertiary education (Gibbs, 1982). Pask (1976) found that when students were presented with material to study, distinctive approaches or strategies could be observed. He found he was able to distinguish between two distinct learning approaches adopted by the students. He named these 'holist' and 'serialist' approaches. He found that the serialists' moved step by step, adopted a narrow focus of attention, concentrated on one feature of the task at a time and were concerned with details rather than general principals. Holists on the other hand adopted a broader perspective, looked for interrelationships and analogies, while attempting to transform the information. According to Pask, holists examine the overall picture, while being able to describe relations between topics, while serialists focus on rules, methods and details but are unable to fit them together to form an overall picture. Pask argues that each strategy has its own disadvantage in that holists may over-generalise or look for inappropriate analogies, while serialists are unable to see the overall picture because they focus

on discrete details. Furthermore, as they fail to generate analogies they find it impossible to integrate knowledge effectively.

As stated previously, Pask (1976) described the 'versatile' learner as one who could apply both strategies depending on the demands of the learning task. This implies that although there is a stability of strategy across academic tasks, these approaches are not immutable but can be changed by direct intervention, changing contexts and the development of student awareness about learning.

Svennson (1976) developed a similar classification of learning strategies, and described atomist vs holist approaches to learning. According to Svensson, atomists focused on details and surface structure without integrating the information. They attempted to directly memorize the information in a sequential manner and were unable to ascertain the overall intention of the author. Follow-up interviews with the atomists revealed that they relied on memorising introductory sentences and attempted to visualise as much of the text as possible. The holists, on the other hand, reported that they attempted to understand the overall text, tried to grasp the authors' intention, attempted to integrate what they had read, indentified the main arguments with supporting information and facts and most importantly, tried to reach an independent conclusion or recognise the authors' conclusion.

On the basis of semi-structured interviews, Marton and Saljo (1976) have described learners as deep-level processors and surface-level processors.

"In the case of surface-level processing the student directs

> his attention towards learning the text itself (the sign), ie he has a 'reproductive' conception of learning which means that he is more or less forced to keep to a rote-learning strategy. In the case of deep-level processing, on the other hand, the student is directed towards the intentional content of the learning material (what is signified), ie he is directed towards comprehending what the author wants to say." (pp 7-8)

A similar classification was used by Entwistle (1987) working with the so-called Lancaster group. They described two major approaches to student learning, namely the 'deep' approach and 'surface' approach. He polarises the two approaches as such:

DEEP APPROACH

- Intention to understand
- Vigorous interaction with content
- Relate new ideas to previous knowledge
- Relate concepts to everyday experience
- Relate evidence to conclusions
- Examine the logic of the argument

SURFACE APPROACH

- Intention to complete task requirements
- Memorize information needed for assignments
- Failure to distinguish principles from examples
- Treat task as an external imposition

- Focus on discrete elements without integration
- Unreflectiveness about purpose or strategies

(from Entwistle, 1987; p 16)

Entwistle and his collegues identify another strategy, namely the strategic approach, however as argued previously, this approach is mostly a response to context factors previously discused. For example, the strategic approach uses "previous exam papers to predict questions". (Entwistle, 1987; p 16).

Thus there is general consenses among the observed differences in learning strategies of students. Although semantic differences are prevalent the general descriptive categories remain relatively consistant across theorists.

TABLE I

AUTHOR	STUDENT LEARNING STRATEGIES		
	I	II	III
Pask (1976)	HOLIST	SERIALIST	VERSATILE
Svensson (1976)	HOLIST	ATOMIST	---
Marton & Saljo (1976)	DEEP-LEVE	SURFACE-LEVEL	---
Entwistle (1987)	DEEP APPROACH	SURFACE APPROACH	STRATEGIC

A crucial component distinguishing holists from atomists in terms of learning outcomes involves the level of abstraction in understanding new, complex information. The focus is thus on the quality of what is learnt as opposed to how much is learnt.

It would appear that most theorists agree that a major difference between holists and atomists in terms of learning involves the transformation of information. Ford (1981), points out that an important indicator of transformation is the level of abstraction. According to Ford, the highest level of transformation consists of an integration of themes beyond the context of the original information and is accompanied by a questioning of the validity of the material. A second level of abstraction is where discreet information is brought together and substantiated by supporting facts. According to Ford this involves:

> "the identification of an underlying structure, whether in studying a text or learning about a complex topic, by means of which otherwise discrete arguments and details become integrated." (p 345)

This is an important component of university study in that students are often required to synthesise information from a variety of sources. Atomists and surface-level processors are typically characterised by the absence of any attempt to transform information. This inevitably results in an emphasis on details and a reproductive conception of learning, while the inability to synthesise discrete units of information often leads to confused and haphazard conceptions of the study material. Another major factor agreed upon as representing a fundamental difference between

atomists and holists, is that holists typically attempt to evaluate and reach conclusions regarding study material. A major issue concerning learning strategies is that the majority of researchers in the field do not conceptualise these approaches as static, predetermined personality traits, but rather as habitual patterns of study behaviour which have been developed through teaching, assessment and context factors.

In terms of their usefulness as indicators of consistent differences in learning, a review by Entwistle (1987) of learning strategies led him to conclude that there was nevertheless a consistency of approach across academic tasks.

> " ..approaches to studying could be viewed as relatively consistent individual differences...Interviews showed that, across a range of everyday academic tasks and across departments, most students showed enough consistency to justify describing approaches characteristic of individuals. Thus the operationalization of approaches to learning and learning styles through inventories measuring general strategies and processes could be justified ". (Entwistle, 1987; p17)

The important issue here is that it has been demonstrated by Ramsden (1979) that learning strategies can be modified by educational intervention programmes. In addition, it has been demonstrated that learning strategies are relatively consistent (but not immutable) across academic tasks, thus allowing for the identification of reliable research categories of student approaches to learning. As examined previously methods of classification and data collection differ from traditional

methods. One method of investigating learning strategies involves the use of semi-stuctured interviews while a more reliable and direct approach involves asking students specific questions and then to make a qualitative analysis of the answers. An application of this approach has been to ask the students to summarize study material (Dahlgreen, 1984; Wenestam, 1980). This method, according to Cloete (1984), has been proved to be effective and reliable (interrater reliability of over 80% reported). Learning strategies and their relationship with other varaibles, ie academic performance, can thus justifiably be examined. Most importantly research in this area has already demonstrated a link between learning strategies and academic success. (Cloete & Llowana, 1984; Entwistle & Ramsden, 1983; Svensson, 1976).

3.5 THE CONTEXT OF LEARNING

Studies which emphasise the 'context' aspect in learning have focused on how student approaches vary according to the demands of the situation. According to Marton and Svensson (1979), descriptions involving the context of learning have the longest and most extensive tradition of all the three components of learning already mentioned. Cloete (1984) points out that in the university environment, context usually consists of the demands of the 'evaluation system', the style of instruction, expectations from previous learning experiences and the type of learning material encountered. (p 74) According to Wilson (1981), the context of academic studies therefore provides the means through which the student gains an academic award. It is this fact, according to Ramsden (1979), that explains why students will attempt to turn themselves into the kind of person that the academic context demands. This aspect of learning has been

described by Entwistle (1987) as the strategic approach to learning, Entwistle argues that awareness of context demands often produces the type of student who:

1) Intends to obtain the highest possible grades;
2) Ensures that the conditions and materials for studying are appropriate;
3) Is alert to cues about marking schemes;
4) Uses previous exam papers to predict questions; and
5) Organises his/her time and distributes effort to greatest effect.(Entwistle, 1987; p 16)

Marton and Saljo (1976) point out how this strategic approach adopted by students can have a detrimental effect on learning. They argue that there is often a disparity between the stated requirements of academic environments and the actual requirements as perceived by students. Desirable academic demands are usually articulated as a call for creativity, competence and independent thinking, whereas students often perceive the demands as requiring memorisation, fact gathering, conformity and rote learning. They argue that certain schools and academic institutions often implicitly encourage 'surface approach' strategies in students to the ultimate detriment of those students. This is well illustrated by the work of Lurillard (1979) and Marton and Saljo (1976).

Marton and Saljo (1976) demonstrate how the demands for recall anticipated or the type of test anticipated after learning, are crucial for the level of processing that students employ during learning. They demonstrate that when students expect an 'objective' assessment after learning, this invariably leads to a superficial reproductive level of information

processing, whereas expecting an essay or oral test often leads to deeper creative information processing.

Marton and Saljo noted that although it was possible to influence the learning strategy used by students by altering the demand characteristics of a learning task, it was easier to induce surface processing than deep-level processing. Fransson (1977) demonstrated that students that customarily exhibited superficial rote learning type responses to learning material were unable to transcend this approach even when the demands were explicitly geared towards eliciting complex depth analysis of the material. Entwistle and Hounsell (1977) argued that it was often the structure and content of examinations that encourage rote learning and superficial reproduction of material. The implications of context determined student strategies for learning for tertiary education was demonstrated by Ramsden (1979), whereby he found that over 50 percent of first-year student subjects in a research sample could be classified as surface processors.

Thus research examining the context in which learning takes place has demonstrated a link between demand, perceived demand and outcome in academic performance. In South Africa this has important implications for tertiary academic selection and prediction. Slonimsky and Turton (1985), have pointed out that black education encourages rote learning and 'surface' approaches to learning. The analysis of context in learning thus encourages a context determined analysis of low performance in higher education, thereby challenging static, hereditary and cultural-difference theories of performance.

3.5.1 LEARNING AND AWARENESS OF THE LEARNER

According to Entwistle (1982), traditional research on learning has interpreted learning from the perspective of the educator. He argues that this approach is less useful than examining learning from the students' perspective. Research in this area has been based on interviews regarding students' ideas and beliefs about learning. On the basis of material elicted in this manner, Saljo (1979) found he could differentiate between two types of learners. He found that the first group took learning for granted and did not discriminate between learning and knowledge, the group's sole objective was directed at obtaining as much information as possible and reproducing it. The second group, however, tended to reflect on learning as a phenomena. To this group, learning consisted of more than simple facts or the transfer of discreet units of information. Saljo (1979) argued that these students perceived that learning could have different purposes, outcomes and usages, that is, they were aware of the need to adapt their learning to the situation or context.

Gibbs (1981) developed this argument, advocating that conceptions of learning underlay all aspects of study behavior. He argued that these conceptions were often deep-rooted and based on powerful experiences from school. Gibbs argued that to change conceptions or beliefs was a threatening experience, thus explaining the difficulty of surface and reproductive learners to change to meaningful 'depth processors'. The most important difference found in this area of research, according to Cloete (1984), was that certain students differentiated between learning and 'real' learning - namely understanding. Gibbs (1981) argued that it was obvious that:

"..the approach people adopt to learning tasks has to do with their conception of what knowledge and learning is ". (cited in Cloete, 1984, p 75).

The important issues raised above reflect the growing realisation of the importance of taking into account the manner in which students conceptualise the learning process. This research paradigm insists on taking cognisance of so-called 'unobservable behaviour' (ie, students beliefs and self-reflections) so vigorously excluded by the behavioural paradigm in its search for scientific objectivity. The learning processing research paradigm thus emphasises the personal independence and responsibility of the learner as opposed to objectification and the exclusive focus on the acquisition of study skills. In addition it has been demonstrated by Saljo (1975) that it is those students who know why they they do or do not take lecture notes who tend to be successful academically. He argues that this implies that it is not the method that is crucial but the students' awareness of why they are using any particular study technique. Placing emphasis on student awareness and learning outcomes implies that change is possible by intervening at the level of students' awareness. Thus the information processing paradigm is at odds with static immutable conceptions of ability.

3.6 LEARNING STRATEGIES AND ACADEMIC PERFORMANCE

Although it was never the intention of qualitative assessments of learning strategies to be applied to predictions of academic success, Svensson (1976) argues that the holistic approach is superior to the atomist approach. He claims that the atomistic approach does not lead to critical thinking as opinions are taken over uncritically and are based on superficial aspects of the problem. The holist approach according to him actively promotes personal knowledge and critical thinking.

As the learning strategies approach has been mainly descriptive, very little has been written about the relationship between learning strategies and academic success. However, the little that there is suggests a clear indication of a functional relationship between the two. Svensson (1977), for example, demonstrated that more than 80 percent of students at a Swedish university using a holistic approach passed their first term examinations while less than 30 percent of students classified as atomists performed similarly, Marton and Saljo (1976b) found that students who could effectively identify main points in study material did extremely well on a test of recall of the material, while those who had to be told what the main points were (similar to lecturers' notes) performed poorly on the same test.

Entwistle & Ramsden (1983) found that 76 percent of students classified as deep processors passed their degrees 'well', while only 23 percent of those classifed as surface processors obtained similar results. Cloete & Lolwana (1985) found that 63 percent of students classified as holists achieved good academic performance while only 31,8 percent of students

TABLE 2

RELATIONSHIP BETWEEN APPROACHES TO LEARNING AND STUDYING, AND EXAMINATION PERFORMANCE (FROM SVENSSON, 1979; SWEDEN)

COGNITIVE APPROACH		EXAMINATION PERFORMANCE		TOTAL
EXPERIMENT	NORMAL STUDIES	PASSED ALL	SOME FAILURE	
		n %	n %	n %
Surface	Surface	3 (23)	10 (77)	13 (43)
Deep	Deep	9 (90)	1 (10)	10 (33)
Deep	Surface	4 (66)	2 (33)	6 (20)
Surface	Deep	1 (1)	0 (0)	1 (3)
				30

TABLE 3

LEVEL OF APPROACH AND DEGREE RESULT (ENTWISTLE & RAMSDEN, 1983; B. N)

RESULT	APPROACH		TOTAL
	DEEP	SURFACE	
	n %	n %	
Good Degree	16 (76)	5 (23)	21
Other Degree	10 (43)	11 (52)	21
Total	26	16	42

Corrected $x^2 = 2,52$; $p < 0,06$

TABLE 4

RELATIONSHIP BETWEEN STRATEGY AND ACADEMIC PERFORMANCE (CLOETE & LOLWANA, 1984; TRANSKEI)

STRATEGY	ACADEMIC PERFORMANCE		
	HIGH %	LOW %	TOTAL %
Holists	21 (63,6)	12 (36,4)	33 (60,0)
Atomists	7 (31,8)	15 (68,2)	22 (40,0)
Total	28 (50,9)	27 (49,1)	55

Corrected $x^2 = 4,15$; df = 1; $p < 0,05$;
Kendall's Tau B = 0,31; $p < 0,01$

classified as atomists had comparable results. More important was the finding that more than 68 percent of those classified as atomists performed poorly in their academic work.

Miller and Parlett (1974) argue that the cognitive approach adopted during learning is the logical explanation of patterns of study which contribute considerably to academic success or failure. For example, they find an association between atomistic approaches and the number of hours invested in study time. They find that atomists tend to invest more time on their studies than holists. However as using an atomist approach means learning without understanding, which leads to a lack of motivation, the attempt to directly memorise the vast amount of required material is a nigh impossible task leading to discouragement and apathy towards study. Svensson (1976) argues that in fact most of the type of learning demanded in higher education is extremely difficult to tackle in an atomistic fashion.

The above findings therefore lead to the conclusion that the holist, atomist dimension in approaches to learning is a major deteminant of tertiay academic success.

3.7 AIMS OF THE PRESENT STUDY

The aim of this study is to try and identify those students who have the resources to succeed at university. It is suggested that this aim can be facilitated by using a qualitative method of classifying student learning strategies. This method involves the operationalisation of categories of student approaches to learning.

It is argued that this approach represents a fundamental paradigm shift in approaches to student selection and prediction. Unlike traditional psychometric approaches to selection that focus on static end-pont conceptions of 'ability', the learning strategies approach examines the underlying processes intrinsic to the acquisition of knowledge. Furthermore, if the study is successful, the findings will have important practical consequences in that the link established between success at university (presumably knowledge) and strategy will help dispel the ideology of innate notions of 'g', as a strategy is something which can be acquired and changed. Traditional methods of prediction based solely on correlation do not elucidate the essential constituents underlying success and consequently do not contribute to understanding or remediation. Selection using this approach will help identify vulnerability in student approaches to learning thus being in the position to meaningfully contribute to compensatory educational programmes which might seek to assist educationally disadvantaged students.

This is particularly important in the South African context where traditional predictors of academic success, ie school results, have demonstrated little or no relationship to tertiary academic success. Furthermore, traditional selection procedures have attempted to identify black students who will be successful at university <u>despite</u> their educational and socio-economic disadvantages. It is argued that selection based on student learning strategies leads not only to the identification of student vulnerabilities in the higher education process but also points to the manner in which the institutional context can best facilitate student success by adapting their own teaching strategies. This study thus proposes that selection, remediation and teaching could be a continuum,

rather than three seperate and discrete exercises as is the current situation.

Wilson (1988) after a review 19 articles on research into learning strategies states that most of these studies have focused only on the short-term effectiveness of the relationship between learning strategies and academic performance:

> " ..most learning strategies research seems to have a short temporal focus of 1 month or less, although a few studies extended over 3 months. One tentative conclusion to be drawn from this is that there is currently little knowledge about the long-term effects of learning strategies ". (Wilson, 1988, p 266)

According to Entwistle and Hounsell (1977), developmental differences in learning strategies are observable. They argue that children tend to move naturally from being rote learners by necessity, in which properties are accumulated and examples learned - to a later stage where learning tends to take on a different character when concepts can be learnt primarily by analogy. These observed developmental learning differences suggest that learning is a function of being exposed to certain experiences. Svensson (1976) has argued that an evaluation of earlier schooling methods reveals that schools tend to direct pupils towards atomistic conceptions of knowledge. Hence the finding that most Swedish and British first-year students are reported to be surface processors. The important issue in terms of development of strategies and learning to the present study is articulated by Perry (1970). Perry argues that in principle, all 'normal'

individuals are capable of equilibrium and reaching the highest levels of intellectual development in the learning situation, on condition that the social environment and acquired experience provide the subject with the necessary cognitive nourishment and intellectual stimulation. Perry maintains that an environment that offers support and challenge to students promotes cognitive growth. Perry argues that given the right conditions in higher education, students are likely to move from passive conceptions of their role in learning to more active, thoughtful, questioning and challenging roles as they progress through university.

Wilson (1981) argues that Perry's ideas correspond closely to that of the atomist-holist dimension. He argues that in accordance with Perry's ideas one would expect those students who are predominantly atomistic in approach to move from this approach in first year to deeper levels of processing as they progress through their academic careers. The argument here is that by being exposed to the demands of university education the students will be forced into restructuring their conceptual frameworks around learning and knowledge.

On the basis of the above arguments this study aims to examine the predictive strength of learning strategies and academic performance over a three-year period. In terms of the above arguments, ie that the university context should in itself bring changes in student learning strategies, we would expect the strength of correlations between original learning strategies and subsequent academic progress to gradually decline as students progress through their academic careers.

In terms of traditional research paradigms of tertiary academic

prediction, the present study also proposes to examine the relationship between a traditional test of intellectual functioning and academic success as well as to examine the relationship between school results and academic performance. These results will then be contrasted with the learning strategies approach. The implications of these results in terms of their respective paradigms will be examined and contrasted. Finally the implications of the findings of the major hypothesis and related issues will be examined in terms of their implications for tertiary academic selection.

3.8 STATEMENT OF HYPOTHESIS:

HA1: It can be expected that students using holistic approaches will perform significantly more successfully academically than those students using atomistic approaches

This statement forms the major hypothesis of this study, however, a number of related issues will also be examined as subsidiary analyses.
From research already mentioned it could be expected that school results do predict tertiary academic success.
HA2: It can expected that matric results are significantly related to academic success.

Previous research findings (Shochet 1986) would suggest that a traditional measure of intllectual functioning (DRT) would not predict tertiary academic success.
HA3: It can be expected that the Deductive Reasoning Test (DRT) is not significantly related to academic success.

CHAPTER 4

METHODOLOGY

4.1 Introduction:

The present study is aimed at the prediction of tertiary academic success, however, it departs from traditional research paradigms in this area in that the predictor variables are based on a learning processing paradigm, namely that of student learning strategies. This perspective as discussed in chapter 4 represents a change not only in the theoretical assumptions embodied in the research but also in the methods used in collecting data.

As argued earlier, this approach focuses on the learner's perspective, ie process orientated, rather than 'end-product' orientated. Common methodologies have been applied by Dahlgreen (1975), Marton and Saljo (1976a), and Svensson (1977). These studies set about categorising strategies of student learning on the basis of responses to learning material which approximated as close as possible the type of course work students would be confronted with at university. This was followed by semi-structured interviews in which students were asked to reflect on how they approached, transformed, memorised and integrated the material. This technique thus uses retrospective probing and in addition students were questioned carefully as to how they usually approached studying. On the basis of information gleaned from the interviews students were categorised into the respective learning strategy categories.

Cloete (1989) argues that:

> " This method is essentially a discovery process during which a hierarchy of similarities and differences appear. Whilst it does not allow for an objective, uniform analysis where all researchers will produce an exactly similar hierarchy of meanings, it does result in a 'rigourous qualitative analysis' which has consistently demonstrated interrater reliabilities of over 0.80 ". (p 9)

Although interrater reliabilities are high, a number of problems with this approach have been expressed. Svensson (1976) points out that students often misrepresent the learning processes they habitually use, instead describing what is seen as 'ideal' study behaviour. In addition, he finds self-report accounts are often at variance with the experimental results. Few students point to the fact that they concentrate on details and surface aspects while memorising information without understanding in their normal studying. Wilson (1981) argues that categorising student strategies on the basis of semi-structured interviews has its pitfalls in that students are often not clear about their study approaches and may not be faithful in describing their thoughts when going through a learning experiment. These problems illustrate quite clearly how subjective the interview approach can be as a method of obtaining information. Kerlinger (1973) in fact reports a low degree of validity and reliability of inferences drawn from interviews. According to him, interviewing allows for subjective judgments and for respondents to give answers which are perceived as being socially desirable.

A more reliable way of categorising student approaches to learning is that advocated by Wenestam (1980). Wenestam found that a useful approach was to get students to summarise learning material and then to make a qualitative analysis of the answers given. He found he could categorise the answers in terms of levels of abstraction.

Cloete (1984) argues that this is a useful and reliable method for categorising student learning strategies in that:

> " Similar to a projective technique, this allows the learner to impose his/her own constraints on the order of recall and most important, it reveals the learner's subjective structuring of the material". (p68)

Cloete argues that by using this approach it becomes possible to determine whether students attempt to transform the material, or whether they merely reproduce the material in a sequential reproductive manner. In addition, it allows the researcher to determine whether there has been a focus on understanding the author's overall intent, main arguments, logic and if the student has tried to reach a conclusion regarding the material. Thus the main distinguishing characteristics of learning approaches namely, understanding vs reproducing, can be elicited by this method. (Entwistle, 1987).

Another method that has been applied in categorising student learning strategies is that of the learning inventory developed by the Lancaster group in Britain. The Approaches to Studying Inventory was designed by the Lancaster group to 'assess sixteen subscales across four domains.'

According to Entwistle (1987) the deep and surface factors in the inventory "contain among their component items the defining features derived from qualitative research" (Entwistle, 1987; p18). Although some work using this inventory has examined the relationship of learning strategies and other factors such as motivation and personality, research into the relationship between learning strategies and academic success using this inventory remains unclear and ambiguous. The inventory was not used in the present study for a number of reasons:

1) It was felt that the inventory was susceptible to students' stated study habits as opposed to their actual study behavior.
2) It was felt that the inventory was too structured and rigid.

As the inventory is still under development it may be useful for future research to compare results from the quantitative approach (inventory) with the qualitative approach undertaken by the present study.

4.2 OPERATIONALISING LEARNING STRATEGIES FOR ACADEMIC PREDICTION

In accordance with the literature (Cloete, 1984; Marton & Svensson, 1979; Wenestam, 1980), students were given an article to read that approximated real learning conditions as closely as possible. As the sample was based on first-year Arts Faculty students, the text chosen to represent the learning material was taken from an introductory psychology text: Introduction to Psychology by Hilgard, Atkinson & Atkinson (1979).

The article chosen was on obesity. Students were asked to read and summarise the article. In addition two questions relating to the main

ideas and authors' conclusion were included to facilitate the coding into learning strategies. The article dealt with research into the causes of obesity. The content of the article dealt with four conflicting psychological theories about the causes of obesity. Three of these theories were delimited under separate sub-headings in boldface typing. The article ended with no specifically drawn conclusion beyond the notion that obesity was a complex problem. The article was judged suitable for experimental purposes for several reasons;

1) The subject matter was bound to be of interest to most students whether they took psychology or not;

2) The article was written in normal prose without extensive use of technical jargon; and 'Americanisms' were removed as far as possible.

3) It contained a combination of general theories as well as detailed information which was presented in both literal and graphical form.

Student summaries were evaluated by a trained rater who read the summary several times and indicated the extent to which characteristic attributes were present. These attributes are operationally defined in table 5 (p 80). A second rater then evaluated the same scripts after which interrater reliabilities were computed on the basis of agreement between both evaluations; 90% agreement was found. Once the summaries had been analysed in terms of the attributes students were categorised as either holists or atomists.

To qualify as holists, students needed to have made an attempt at abstraction and transformation of the material. In addition, they had to

TABLE 5:

SUMMARY OF ATTRIBUTES AND THEIR OPERATIONALISATION

Attribute	Operationalisation
1. Abstraction	Identification of an underlying structure/ integrating theme or presentation of the general principle.
2. Poor abstraction	Identification of part of the underlying structure or another minor principle.
3. Transformation	Restructuring of information i.e. grouping together information that seems to be related.
4. Main argument	Main points or main parts of the argument that determine the structure.
5. Supporting details	Information that supports and explains what has been identified as the underlying structure of main arguments.
6. Conclusion	Identification and presentation of the final remark/solution of the article. This can be either an own conclusion or the author's.
7. Sequence	Emphasis on the sequence of the test. Starting with the beginning or ending and attempting to reproduce the same order as in the article.
8. Irrelevant information	Introducing new information/interpretations which may be true but has not been presented in the text and no justification is given as to why it is included.
9. Discrete details	Facts that are disjointed without any apparent connections, sometimes presenting direct information.
10. Incorrect information	Text-based information but incorrect.
11. Confused	Mixing main arguments and supporting details.
12. Haphazard	Completely lacking in coherence, no meaningful sequence.

attempt to reach a conclusion based on the content of the article. Atomists on the other hand were characterised by the complete absence of any attempt to transform the material, attempts at reproducing sequence, and providing discrete details. On the basis of these exclusion/inclusion categories an interrater reliability of 0,9086 was obtained with significance at 0.001 level.

On closer examination of the categorised student summaries it became obvious that there still existed distinct quality differences between student responses within the two groups. On the basis of these observations it was decided to further sub-divide the categories on the basis of 'good' and 'poor'. This had the effect of making the learning strategies variable less crude in terms of a basic dichotomous split. The classification thus consisted of good and poor holists and good and poor atomists. The main distinguishing feature between the good and poor holists was that the good holists identified two or more main arguments which had supporting details or 'facts' and contained no confusing or haphazard sequences of information.

The main distinguishing features between good and poor atomists on the other hand was that the former were able to identify more main arguments, provided supporting details, had some sequence to the information, did not provide irrelevant information and had no haphazard information. Those students who were difficult to classify as either good or poor had their scripts rechecked and their answers to the additional questions were also examined, thus further facilitating clarification. On the basis of the four-level categorisation an interrater reliability of 0,7467 was achieved at the 0,001 level of significance. Thus the four-way classification

Table 6:

DISTRIBUTION OF ATTRIBUTES ACCORDING TO STRATEGY

ATTRIBUTES	STRATEGY			
	HOLISTS		ATOMISTS	
	H1 GOOD	H2 POOR	A1 GOOD	A2 POOR
	%	%	%	%
1. Abstraction	80	53	0	0
2. Transformation	20	47	0	0
3. Main Argument : 0	0	48	12	57
1 - 2	40	38	37	35
3 +	60	16	51	7
4. Supporting Detail: none	0	35	0	71
1 - 2	20	52	25	29
3 +	80	12	75	0
5. Conclusion	100	52	29	25
6. Sequence	0	0	70	7
7. Irrelevant Information: none	100	48	87	71
1-2	0	43	13	21
3 +	0	9	0	8
8. Discrete Details: none	70	30	13	7
1 - 2	30	48	50	14
3 +	0	22	37	79
9. Incorrect Information: none	90	87	50	14
1 - 2	10	13	50	64
3 +	0	0	0	21
10. Confusing	0	13	12	21
11. Haphazard	0	60	0	100

decreased the level of interrater reliability but remained strong enough to justify the subdivision within the group. Table 6 lays out the distribution of attributes for each subdivision.

On the basis of the above classification the following abbreviations were used to denote strategy:

1) Good Holist = H1
2) Poor Holist = H2
3) Good Atomist = A1
4) Poor Atomist = A2

From the above codings the overall categories would then be as follows:

1) H1 + H2 = Holists
2) A1 + A2 = Atomists.

4.3 DESIGN

Learning strategies have traditionally fallen into the phenomenological paradigm which emphasises descriptive categories of learning. This study proposes to go beyond purely descriptive categories and to attempt to predict university success from student learning strategies. The design is not a traditional treatment-assessment paradigm as there are no manipulations on the external condition. Instead variations expected in the results will be a function of variations in the internal states between and within subjects. The design thus consists of predictor variables and criterion variables.

The design involved testing subjects on a number of predictor variables,

then assessing the relationship of these variables with academic success (criterion variables). Criterion measures of success (university results) were obtained after six months, one year, two years and three years of study. The subjects, predictor variables and criterion variables will each be discussed in turn.

4.4 Sample

The sample of the present study consists of 118 first year white BA students. It is beyond the scope of this study to examine prediction across different faculties due to the vast logistics involved. The present study thus confines itself to the Faculty of Arts. In addition, the study only examines the performance of white students. The major reason for this is contained within the theoretical paradigm from which this study arises.

As discussed in chapter 3, the literature has demonstrated the extent to which the context of learning can affect student strategies to learning (Entwistle, 1977; Lurillard, 1976; Marton & Saljo, 1976b). On the basis of the above it is reasonable to expect that the majority of students emerging from the D.E.T. educational system could be atomistic processors. It would be problematic, however, to use this paradigm without extensive research into the effects of DET education on learning strategies. This research would also provide empirical evidence for these common sense assumptions.

Consequently the present study has focused only on white students who have had a relatively advantaged education. However, this does not mean that the learning strategies paradigm has no relevance for disadvantaged students - on the contrary it is suggested that this paradigm has major relevance for the problems of educationally disadvantaged students in the areas of understanding, remediation,

selection and prediction. In terms of disadvantaged students and tertiary academic prediction, it is suggested that learning strategies could be applied in a test-teach-retest design. These issues will be thoroughly examined in the discussion and conclusions section of this study. Entwistle et al (1977) has pointed to the major problems in obtaining a representative sample for tertiary academic prediction studies. He argues that most often these studies rely on volunteers, which means the sample is thus self-selected. Furthermore, the volunteers themselves are often more motivated than most students. These trends can thus make the sample unrepresentative of most students. Entwistle et al argue that wherever possible attempts should be made to assess non-volunteer students as part of the whole experimental sample.

The present study was able to overcome this problem by testing a number of waitlisted subjects as part of the sample. Waitlisted students are those students who did not have the necessary prerequisite school results to gain automatic admission to university and were subject to selection decisions. These students representing roughly 20% of the sample were thus compelled to undergo testing in order to gain admission to university. The remainder of the sample consisted of volunteer subjects.

4.4.1 Description of the Sample

The subjects thus consist of a sample of N = 118 white students registered for the first time in the Faculty of Arts in 1986. Table 7 shows the sex distribution for the sample. Table 8 shows the age distribution of the sample. As neither age nor sex is taken into account in selection decisions at Wits university neither of these variables are included as predictor variables in the present study.

Table 7:

DISTRIBUTION OF SAMPLE BY SEX			
MALE		FEMALE	
N =	%	N =	%
38	32.2	80	67.8

This table indicates that there are more females than males in the sample. This is, however in keeping with the general sex distribution in the overall BAI population.

Table 8:

DISTRIBUTION OF SAMPLE BY AGE

AGE	N =	%
16	1	0.8
17	32	27.1
18	53	44.9
19	12	10.2
20	5	4.2
21	5	4.2
22	4	3.4
23	3	2.5
27	1	0.8
28	1	0.8
41	1	0.8

This distribution shows that most students in the sample fall in the 17-19 years age range with a few older students filling the 20-41 age range (16.8 %). The mean age of the sample is 18.64 years old. Again this approximates the overall BAI age distribution.

With regard to school results the mean matric rating score is 28.33 with a range of 16-49 points, and a standard deviation of 5.95. The use of the matric rating conversion formula will be examined in more detail under predictor variables.

4.5 THE VARIABLES

4.5.1 Predictor variables:

In accordance with the traditional approaches to prediction it was decided to examine the predictive ability of both a traditional aptitude test and the school performance of subjects. Shochet (1986) asserted that "any attempt to find new selection criterion must obviously compare the predictive capacity of the new measures to the existing selection criterion. In the context of the prediction of university success, studies have classically attempted to find predictors that would improve on the school results." (Shochet, 1986; p 195)

4.5.2 School results

When this study was initiated the selection criterion in the Faculty of Arts was that of school results. Thus it was crucial to include this variable in the present study. For the purposes of this study it was decided to use the matric rating scale used by the Faculty of Arts. The matric rating scale at Wits University was calculated as follows:

TABLE 9:

MATRIC RATING CONVERSION SCALE

MATRIC SYMBOL	VALUE	
	Higher grade	Standard grade
A	8	6
B	7	5
C	6	4
D	4	2
E	3	1
F	2	-
G	1	-

To obtain the matric rating of any student the numerical values are summed up and results for English are given a double rating. For the purposes of this study the abbreviated variable name for matric ratings will be 'Matrat'.

4.5.3 Deductive Reasoning Test

In accordance with traditional approaches to tertiary academic selection, the present study has included a traditional intellectual test within the group of predictor variables. The test chosen is the Deductive Reasoning Test (B/112(a) developed by Dr J M Verster (1973) under the auspices of the National Institute for Personnel Research (NIPR). According to Verster (1973) this test is based on the principles of formal logic. The test examines the "relationship between premises and conclusions of a valid argument." (Verster, 1973, p.1)

It has been decided to use this test for a number or reasons:

1) The test represents the traditional model of intelligence testing, and has been normed on university students.

2) The content of the test is based on "verbal nonsense syllogisms", thus representing a tradition of psychometric and behavioural approaches to selection and learning, which emphasise detached cognitive abilities which seem to have little relation to academic learning tasks.

3) The test is verbal and in the English language. This is appropriate as success at Wits University, according to Schochet (1986) requires an

appropriate level of proficiency in the English language as assignments, lectures and exams are all conducted in English.

4) The test seems to have some face validity in that deductive reasoning could be related to the ability to reach conclusions (a characteristic of holists). However, how the test items might relate to tertiary academic success remains unclear.

5) In terms of the psychometric paradigm, the test has demonstrated both reliability and an appropriate level of complexity for university students, ie the test has been normed on white graduate students.

At face value then the Deductive Reasoning Test seems to be related to success at university in the absence of any information on the tests predictive validity academic success, this relationship will be examined.

The test consists of 36 items from which students must chose one correct answer out of five. For example,

ITEM 29. No bookkeepers are searchlights
Some chimneypots are searchlights
Therefore:

K. No chimneypots are bookkeepers
L. Not all searchlights are chimneypots
M. No bookkeepers are chimneypots
N. Some chimneypots are not bookkeepers
O. Some bookeepers are not chimneypots

See Appendix A for the instructions of the test. For the purposes of this study the abbreviated variable name for the Deductive reasoning Test will be: DRT. The raw scores of the Deductive Reasoning Test have been used in the present study and the range of the scores for the sample was 4-34 with a mean score of 19.31 and a standard deviation of 6.41.

4.5.4 LEARNING STRATEGIES

The description and operationalisation of learning strategies has already been dealt with. See appendix B for the learning strategies text and for the questions which followed the test. Table 10 shows the distribution of all categories of learning strategies for the sample. Table 11 shows the distribution of combined holists and atomist categories.

Table 10:

DISTRIBUTION OF ALL LEARNING STRATEGIES

STRATEGY	N =	%
H1	7	5.9
H2	6	5.1
A1	53	44.9
A2	52	44.1

Table 11:

DISTRIBUTION OF COMBINED LEARNING STRATEGIES

STRATEGY	N =	%
HOLIST (H1+H2)	13	11.0
ATOMIST (A1+A2)	105	89.0

For the purposes of the present study the abbreviated variable name for the learning strategies categories will be as follows:

1) The overall categories of learning strategies, namely holists and atomists, ie (H1 + H2) and (A1 + A2) will be 'COMB'.

2) The second learning strategies variable which contains all 4 levels namely, H1, H2, A1 and A2 will be named 'LS'.

See table 12 for a summary of the predictor variables and their abbreviations.

Table 12:

SUMMARY OF PREDICTOR VARIABLES

VARIABLE	ABBREVIATION
1. MATRIC RATING	MATRAT
2. DEDUCTIVE REASONING TEST	DRT
3. LEARNING STRATEGIES	
i) H1 H2 A1 A2	LS
ii) (H1+H2) (A1+A2)	COMB

4.5.5 CRITERION VARIABLES

The criterion measures for university success in this study are based on the university evaluation procedures. There are two major forms of evaluating university success and these will be discussed in turn.

4.5.6 Number of Credits Achieved

The criterion used by the Wits Faculty of Arts in terms of passing or failing first year is determined by the number of credits students achieve at the end of the year. Students may register for a maximum of four

courses and in order to continue at university they must pass a minimum of two courses. Each course passed earns the student one credit. Thus a first-year student can obtain a maximum of 4 credits or a minimum of two credits to pass the year. The credits variable also indicates whether the student attempted fewer courses than the maximum allowed. However, the weakness of examining the number of credits obtained is that it has a restricted range, that is, 1-4. Furthermore, it does not tell us how well a course was passed, but merely that the course was passed. For the above reasons another variable, namely average mark achieved, was examined.

4.5.7 Average Mark Achieved

The Faculty of Arts publishes each course result as a percentage. The percentage is made up of a 'year mark', which includes results from assignments, etc, through the year, and exam results. Students average year mark is thus computed by summing the percentages obtained per course and dividing by the total number of courses taken. This measure thus can theoretically range from 0-100 percent. However, the weakness of this measure is that an average mark can be obtained from one result, thus not reflecting whether the student passed or failed. For the above reasons it was decided to use both measures in conjunction with each other as criterion measures.

An issue that has been examined in chapter 3 is that of the dearth of studies examining the long-term relationship between learning strategies and academic performance. The present study therefore proposes to examine indicators of academic progress, ie, long-term success. These measures have to be based on the total aggregation of credits obtained over two and

three years, respectively. It is impossible to compute an average mark obtained at the end of the second and third years of study due to the infinite variations of course combinations possible. Many students drop courses while some complete the maximum allowed, some students may take up to five years to finish a basic three-year degree. Thus it is obvious an average mark will not reflect the student's progress, whereas the number of credits obtained reflects the number of courses passed and is consequently a better indicator of academic progress.

In view of the above criterion measures were obtained after six months (when students write their major mid-year exams) and the first, second and third years of study. As average mark obtained was still a meaningful criterion measure up to the end of the first year of study, Averages were computed for the mid-year exams, and their final first-year results. Thus the criterion measures of success are as follows:

Table 13:

SUMMARY OF CRITERION MEASURES AND THEIR ABBREVIATIONS:

	VARIABLE ABBREVIATION FOR MEASURE AFTER:			
CRITERION	6 MONTHS	1 YEAR	2nd year	3rd year
NO. OF CREDITS	JCREDITS	FCREDITS	CREDSEC	CREDTHIR
AVERAGE MARK	JAVERAGE	FAVERAGE	-	-

4.6 Procedures

The scoring of learning strategies, deductive reasoning and matric rating have already been discussed in previous sections. This section will thus focus on the sequence of testing and the testing conditions.

The testing session extended over two periods lasting one-and-a-half and one hour, respectively. Students were given a half hour break between sessions. During the first session the learning task was administerd to students. The second session involved administering the intellectual test, namely the Deductive Reasoning Test.

Session 1

Handouts of the learning material were given to all students and the following verbal instructions were given:

First of all I would like to thank you for being here and for agreeing to participate. You are going to take part in an experiment in learning. The reason for this is that we are interested in finding out how people learn the content of a text which they read. This is how the experiment will be conducted: You will be given a text to read and learn. We want you to study the text as you normally study for test material that has not been discussed in class. This is the article you are going to read. You can use this clean sheet of paper if you want to write down anything. You are free to write or mark anything on the article. You may read the article more than once if you want to. You will be given approximately 30 minutes to go through the text. You will be told when your time is up. I shall then give

you some questions on the content of the text, which I expect you to answer on paper. The text you are about to read is taken from an introductory course in psychology and I don't think you will have any major difficulties with it. Is there anything you want to ask? In that case you can start reading.

When the 30 minutes has passed students were handed out the following questions.

1) Summarise the article using your own words as far as possible.
   The summary should be approximately one page (1 words.

2) List the main ideas expressed in the article.

3) What is the author's conclusion?

See apendix C for the text.
After this session students were given a half-hour break before the next session.

Session 2

Students were handed out the Deductive Reasoning Test booklet (NIPR No B112a) and the Deductive Reasoning answer sheet. Students were then read aloud the standard instructions for the test as laid out in the test administrator's manual (see appendix B). They were then told to mark the test answers in pencil on the answer sheet provided. They were then told to begin and after 45 minutes were told to put down their pencils

whereupon the answer sheets were collected.

4.7 Testing Conditions

In order to contol for extraneous testing interference a number of precautions were taken to ensure ideal and uniform conditions in the test situation. Students were placed in alternative rows and seats during testing thus ensuring clarity of vision and hearing while minimising the possibility of copying. Clear and consistent instructions were given and assistance in the form of post-gradute students were provided to deal with any queries or problems the testees might experience.

4.8 Statistics

The 'Statistical Analyses System' (SAS) computer package, version 5.1, under licence of the University of the Witwatersrand was used to perform all statistical analyses on the data. The SAS system is an integrated system of computer programming software for data analysis. At Wits University the system runs on an IBM VM/SP mainframe under the 'CMS' operating system. The present study uses the SAS system as it carries all the statistical procedures needed for analysis.

The two learning strategy variables are both classified into discontinuous, categorical data. The criterion measure of number of credits obtained is also discontinuous, categorical data. Thus as the data for these analyses are purely nominal or classifacatory and therefore in

frequency distribution format, the obvious test to use to investigate these sets of relationships is the chi-square (χ) test. However, Mcnemar (1969) points out that the chi-square as a test of statistical significance only indicates the likelihood that a relationship exists, but does not reveal the strength of that relationship. To examine the strength of the relationship, the contingency coefficient that is routinely calculated by the SAS package will be used.

A requirement of the chi-square test that should be adhered to is that when degrees of freedom are larger than 1, the chi-square should not be used if more than 20% of the expected frequencies have counts which are smaller than 5. If this requirement is violated the data may be an overestimate which could lead to erroneous conclusions (Siegel, 1956).

According to Siegel (1956), a method for increasing the number of expected frequencies is to combine categories that have something in common. He argues that if this classification does not increase the expected frequencies a different test should be used. Siegel argues that the reclassification of categories should also be theoretically justified. Whenever there has been a reclassification of categories in the present study, this will be indicated and the theoretical rationale will be provided.

The second criterion measure is that of 'average mark obtained'. This is a continuous variable and thus a standard Analysis of Variance (ANOVA) will be used to assess the relationships between 'success' and strategy. In an extensive evaluation of learning strategies research, Wilson (1988) states

that:

> " ..it was concluded that the methods currently being used are probably appropriate, especially ANOVA techniques." (Wilson, 1988; p.273).

According to Runyon & Haber (1980), once the overall F-ratio is found to be statistically significant it is useful to determine the specific direction of significance in a variable with more than two levels by applying a multiple-comparison test. In this study the Tukey test for differences between pairwise comparisons will be applied to significant Anova's when using the 4-level categorisation of learning strategies.

To investigate the relationships of both Matric rating and deductive reasoning with academic success (average marks obtained), Pearson Product Moment correlations will be computed as both variables are continuous. An Analysis of Covarience (ANCOVA) will be used to assess whether matric rating has an effect on the relationship between learning strategy and academic performance.

Finally the assessment of the academic progress variables, ie Credsec & Credthir, with learning strategies will be evaluated by using a standard ANOVA test. This can be done as both variables approximate a normal distibution and thus the use of the Anova technique in this instance is appropriate (McNemar, 1969).

All significance levels in the study will be set at 0.05.

CHAPTER 5

RESULTS

5.1 Introduction

In this section a restatement of the major hypothesis will be given. The results pertaining to this hypothesis will then be examined over two time periods, namely the mid-year results and final first year results. Subsidiary hypothesis will then be examined under the folowing headings:

i) Intellectual functioning and academic success
ii) Learning strategies and academic progress.

5.2 Restatement of hypothesis

HA1: It can be expected that students using holistic approaches will perform significantly more successfully academically than those students using atomistic approaches.

This hypothesis will be investigated for both criterion measures after mid-year and at the end of the first year of study. The reason for examining both criterion measures is that the average mark obtained does

not reflect the number of courses from which the average was derived, while the number of credits obtained is a limited interval scale with a restricted range of 0-4.

5.3 MID-YEAR RESULTS

TABLE 14:

FREQUENCY DISTRIBUTION OF LEARNING STRATEGIES BY CREDITS OBTAINED AFTER MID-YEAR

		JCREDITS					TOTAL
LEARNING STRATEGY		0	1	2	3	4	
HOLISTS	N	0	1	3	8	1	13
	%	0	8	23	62	8	
ATOMISTS	N	16	28	19	29	13	105
	%	15	27	18	28	12	

N = 118.

X = 8.28; df = 4; p > 0.08

Contingency Coefficient = 0.25

Table 14 reveals that out of an entire sample of 118 students only 13 (representing 11% of the sample) could be classified as holists. The table also reveals that there are no significant differences between holists and atomists in terms of the number of credits they obtained at the end of six months of study. However, as discussed previously this result could be invalid due to the fact that more than 20% of cells have a count less than 5. Thus a one-way ANOVA which is not affected by unequal cell frequencies (McNemar 1969) was applied to examine the relationship between learning

strategies and academic success at mid-year. The result of the analysis is shown in table 15.

TABLE 15

ANOVA BETWEEN LEARNING STRATEGY (COMB) AND MID-YEAR AVERAGE (JAVERAGE).

VARIABLE	CRITERION	df	F Value	R-Square
Comb	- Javerage	1	8.48 *	0.06

* = significant at 0.05 level

The results of this analysis demonstrates that there is a significant relationship between learning strategies and average mark obtained by students in their mid-term exams. However, this relationship is not very strong as the R-square value is only 0.06. Although the hypothesis would seem to be accepted by this analysis it is important to examine the relationship between the four levels of learning strategies and performance at mid-year as the four levels of strategy are more sophisticated theoretically.

A major problem which arises out of the four-level classification of learning strategies (LS) is that due to the low number of holists in the sample we would expect to get a number of empty cells in the analysis. According to Siegel (1956), a method for increasing the number of expected frequencies is to combine categories that have something in common, in addition the reclassification of categories should be theoretically justified. In accordance with the above issues it was decided to regroup

the five levels (0-4) of the criterion variable credits obtained. This was theoretically justifiable as passing or failing first Year BA1 at Wits University is contingent on students obtaining a minimum of 2 credits. It was thus decided to split the 'number of credits obtained' variable accordingly. The new variable was named Jcreditsi and grouped as follows:

Variable	level	grouping	Status
JCredits1	1	Jcredits ≤ 1	Fail
	2	Jcredits ≥ 2	Pass

Table 16 shows the distribution of 4 levels of LS (H1, H2, A1 and A2) and Jcreditsi.

TABLE 16

FREQUENCY DISTRIBUTION OF LS AND JCREDITS1

		JCREDITS1		TOTAL
LS		0 - 1	2 - 4	
GOOD HOLISTS (H1)	n	0	7	7
	%	0	100	
POOR HOLISTS (H2)	n	1	5	6
	%	17	83	
GOOD ATOMISTS (A1)	n	12	41	53
	%	23	77	
POOR ATOMISTS (A2)	n	32	20	52
	%	62	38	

N = 118.

X = 22.95; df = 3; p ≤ 0.001

Contingency Coefficient = 0.40

The results of this analysis shows that when learning strategies are divided into four levels there is a significant relationship between learning strategies and academic success at mid-year. Furthermore, the contingency coefficient is equal to 0.40 demonstrating that this is a strong relationship. A closer examination of the distribution reveals that 100% of good holists obtained two or more credits, while 83% of poor holists also managed to pass with two or more credits. The findings for the atomists present a different picture in that 62% of poor atomists failed with one or less credits, although 77% of good atomists managed to pass two or more credits at mid year. An examination of the full frequency distribution (table 17) of Jcredits with the four levels of learning strategies reveals a stepwise pattern (see underlying) that moves from a majority failing (A2) to everybody passing (H1).

Table 17

FREQUENCY DISTRIBUTION OF LS BY JCREDITS

	JCREDITS				
LS	0	1	2	3	4
GOOD HOLISTS (H1) %	0	0	0	86	14
POOR HOLISTS (H2) %	0	13	50	33	0
GOOD ATOMISTS (A1) %	6	17	21	43	13
POOR ATOMISTS (A2) %	25	37	15	13	12

The relationship between the four levels of learning strategies (LS) and average marks obtained in June was then examined (table 18).

TABLE 18

ANOVA BETWEEN LEARNING STRATEGIES (LS) AND MID-YEAR AVERAGE (JAVERAGE).

VARIABLE	CRITERION	df	F Value	R-Square
LS	- Javerage	3	8.65 **	0.19

** = significant at 0.001 level

The results of this analysis reveal that there is a significant relationship between the four levels of learning strategies and average mark obtained in June. Furthermore, the R-Square value is 0.19 meaning that learning strategies are explaining about 19% of the variance in academic performance at mid-year. The direction of the significance regarding learning strategies was further examined by using Tukey's test for differences between pairwise comparisons (Runyon & Haber, 1980). The results are presented in table 19.

An examination of the results reveals that good holists (H1) did significantly better academically than the poor atomists (A2). Poor holists (H2) also do significantly better academically than the poor atomists (A2). Finally the table reveals that good atomists (A1) do significantly better academically than poor atomists (A2).

Table 19

PAIRWISE COMPARISONS BETWEEN CATEGORIES OF LEARNING STATEGIES AT MID-YEAR

LS Comparison	Difference between means	
H1 - H2	0.46	
H1 - A1	4.09	
H1 - A2	10.01	*
H2 - A1	3.61	
H2 - A2	9.53	*
A1 - A2	9.73	*

* denotes significance at 0.05 level

School performance and academic success at mid-year.

As stated previously the single best predictor of tertiary academic success historically has been that of school performance. In terms of the hypothesis it is thus necessary to examine the relationship between school performance (Matric Rating) and academic success.

A Pearson product moment correlation coefficient was used to examine the relationship between matric results and mid-year average while a one way Anova was used to examine the relationship between matric and the number of credits obtained at mid-year. These results are presented in table 20.

TABLE 20

CORRELATIONS OF MATRIC RATING WITH MID-YEAR CREDITS AND MID-YEAR AVERAGE

VARIABLE	JCREDITS	JAVERAGE
MATRAT n = 118	$F = 3.16$; $df = 4$ $p \leq 0.01$	$r = .28$ $p \leq 0.001$

The results of this table demonstrate that school results are

significantly related to academic success at mid-year. In the light of these findings it was crucial to examine whether learning strategies were not intrinsically related to matric results. Thus an Analysis of Covariance (ANCOVA) was run to determine whether the four levels of learning strategies still predicted academic success while controlling for the effects of matric. See table 21.

TABLE 21

ANCOVA BETWEEN LEARNING STRATEGIES (LS) AND MID-YEAR AVERAGE (JAVERAGE) CONTROLLING FOR EFFECTS OF MATRIC.

VARIABLE/CRITERION	df	F Value
LS/MATRAT JAverage	3	8.99 **

** = significant at 0.001 level

The findings thus demonstrate that although there is a significant relationship between school results and mid-year academic success, that this result is not confounding the finding that learning strategies are also significantly related to academic success. Indeed the results demonstrate that when controlling for school results learning strategies still manage to explain 19% percent of the variance. The above findings show that the hypothesis of this study can therefore be accepted.

5.4 Summary of mid-year findings

A brief summary of the findings at mid-year reveal that the two level classification of learning strategies is not significantly related to

academic success. However, this finding was confounded by the low frequency counts in the chi-square statistic. When this analysis was performed using an ANOVA technique it was found that there was a significant but weak relationship (R-square = 0.06) between learning strategies and mid-year average. The immediate conclusion from these results is that the two-level classification of learning strategies is a crude measure which is not particulary useful in predicting academic success.

The picture changes dramatically, however, when the four-level classification of learning strategies is used. A significant and strong relationship (contingency coefficient = .40) was found beween the four levels of learning strategies and credits obtained in June. In addition, an examination of the frequency distribution of learning strategies and credits obtained revealed a stepwise movement from everybody passing (Good Holists) to a majority failing (Poor Atomists). This relationship was further confirmed by the findings that the four levels of learning strategies are significantly related to the mid-year average. This relationship proved to be strong (R-square = 0.19) showing that learning strategies account for 19% of the variance in academic performance. Pairwise comparisons revealed that differences existed between, Good Holists and Poor Atomists, Poor Holists and Poor Atomists, and Good atomists and Poor atomists. The implications of this finding are that in terms of academic performance there is not much difference between the holists and Good atomists. This will be explored later in the discussion section. Finally it was found that learning strategies still predict well for mid-year academic success when the effects of school results are controlled for. This implies that learning strategies are independent of

matric results.

5.5 FINAL FIRST-YEAR RESULTS

From the above findings it was expected that the two level categorisation of learning strategies (Comb) did not predict final first year academic success. (Fcredits/Faverage). See table 22.

TABLE 22

RELATIONSHIP OF LEARNING STRATEGIES (COMB) WITH FINAL-YEAR CREDITS AND FINAL-YEAR AVERAGE

VARIABLE	FCREDITS	FAVERAGE
COMB	$X = 5.39$; df = 4 $p \leq 0.25$	$F = 1,79$ df = 1 $p \leq 0.1835$

The results of both the chi-square analysis with Fcredits and the ANOVA with Faverage, reveal that there is no relationship between the two level classification of learning strategies and academic performance. Although this relationship is significant (but weak) at mid-year, the results demonstrate that by the end of the year this relationship no longer holds true. However, as at mid-year when learning strategies are classified into four levels, significance is once again obtained (See table 23). Again because of expected low cell frequencies in the chi-square analysis, final year credits have been reorganised into a pass/fail division.

Variable	level	grouping	Status
FCredits1	1	Fcredits $\leq$ 1	Fail
	2	Fcredits $\geq$ 2	Pass

Author Culverwell David
Name of thesis Learning Strategies And Academic Success Of Undergraduate Arts Students. 1989

PUBLISHER:

University of the Witwatersrand, Johannesburg
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