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THE VALIDITY OF THE COGNITIVE ASSESSMENT SYSTEM (CAS) AS A FAIR DIAGNOSTIC INSTRUMENT IN SOUTH AFRICAN SCHOOLS

by

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Supervisor: Prof. J.C. Kok

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DEDICATION

To all those striving to improve the lives of children who face many obstacles, both material and academic.
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I would like to pay special tribute to the following people:

- my supervisor, Prof. J.C. Kok, for his ability to encourage and motivate me through this study. Thank you also for enabling me to maintain focus and keep up the momentum;

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- Finally, to my family, for their patience and support during this research project.
SYNOPSIS

Diversity is an important component of the South African society. Traditional standardised methods of assessment have been discouraged or abandoned, as they have been found to be discriminatory. Arguing for a systematic assessment process, Siegel (1999:307) states that the standardised methods are the best way to achieve understanding as to the reasons for the breakdown in learning and ensure effective intervention.

The objective of this study was therefore to establish whether the Cognitive Assessment System (CAS), a cognitive assessment tool, correlates and is a predictor of achievement in the South African context. In order to examine the validity of this claim, I selected 32 black, Grade 6 learners, from a school in a Northern Johannesburg suburb, to determine whether the scores obtained on the CAS, correlate and predict achievement in the areas of reading and scholastic work.

The quantitative research involved identifying correlations between three data areas, the CAS, Woodcock Diagnostic Reading Battery (WDRB), and the scholastic marks obtained from school subjects for December 2000 and June 2001.

As a result of this research and data analysis, high correlations were obtained between the three data areas. In addition the achieved scores of the WDRB were found to correlate with predicted scores taken from the learner's CAS Full Scale score. It was therefore concluded, that the Full Scale score of the CAS is predictive of achievement as measured by the six sub-tests taken from the WDRB.

The findings of this study thus indicate that the CAS cognitive assessment tool could, within certain limitations, be used in the South African context to improve diagnostic interpretations and subsequent interventions. The challenge remains for additional research to be undertaken to explore the diagnostic value of the CAS in the wider community.
THE VALIDITY OF THE COGNITIVE ASSESSMENT SYSTEM (CAS) AS A FAIR DIAGNOSTIC INSTRUMENT IN SOUTH AFRICAN SCHOOLS

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CHAPTER ONE

BACKGROUND AND INTRODUCTION TO THE RESEARCH

1.1 INTRODUCTION

"The structure and dynamics of assessment determine the quality of education offered to children. By the same token, the quality of assessment offered to the child affects the extent and quality of his participation in society" (modified from Pretorius, 1993:24).

In a country like South Africa, where diversity is an important component of society, traditional methods of assessment have been found, among other things, to be discriminatory in nature (Foxcroft, 2000). Contextual disadvantage and the negative cycle of poverty, health and special needs have become vital considerations when understanding the concept of learning difficulties in the South African context (Donald, Lazarus & Lolwana 1997; Archer 1993; Le Roux, 1994). Standardised assessment tools used in the past, with subsequent inappropriate placement of learners, is said to reflect "socio-economic, linguistic and cultural factors rather than psycho-educational factors" (Donald et al., 1997:277; Limbos & Geva, 2001; Lidz, 1994). In addition, there is a reluctance to use the traditional intelligence and norm based scholastic assessment tools that were previously used (Foxcroft, 2000).

The consequence of avoiding standardised tests, is the reliance and use of non-standardised type testing techniques, such as informal type assessments (Limbos et al., 2001:136). However, the reliability and validity of the informal and dynamic type strategies of assessment are also questioned (Deno, 1985:220). The concern raised by Lidz (1994:24) with regard to dynamic assessment, is whether the “assessors viewing the same performance arrive at similar conclusions and recommendations.” Donald et al., (1997:19), acknowledge that it is important that we do "not exclude from our concern, any special needs which arise out of ...individual disabilities or difficulties in learning. “ When faced with the challenge of understanding the child with learning difficulties, the advice provided is to use “accurate observation and identification of the specific difficulty” (Donald et al., 1997:298).

It is argued here, that by not adopting the use of a structured assessment framework, we continue to perpetuate inequality and discriminatory practices. One reason for this concern is
that practitioners do not have a defendable, researched, theoretical framework from which to structure observations, interpretations and finally design relevant intervention strategies. It is argued that this situation will make any intervention programme, subjective in nature, reliant on intuition, haphazard and have questionable validity. Siegel (1999:307), states that to identify whether there is a difficulty "one must use a systematic assessment of these academic areas." She goes on to mention that the standardised methods are the best way to achieve this understanding. The reasoning for this statement is, according to Siegel (1999:307), that with informal assessment, it is "impossible to know whether an individual has made the number and type of errors that are typical of his or her age group and whether these errors are atypical and unexpected, and therefore indicative of a problem."

The standardised assessment approach that has dominated thinking in the past, is based on the understanding of intelligence, as a fixed measurable general ability. Naglieri (1999b:3) argues that although the IQ tests of Binet and Wechsler have enjoyed "widespread use in the last 100 years," they have limitations. The major limitations in the South African context are that the tests are culturally biased and heavily dependant on exposure to prior learning and environmental factors such as language, culture and socio-economic factors. Ravaged by discriminatory policies of the past, 70% black South Africans live in a culture of poverty (Le Roux, 1994). They have experienced limited schooling opportunities, high illiteracy rates and are often second language learners, rendering these tests inappropriate and lacking in practical applicability (Groth-Mamat, 1997; McCloskey & Athoanasiou, 2000; Foxcroft, 2000). Wong (1989:469) also supports the need for practical application of scores obtained, but states that these test scores of Binet and Wechsler are "meaningless and not useful in instructional planning." Anti-testing sentiment has reached a new high as parents and practitioners search for ways to obtain information "regarding learning strengths and weaknesses for practical application" (Haney & Evans, 1999). Not only do these programmes need to be functional in nature, but also relevant in the South African context. This was clearly stated in the reports of the National Commission on Special Needs in Education and Training (NCSNED) and the National Committee on Education Support Services (NCESS), (1997:85) saying that "only tests which have proven usefulness in identifying barriers to learning and development should be used as part of the assessment process."

The Planning, Attention, Simultaneous and Successive (PASS) model of intelligence is a move away from requiring familiarity and proficiency of tasks, to the measuring of hidden cognitive processes used in the production of a task. This, according to Das, Mishra and Kirby (1994:4), allows for the understanding of individual differences and the needs of the children assessed,
emphasising “fairness and social value” (Das et al., 1994b:12). The application of this PASS theoretical framework to practical testing strategies has been achieved by means of a test called the Cognitive Assessment System (CAS). This test is individually administered and available for the age groups ranging from 5 years to 17 years. In evaluating the PASS, many tests have been conducted to assess its “practical utility and validity.” The findings are contained in more than 100 published papers and several books. ...summaries of these papers can be found in Das et al., (1994b). According to Kaufman (2000:14), the CAS is screened for bias and is an "excellent...theory based test." In chapter two an account will be offered of Luria’s research, "the most distinguished Soviet psychologist of our time" (Penguin Publishers, 1976)." This research forms the basis for the PASS model of intelligence and finally the CAS assessment tool.

1.2 STATEMENT OF THE PROBLEM

One of the important reasons for an assessment, is the practical applicability of results for intervention purposes (Kaufman, 2000; Leamer, 1993; Roodin, 1996; Das et al., 1994b:8).

There is therefore a need to establish whether the CAS assessment tool, based on cognitive processing, "is a good predictor of achievement" in the South African context (Naglieri & Das, 1997a:61). Should it be found to be a good predictor of achievement, it could then be used diagnostically to investigate reasons for breakdown in achievement. To establish the CAS as a possible predictor of achievement, the CAS needs to be correlated with an objective score derived from a recognised achievement test.

The problem therefore, is to probe whether, in a small sample of children, the Full Scale score obtained on the CAS correlates and predicts achievement in reading, as measured by an objective test, according to the claims of Naglieri et al., (1997a:61) and Das et al., (1994b:5). A correlation of .73 (Standard Battery) was found between the WJ-R skills cluster and the CAS Full Scale score in a previous study (Naglieri et al., 1997a:61). In addition a .50 to .67 (Standard Battery) correlation was found between the PASS scales and the WJ-R skills cluster (Naglieri et al., 1997a:61).

Additional correlational questions are posed to;

1. Identify correlations between the CAS standard scores and the WDRB reading achievement score for a few of the subtests and clusters.
2. Identify correlations between the CAS and school marks obtained in 2000.
3. Identify correlations between the CAS and school marks obtained in 2001.
4. Identify correlations between the WORB and school marks obtained in 2000.
5. Identify correlations between the WORB and school marks obtained in 2001.

1.3 THE PURPOSE OF THE RESEARCH

Without the aid of testing tools, practitioners in the South African context are reliant primarily on the observation and the making of inferences based on tests such as curriculum-based tests, learning potential measures, criterion-referenced tests, achievement tests and performance-based strategies. The purpose of this study is to try to establish empirically, whether the CAS assessment instrument could be a valuable source of information within the South African context. To be suitable, it needs not only to be able to predict achievement, but also needs to address current concerns about testing which could add value to the interpretation and intervention process.

The possible value as a diagnostic tool for practitioners could lie in the potential for it to assist in the understanding of "individual differences, ... provide a framework for assessment ... and link directly to theory-based remediation" (Das et al., 1994b). The purpose of this study is to explore the possibility of using the PASS framework of intelligence and the CAS as an assessment tool in an urban context for black, English second language pupils. This study, therefore, is a preliminary study to explore whether the results obtained could predict the academic functioning of individual learners, such that it can ultimately lead to a structured intervention programme.

The CAS assessment tool proposed here as a diagnostic tool for predicting academic success for the black urban South African child, was standardised in the USA. The data will be analysed purposefully to identify possible correlations among the three components, the CAS results, the child's own scholastic results and the achievement results obtained from the Woodcock Diagnostic Reading Battery, in order to establish correlational and predictive value of the CAS.

1.4 THE RESEARCHER'S VIEWPOINT

The researcher maintains that the CAS may be useful as an assessment tool with black urban South African children to provide insight into their cognitive functioning, if grounded in a
theoretically sound model of intelligence. In addition, the PASS framework of intelligence could help with the understanding of individual differences and the design of intervention programmes. Improved communication between professionals using this framework as a basis could ensure improved progress rates and could provide a framework for further research. The possible insights gained from this research may provide some degree of structure for testing, founded on an internationally recognised theoretical base to establish reliability and validity. Such a practice is not currently available for this group of children. This research therefore needs to be correlational in nature.

1.5 THEORETICAL ASSUMPTIONS FOR THE PROPOSED RESEARCH PROJECT

The last century saw the creation and development of various IQ tools. The "Stanford-Binet remained king through the 1940's and the 1950's. It was not until the 1960's that Wechsler's scales started to gain ground on and finally surpass the Binet" (Kaufman, 2000). The reason for this change, according to Kaufman (2000), was that it "was a practical, education-related, society-driven variable that facilitated the ascendence of the Wechsler approach." The strength of the Wechsler approach was that it gave the school psychologist a profile that permitted the identification of learning difficulties and some understanding of cognitive strengths and weaknesses. This would mean that practitioners would be better equipped to select the intervention required. The next wave of research involved neuropsychology and brain specification was followed by an anti-IQ testing wave. According to Kaufman (2000), the theoretical underpinning of test material became even more important, together with the practical applicability of results for intervention purposes. A test that fits this criterion is, according to Kaufman (2000:11) the CAS, developed by Naglieri et al. (1997b). The framework of this test is based on the research of Luria (1976) and of contemporary cognitive psychology. They rooted the CAS in the "three functional units of Luria (1976)." Another important influence, according to Kaufman (2000:12), has been the ability to factor analyse the various cognitive tests and the ability to use Flanagan and McGrew cross-battery analysis. Other advantages of the CAS are, according to Naglieri et al. (1997c:91), that it is not reliant on prior exposure or retrieval of facts and involves only a limited use of the English language. These factors are therefore important aspects of this research. Another important theoretical consideration is the view of intelligence as being modifiable, and not as an innate fixed factor.
1.6 KEY CONCEPTS DEFINED
THE COGNITIVE ASSESSMENT SYSTEM (CAS) AS PREDICTOR OF SCHOLASTIC ACHIEVEMENT FOR URBAN BLACK LEARNERS.

The main aim of this work is to identify whether the CAS is a predictor of achievement. For the purposes of this study, it is necessary to clarify what is meant by the following terms: CAS, prediction, achievement and urban black learner.

COGNITIVE ASSESSMENT SYSTEM (CAS):
The PASS theory was used as the basis for the CAS to provide an individually administered instrument for assessing cognitive functioning and was developed by Das and Naglieri (1999a:23). The cognitive processes involved are Planning, Attention, Successive and Simultaneous processing (PASS) and a Full Scale standard score, each with a mean of 100 and standard deviation of 15. These cognitive functions are regarded as interdependent systems that contribute to the understanding of each learner's individual cognitive differences.

PREDICTION:
Prediction is an inference made about school achievement based on the CAS assessment. This prediction is limited to current functioning as cognitive processes are regarded as modifiable. Therefore, any intervention will change the eventual outcome. Prediction based on a theoretical model, as with the CAS, provides an explanation and understanding of the learner's current functioning. It is, however, understood that prediction occurs within a context and that any change to the context, knowledge or experience, will alter predictive value (Das et al., 1994b:8).

ACHIEVEMENT:
Achievement, in this study, refers to the degree to which the learners have been able to meet specific English reading related criteria, measured by an outside source. The measure to be used is the Woodcock Diagnostic Reading Battery (1997). Achievement is viewed as dependant on the functioning of different cognitive processes, (Kirby, 1998:5). Another component of achievement refers to the learner's scholastic marks obtained for the year 2000 and for the second term ending in June 2001.
**URBAN BLACK CHILD:**

The urban black child, in this study, refers to black children living within a fifteen kilometre radius of Parkhurst Primary in Johannesburg, who have received schooling through the medium of English for a minimum of one and a half years.

1.7 STUDY PLAN

This study will be carried out by following a proposed framework:

**CHAPTER ONE:** This chapter will provide the background to the problem and the need for this research within the South African context. It will also cover the aim of the research, key statements and assumptions relevant to the study.

**CHAPTER TWO:** The relevant research literature will be reviewed to establish the theoretical framework for conceptualising intelligence, learning and the need for assessment. This framework will involve the modifiable PASS cognitive processes that can be measured by using the CAS. The research done, showing the ability of the CAS to predict scholastic achievement, using academic measures, will also be discussed. Ultimately, the aim is to establish a framework for understanding difficulties in learning experienced by urban black learners and possible intervention strategies.

**CHAPTER THREE:** This chapter will outline the research design, research procedures and the planned statistical analysis of the data.

**CHAPTER FOUR:** The data will be presented with the analysis and the interpretations gained by testing the set hypotheses.

**CHAPTER FIVE:** This chapter will provide a summary and conclusions, clarify the findings based on the results, and include recommendations for further research.
1.8 SUMMARY

The basic premises of this research project support the view of intelligence as involving various cognitive processes that are measurable using the CAS. Four cognitive processing areas of the PASS model together provide a Full Scale score that could predict the current academic functioning of the urban black South African child. The aim is to establish procedures for practitioners that might be of assistance in identifying underlying cognitive weaknesses causing the breakdown in academic functioning. The expressed aim is to establish a more specific, detailed profile about the area of weakness of a learner and to link this profile to specific areas of academic functioning. In this way, the class teacher or support staff could address by establishing a theoretically based intervention programme.
CHAPTER TWO

REVIEW OF THE LITERATURE: COGNITIVE PROCESSING AS A NEW MODEL FOR INTELLIGENCE

2.1 INTRODUCTION

This study attempts to meet the challenge of Haney et al., (1999:300) and identify an alternative assessment technique appropriate for addressing the needs of a culturally and linguistically diverse population of students. It is argued that ESL learners have in the past been inappropriately placed owing to their insufficient oral language proficiency (Limbos et al., 2001:136). These researchers are also concerned about the delay in the “diagnosing of learning difficulties for up to four or five years, to allow time for proficiency in the language to develop.” According to Limbos et al., (2001:136), this delay argue will “take away preventive opportunities and possibilities of instituting remediation strategies.” This study will begin by reviewing concepts of intelligence and assessment tools designed to measure cognitive functioning. The development of these assessment tools is briefly traced, and the research into cognitive and neuropsychology is incorporated. The notion of intelligence as a group of cognitive processes that are interdependent and modifiable is presented. One area of focus will entail the theory and research into the PASS (Planning, Attention, Successive, Simultaneous Processing) model of intelligence. Also explored, is the use of the CAS as a tool to measure the PASS cognitive processes. The ultimate goal of this paper is to provide clarity as to the possible usefulness of the CAS as an assessment tool for predicting and understanding scholastic functioning of the urban black South African learner. This is done in an attempt to improve strategies and quality of intervention.

Measurement techniques currently being used to identify the level of intellectual functioning for an individual, are the South African Intelligence Scale - Revised (hereafter abbreviated as SAIS-R) and the Wechsler Intelligence Scale (hereafter abbreviated as WISC). Researchers, (Das, Naglieri & Kirby, 1994; Kirby & Williams, 1998; Naglieri, 1999a; Kirby & Das, 1990) have proposed an alternative model for understanding intelligence that “redefines intelligence within the context of cognitive processes” (Naglieri & Rojahn, 2001:431). The existence of these processes is based on the neuropsychological research of Luria (1976) and cognitive psychology. The basic premise is that there are three functional units. They are modifiable and need to function harmoniously in order to perform specific achievement or scholastic type tasks.
Therefore, what is tested, is not content driven, but process driven (Groth-Mamat, 1997:143).

The SAIS-R and WISC are arranged according to a set of organised abilities (Das et al., 1994b:8). These tasks were selected by the researchers because they were found to reflect school type tasks and correlated statistically. It is argued that these tasks were not selected to reflect a researched theory of intelligence. They were selected because there was statistical correlation between the tests. This implies that they are predictive of school type tasks but not necessarily of a specific theoretical framework of intelligence (Das et al., 1994b:8; Kaufman, 2000). The abilities tested are conceptualised as a trait or characteristic of a person, which is not modifiable and can be observed in their handling of a specific type task. The tasks are arranged to reflect verbal and nonverbal functioning. An example of task clustering for these tests would be, that comprehension, maths problems and vocabulary provide insight into the individual's verbal ability. The test tasks are also arranged in a hierarchy of complexity, from task specific mental processes, to more generalised tasks. The tasks are then all grouped together, ultimately reflecting general intelligence (Kaufman, 1994; Groth-Mamat, 1997).

An argument against the above conceptualisation of intelligence testing as presented by Das et al., (1994b:8), highlights that some test items look at processing (memory, perception, reasoning) and others are measure product (comprehension and vocabulary). In her paper, Siegel (1989) puts forward a powerful and controversial argument supported by data, to show that the WISC does not identify those learners with reading difficulties. She argues that in fact, the cognitive processes required for reading are not tapped by the usual intelligence type tests.

Das et al., (1994:9) have also voiced these same concerns and propose that when trying to understand variations in intellectual performance, the focus needs to be on the interaction between the different cognitive processes. They claim that this cognitive processing involves the "voluntary implementation of strategies to complete tasks" (Das et al., 1994b:9). The aim is to plan intervention strategies to enhance cognitive processing skills and thus ultimately to improve learning. Das et al., (1994b:11) note that this modifiability of cognitive processes, will still occur within the context of an individual's specific cognitive processing limitations.

2.2 DISCUSSION ON INTELLIGENCE AND COGNITIVE PROCESSING

Much research has been undertaken in the area of intelligence. The understanding of intelligence as a fixed, measurable, general ability, has dominated thinking in the past. Naglieri (1999b:3) argues that although the intelligence quotient (IQ) tests of Binet and Wechsler have
enjoyed "widespread use in the last 100 years" they have limitations. According to Kaufman, (2000:8), Binet and colleagues "conceptualised intelligence as one's ability to demonstrate memory, judgement, reasoning, and social comprehension" which are tasks that are "primarily verbal in nature, to measure aspects of global intelligence." Another limitation considered by Kaufman (2000:8) is that these intelligence tests "represent a technology that has not changed since Binet and Simon introduced their first scale in 1905" and the changes that have been made have been only "cosmetic changes." Gunderson and Siegel (2001:49) maintain that over the years there have been many objections raised as to the fairness of the various IQ tests that have been developed. Nevertheless, "Stanford-Binet remained king through the 1940's and the 1950's."

In the 1960's, the Wechsler's scales became more widely used than the Binet. The reasoning provided by Kaufman (2000:9) for this change, was that it "was a practical, education-related, society-driven variable that facilitated the ascendance of the Wechsler approach." The strength of the Wechsler was that it provided the school psychologist with a profile that permitted the identification of learning difficulties and some understanding of cognitive strengths and weaknesses. This profile assisted the practitioners with decisions about programme intervention.

A learning difficulty was in the past, and is still often, conceptualised as existing when a learner's IQ score was discrepant with the lower achievement score. This situation was referred to as the "discrepancy definition" (Siegel, 1989:469; Kirby et al., 1990:34). Various assumptions about IQ-Achievement testing are explored in an article by Siegel (1989:469). These assumptions are whether "(1) IQ tests measure intelligence; (2) intelligence and achievement are independent, (3) IQ scores predict reading scores — children with low IQ scores should be poor readers and children with high IQ scores should be good readers; (4) individuals with reading disabilities of different IQ levels have different cognitive and information processing skills."

Various researchers agree with her findings that IQ tests cannot be used to predict achievement, explain achievement difficulties or identify the specific cognitive processes that cause these breakdowns in functioning (Gunderson et al., 2001; Siegel, 1989; Das, 1997; Naglieri & Readon, 1993; Kirby, 1998; Das, Mishra & Kirby, 1994a; Kops & Belmont, 1985; Kaufman, 1994). Put more simply, Das (2000:29) explains that a "child with an IQ of 80 is as likely to show up in a reading disability class or clinic as a child whose IQ is 120." McCloskey et al., (2000:212) agree, emphasising the assessment plight of "linguistically diverse children" and disadvantaged children whose academic success requires knowledge of school subjects.

McCloskey et al., (2000:212) and Stanovich (1989:487) are concerned that this assessment
strategy “may lead to misuse of tests and questionable diagnoses.” However Limbos et al. (2001:136) warn of the dangers involved in delaying assessment and the identification of learning disabilities, in learners who are learning English as a second language.

Research findings into higher order processes in the area of cognitive and neuropsychology research however, did not cause any marked change in the applied world of Psychology. This was owing in part, to misconceptions and misunderstandings (Lucas, 2001:6). According to Das et al. (1994b:4) “psychologists who missed the cognitive revolution entirely may not even suspect the great chasm between their testing methods and a theoretical framework needed to drive practice.” The theoretical framework proposed will, according to Das et al., (1994b:5), predict scholastic functioning using academic achievement measures. This process will provide insight into the learner's needs and the understanding of individual differences. Das et al., (1994b:4) go on to say that there needs to be a constant questioning as to the “fundamental assumptions made behind traditional intellectual assessment.” The first such testing instrument, investigation cognitive processing and cited by Naglieri (1999a:7), was by Kaufman and Kaufman (1993) and called the Kaufman Assessment Battery for Children.

The new wave of research which involved neuropsychology and cognitive psychology, brought with it an awareness that intelligence could be viewed as a collection of cognitive processes (Das, Kirby & Jarmen, 1979; Naglieri & Readon, 1993). Theoretical underpinning of test material also became an important area of focus with the practical applicability of results for intervention purposes (Kaufman, 2000). Another important influence, according to Kaufman (2000:12), has been that of technological advances such as the ability to factor analyze the various cognitive tests by making use of the Flanagan and McGrew’s cross-battery analysis. A test that fits the criterion mentioned in this paragraph, and is also able to predict scholastic achievement is, according to Kaufman (2000:11), the CAS developed by Naglieri and Das (1997b).

The CAS is rooted in the three functional units of Luria (1976). Das and Naglieri (1995:357) regard these three functional units as, “responsible for all cognitive activity” and claim that they are linked to the anatomical areas of the brain. Acknowledging the limitations of previous intelligence tests, the goal of the Cognitive Assessment System is to move away from the traditional IQ, general ability approach, to a “theory-based, multidimensional view, with constructs built on contemporary research in human cognition” (Naglieri, 1999b:7). Using the fields of neuropsychology and cognitive psychology, Das and colleagues have worked at developing a model of cognitive processing responsible for learning which is an alternative to the concept of a fixed general intelligence. The research of Luria and others into the area of intelligence has, over many years, caused a change in our understanding of intelligence. This
change in the definition of intelligence has caused the move away from behaviorist observable skills, to the measuring of hidden cognitive processes used in the production of the product (Kirby, 1998; Das, 1997; Das et al., 1994b; Mishra & Kirby, 1994; Naglieri & Readon, 1993; Eysenck, 1994; Siegel, 1998; Kirby et al., 1990). Luria's (1976) view of intelligence is that it is composed of different functional units which are the building blocks that provide the cognitive ability. Thus, success at the traditional type intelligence tests, favoured those learner's that had prior experience of that type of task.

Despite all these advances, the outcry over IQ assessment has not abated. Kaufman (2000:12) cites the call by Stanovich (1989) to rid the "clinical world of this pseudoscientific neurology that has plagued the field" and Siegel (1999) claims that "Scores on IQ tests are irrelevant and not useful and may even be discriminatory." This discriminatory factor and other assessment concerns were raised by Foxcroft (2000:2). Although not the focus of this research, some of the concerns raised were the power of the tester over the test-taker in situations of selection and placement, and the argument by testers that they had no option but to use test "measures that were not necessarily appropriate for all South Africans" (Foxcroft, 2000:2). In an attempt to address this, Foxcroft (2000:8) suggests the possibility of "adapting the most commonly used "foreign" measures for the South African context" and increasing the "capacity in test development.” Damico (1998) cited by McCloskey et al., (2000:215), does, however, make the point that no tests are truly non-biased. An assessment strategy investigated in this paper for the South African context involves cognitive processing, but more specifically the CAS as an assessment tool. Das et al., (1994a:240) provide empirical evidence showing that the functioning levels of various cognitive processes do identify and separate out various groups of learners. One example of this is that successive cognitive processing measures separated the dyslexic from non-dyslexic children, more effectively than IQ scores.

2.3 ARGUMENTS FOR COGNITIVE PROCESSING

Das, Naglieri and Kirby (1994b:xvii) argue for the need to establish a theoretical framework of intelligence before attempts are made at the assessment of cognitive functioning. The information gathered must then be applied in a practical sense to target specific areas of weakness and improve the learner's level of functioning.

Das et al., (1994b:12) propose an alternative view of intelligence. They claim that the predictor of success and ability involves a set of cognitive processes (Naglieri et al., 1997a:1). The application of this theoretical framework into practical testing strategies has been achieved by
means of the CAS which is individually administered. According to Naglieri et al., (1997a:1), the specific cognitive processes measured are Planning, Attention, Simultaneous and Successive (PASS) processing. This new view of intelligence and ability, maintains that these four areas of cognitive processing are what are needed "to alter the individual's base of knowledge" (Das et al., cited in CAS:2).

Roodin (1996:6) on reviewing the book by Das et al., (1994b), acknowledges the research involved in the development of the PASS theory, but also notes that for him, the model is a "somewhat static assumption of the rather complex understanding of contemporary neuroscience." However, the value for Roodin (1996:6) lies in not only its challenge of current concepts of intelligence but also for its practical applicability. According to Roodin (1996:341), the PASS provides a link between the theoretical structured understanding of cognitive processes and the educational intervention for remediation.

2.4 THE PURPOSE OF A COGNITIVE ASSESSMENT

Das et al., (1994b:6), state that assessment is not regarded as contentious if there is agreement on definition of what is being assessed and agreement as to the inferences that can be made from the data gathered. Intelligence testing has not however enjoyed agreement as to its construct or components (Das et al., 1994b:6; Groth-Mamat, 1997).

Assessment involves observation and the making of inferences. The inferences made from the results obtained have in the past been for prediction of achievement. Das et al., (1994b:6) view cognitive assessment as "measuring a set of intellectual characteristics at a point in time to predict how individuals will perform on other measures or at other points in time or to predict the environmental conditions under which they will perform best." When clarifying predictive value, Das et al., (1994b:7) maintain that it is predictive if there is no intervention. Thus, it is predictive of current functioning and therefore dissociated from the concept of a fixed intelligence. The boundaries identified, regarding prediction, relate to the context of the learner's world. If there is any change in the context, this will change the predictive value. Thus, for Das et al., (1994b:8) what is more important than prediction, is an explanation and an understanding of the learners functioning. With this theoretically based understanding, intervention strategies can be put into place to enhance functioning. Another important aspect of assessment, mentioned by Das (1992:139), is the need for normative values that are "culturally sensitive and take into account linguistic differences, as well as, in some cases, socioeconomic differences."
2.5 OVERVIEW OF A THEORETICAL UNDERSTANDING PROVIDED BY LURIA

Das et al. (1994b:12) contend that "intelligence is better viewed as cognitive processes" and they use Luria's clinical work and functional organisation of the brain as a way of conceptualising the important aspects of human ability. According to Ashman (1997:190), data evidence, supporting the findings of Luria, "has grown to a point where it is difficult not to accept" and which has spanned forty years of research (Das, 1992:139).

Kagan and Saling (1988:3) comment that Luria challenged the concept of cerebral specification where, a specific function could be located as being performed by a focal area in the brain. Instead, Luria developed the notion that the brain integrated functions in order to perform tasks. Luria (1976:30) stated that the classical idea of localization of mental function in the human cortex, needed to be reexamined. Luria (1976) did accept that for some elementary functions, there can be a precise localization in particular cell groups but that localisation in limited areas of the brain, for complex functions, was not possible. Human processes are according to Luria, "complex functional systems and that they are not 'localized' in narrow, circumscribed areas of the brain, but take place through the participation of groups of working brain units" (Luria, 1976:43).

Each of the three functional units identified, makes their own particular contribution in an integrated way and are necessary for all human activity. Luria's (1976:43) three functional units involve "regulating tone or waking, (secondly) for obtaining processing and storing information arriving from the outside world, and finally, a unit for programming, regulating and verifying mental activity."

Kagan et al. (1988:4) describe the three units as being divided on structure-functional grounds, with Unit One being the most primitive and a vital "prerequisite for all mental function" (Luria, 1976). This area "regulates arousal, ... the state of consciousness" upon which all the other cerebral processes are dependent for the optimal level of cortical tone. This structure is found in the "brain stem diencephalon, and medial surfaces of the cerebral hemispheres. The reticular activating system (RAS) is responsible for the continued cortical tone and communicates with higher cortical areas for continued updated feedback" (Naglieri et al., 1997a:44).

The remaining two units are "neocortical and lie on the lateral surfaces, or outer convexities, of the cerebral hemispheres" (Kagan et al., 1988:6). According to Luria (1976:67), Unit Two is responsible for the "reception, analysis and storage of information... and includes the visual (occipital), auditory (temporal) and general sensory (parietal) regions."

Kagan et al. (1988:6)
describe how each of these areas has three zones. The primary zones' function is "to mediate awareness of basic physical change in both the external and internal environments. Each of the three senses (vision, audition and tactile-kinaesthesia) has its own primary zone. The primary visual cortex, lying at the occipital pole of the brain, the primary auditory cortex lying in the superior region of the temporal lobe, and the primary tactile-kinaesthetic cortex, lying in the parietal lobe, immediately posterior to the central fissure."

Each of these primary zones has its own "specific secondary zone." According to Kagan et al. (1988:7), the "function of the second zone within Unit Two is the synthesis into organised perceptual wholes of the sensory information received from the primary zone. (An example provided are phonemes of language)."

Kagan et al. (1988:7), describing Luria's research, state that "all incoming information occurs within channels or systems that are specific to the type of energy picked up from the environment. These channels are called sense modalities, or in Luria's terminology, 'analysers'. Each modality consists of a sense organ peripherally, a sensory nerve or projection pathway, a primary cortex and associated secondary cortex. Thus, the process of sensation and perception proceeds along modality-specific lines. The three secondary cortices of the Unit Two, feed their information into a common tertiary zone that represents the most complex level of processing in Unit Two. The tertiary cortex occupies large areas of the parietal lobe and extends posteriorly into the occipital lobe and inferiorly into the temporal lobe. It is therefore able to integrate the functions of the three analysers/modalities. The tertiary zone is therefore not modality specific."

Thus, Kagan et al., 1988:8) explain that "processes such as visual, auditory or tactile kinaesthetic perception can be handled by individual analysers up to a certain level of complexity. For example, the distinction between phonemes or the sounds of language can be appreciated within the auditory analyser. However, there are many linguistic and cognitive processes which cannot be accounted for in terms of any particular modality, for example, the understanding of complex grammatical structures, the use of arithmetical operations or the appreciation of directionality. Processes such as these are dependent upon intermodal synthesis-function of the tertiary zone. Intermodal synthesis implies that qualitatively different kinds of information are simultaneously integrated."

According to the explanation provided by Das (1992:142), the coding in the second functional unit involves two variations, simultaneous and successive processing. "The simultaneous processing involves the arrangement of incoming information into a holistic pattern, or a gestalt
that can be surveyed in its entirety. Successive processing refers to coding information in
discrete, serial order where the detection of on portion of the information is dependent on its
temporal position relative to other material" (Das, 1992:142).

Unit Three is the executive of the brain, and is responsible for the control and evaluation of
action. Luria (1976:67) describes this as the "programming, regulating and verification of activity
characterized by complex reciprocal connections, both vertically, with lower levels of the brain,
and horizontally with the rest of the cortex." Cortical Zones of Unit Three also have the primary,
secondary and tertiary zones. According to Kagan et al. (1988:10), "the tertiary cortex of Unit
Three may be regarded as the most complex regulatory mechanism of the brain. In essence,
it assembles the information necessary for action, plans the broad framework within which action
is realised and finally verifies its effectiveness... based on information received from the tertiary
zone, the secondary zone of Unit Three programmes the specific details of action. In other
words, it determines the sequential structure, or in Luria's terminology composed the "kinetic
melody" of movement. Once movement sequences have been worked out, the primary zone
initiates the individual muscular contractions which are the physical manifestations of all action.

While each unit has a unique and specific function, cognition depends upon an intimate
collaboration of all three units and is subject to developmental changes. This is a "basic tenet
of Luria's theory" (Kagan et al., 1988).

2.6 THE PASS COGNITIVE PROCESSING MODEL

The PASS model involved integrating the work of Luria (1976) in neuropsychology and
integrating research done in cognitive psychology. The importance of the theory is highlighted
by Crocker and Algina (1986:6), who claim that "psychological measurement, even though it is
based on observable responses, ...(has) little meaning or usefulness unless it could be
interpreted in light of the underlying theoretical construct." This theoretical framework proposes
a structural basis for the understanding of cognitive processes whereby information is integrated
for learning.

This PASS (Planning, Attention, Simultaneous and Successive) model of intelligence makes use
of Luria's three functional units that are said to "work in concert, and necessary for any type of
mental activity" (Naglieri & Reardon, 1993:128).
The mode of input into the brain can be "visual, auditory, or kinaesthetic" (Das & Kendrick, 1997:194). This integration of information occurs in two possible ways and is called simultaneous or successive processing. These concepts will be clarified later, but for now successive processing refers to sensory information being provided sequentially. Simultaneous processing refers to information that is provided in its entirety. For further clarification, auditory input can only be presented serially, but with visual information this may be presented successively or simultaneously (Das & Vamhagen, 1988).
In summary, the first functional unit is responsible for regulating cortical tone and maintenance of attention, the second unit receives processes and stores information using simultaneous and successive information coding and the third unit programmes, regulates and directs mental activity (Das et al., 1994b:13). Knowledge base is another vital component of the functioning of the PASS processes and refers to the "sum total of a person's experiences...formal and informal educational background, habits and predispositions" (Das & Naglieri, 1995:356). This knowledge is obtained informally, formally and may be practical or theoretical but involves the "cultural and social background of the individual" which includes language usage to support thinking (Das et al., 1995:357). In the words of Das et al., (1997:195), "the PASS processes float, as it were, on a sea of knowledge; without which it would sink." There is therefore an understanding that "prior knowledge sets the limits on how incoming information can be coded" (Das et al., 1994b:54).

The output phase provides an indication of what has occurred throughout this process and is what is measured during an assessment process.

2.6.1 Unit One: Attention and Arousal

Unit one "maintains a proper state of arousal or cortical tone that allows for the focus of attention. Only when a proper waking condition is achieved can an individual receive and process information. Maintaining an appropriate level of arousal is especially important for effective activity since too much or too little interferes with proper information coding and planning. Appropriate levels of arousal also provide the opportunity for specific direction of attention. Insufficient performance of this first functional unit, therefore, leads to difficulty with information coding (simultaneous and successive processes) and planning, due to an under arousal or over arousal of the second and third functional units and difficulty in selective and organised responding" (Das, 1994b:13).

The first functional unit can according to Luria (1976:265), "be observed during organised selective behaviour ... but also by a whole group of symptoms which indicate a general increase in the level of preparedness or tone in the person." The identified symptoms include "changes in cardiac activity and respiration, constriction of the peripheral blood vessels, the appearance of a "psychogalvanic reflex, and the occurrence of desynchronisation phenomena (depression of the altho-rhythm), which are observed whenever attention is attracted by a stimulus or by some form of activity" (Luria, 1976:265). However, besides these signs, other signs revealing the specialized forms of activation of directed, selective attention identified by Das et al.
The mode of input into the brain can be 'visual, auditory, or kinaesthetic' (Das & Kendrick, 1997:194). This integration of information occurs in two possible ways and is called simultaneous or successive processing. These concepts will be clarified later, but for now successive processing refers to sensory information being provided sequentially. Simultaneous processing refers to information that is provided in its entirety. For further clarification, auditory input can only be presented serially, but with visual information this may be presented successively or simultaneously (Das & Vamhagen, 1986).
are "changes in cortical evoked potentials. ... (Various researchers found that) with the presentation of a special (visual, acoustic, tactile or nociceptive) stimulus evokes an electrical response (evoked potential) in the corresponding (occipital, temporal and central) regions of the cortex." An evoked potential is described by Das et al., (1994b:42) as "small changes in the EEG (electroencephalogram) that arise shortly after a stimulus has been presented. A particularly important feature for our purpose here is that the structure of these changes varies substantially depending on the intensity of the stimulus and on the subject's activity; a change (increase in amplitude) of the evoked potential may arise as the direct response to a sensory stimulus in the first phase of the evoked potential (after a latent period of 30-50 ms), while changes induced by more complex activity, such as by the analysis of information, arise in the late stages of the evoked potentials." Evoked potential was increased if an instruction was provided. Therefore, Luria (1976:271) maintains that "any complex form of attention, involuntary or more especially voluntary, requires the provision of other conditions, namely the possibility of selective recognition of a particular stimulus and inhibition of responses to irrelevant stimuli of no importance in the current situation. This contribution to the organisation of attention is made by other brain structures located at a higher level: in the limbic cortex and in the frontal region."

Thus, according to Das et al., (1994b:33), arousal is defined as a specific state of being active or alertness. Das et al., (1994b:35) state that a certain level of arousal is important for learning to occur but that, if it is too high, this would then cause "a narrowing of attention so that the individual does not take advantage of alternatives of responding, nor do they utilise the cues that might be presented before them."

Attention is defined as attending to something in particular. In clarifying this, Das et al., (1994b:33) see arousal as more sub-cortical and attention as being "controlled by the cortex particularly by the frontal lobe." A distinction is made between the various types of attention. The first is sustained attention which Parasuraman (1984) cited by Das et al., (1994b:36) describes as "the maintaining of attention to a single source of information for an unbroken period of time." The level of functioning in this area is affected by the length of the task and the frequency of signals. Selective attention may be at the receptive or expressive phase and is defined as either being focussed or divided. Das et al., (1994b:37) define focussed attention as being able to "attend to one source or kind of information and exclude the others, whereas in divided attention, the individual shares time between two or more sources or kinds of information or mental operations."

Tests for selective attention are the Stroop (Golden 1978) for receptive and expressive
attention, as well as Number Detection. Data driven selective tasks are those that require identifying characteristics and memory tasks, are those that require matching letter names (Posner). However, the selective attention tasks have three main components, mentioned by Das et al., (1994b:38) and they are "selectivity, resistance to distraction and shifting strategies." Both the Stroop and the Posner tests are, according to Das et al., (1994b:48), "appropriate measures of selective attention, in that both are measures of discrimination, selectivity and the ability to handle more than one task at the same time. Selective attention, therefore, needs planning and according to Das et al., (1994b:43), the "failure of selectivity is seen in impulsive behaviour of hyperactive children."

2.6.2 Unit Two: Successive and Simultaneous Processing

Das et al., (1994b:15), citing Luria (1966), discuss the functions of Unit Two. In this Unit, the function reflects the manner in which the external stimuli was received. The two variations are simultaneous processing defined as "integration of stimuli into synchronous and primarily spatial groups" and successive processing defined as "integration of stimuli into temporally organised serial order." Thus Das et al (1994b:18) note that the integration is not connected to the modality of the incoming stimuli but to the integration of the stimuli at the tertiary level of Unit Two.

2.6.2.1 Coding of Information Successively Or Simultaneously

The three aspects Das et al., (1994b:56) have identified as important for coding are the level of coding, the code content and the type of coding. Level of coding refers to the complexity of the material presented and involves the level of abstraction and inferencing required. The lower levels of coding could occur "automatically, without any conscious effort, while the higher ones require more effort."

Code content divides the content into whether it is verbal or spatial in nature. This is, however, different from the type of content. Type of content, according to Das et al., (1994b:59), refers to whether it involves simultaneous or successive processing. According to Naglieri et al., (1997a:4), simultaneous processing is a "mental process by which the individual integrates separate stimuli into a single perceptual or conceptual whole." The two dimensions considered in simultaneous processing are "both non verbal-spatial as well as verbal-grammatical activities." The successive processing, according to Naglieri et al., (1997a:5), involves a "mental process by which the individual integrates stimuli into a specific serial order that forms a chain-like progression."
Das et al. (1994b:52) discuss where the action occurs, where "incoming information is received, combined with prior knowledge, in the knowledge base, transformed according to prior knowledge and to the operating plan, and stored for later usage. The stored knowledge adds to the individual's knowledge base." If incoming information is complex, then this process will require effort and limit the amount of effort that can be expended on other aspects of the task. Part of this process requires storing of data for processing. This data may be held in short term memory (STM) or long-term memory (LTM). Das et al. (1994b:55) describe how with short term memory there is a limit to the amount of codes "that it can hold at any one time, estimating varying from four to seven." Thus, what works better, is if each of the codes can hold as much as possible, through a process of chunking and increasing the working memory space. The working memory is where the processing can occur. LTM has been described as forming our knowledge base.

Successive processing was found by Naglieri et al. (1993:131) to be the best correlation for those children with reading disabilities. However, this cognitive process is not tapped in the WISC for two reasons. The one reason is that the digits are a supplementary test and the other reason is that it is not, according to Naglieri et al., (1993:131), a pure successive process. The logical basis for this, is that it has a forward and backward component, involving other cognitive processes.

2.6.3 Unit Three: Planning

The third unit in the model is referred to as involving planning and being able to "provide the individual with the means to analyse cognitive activity, develop a method to solve a problem, evaluate the effectiveness of a solution and modify the approaches used....to provide an efficient and/or systematic approach to solving a problem ... The generation, selection and execution of plans are the three main aspects of planning" (Das et al., 1994b:17).

Various definitions have been provided by experts to define planning. For Luria, (1976:187) it is the part of the brain responsible for the "programming, regulation and verification of human activity." This, according to Anokhin, cited by Luria (1976:90), involves the "synthesis of external environmental information." Luria (1976:79) states that in response to incoming information, man "creates intentions, forms plans and programmes of his actions, inspects their performance, and regulates his behaviour so that it conforms to these plans and programmes; finally, he verifies his conscious activity comparing the effects of his actions with the original intentions and correcting any mistakes he has made."
The distinguishing feature of the prefrontal region of the brain, according to Luria (1976:84), is that it has a "very rich system of connections both with lower levels of the brain and with virtually all other parts of the cortex." These connections are two-way in character and, as described by Luria (1976:89) are "a superstructure above all other parts of the cerebral cortex, so that they perform a far more universal function of general regulation of behaviour than that performed by the tertiary area of the second functional unit." Luria also describes how in the human species the tertiary formation of this area "occupies one-quarter of the total mass of the cerebral hemispheres."

The impact on behaviour, after injury to the frontal lobe as manifested in fragmented and uncontrolled behaviour provides proof of the important role of the frontal lobes. Damage is seen in the disturbance of "impulse control, regulation of voluntary action and perception as in visual search...adversely effecting memory and the adoption of strategies, to manipulate symbolic symbols," (Das et al., (1994b:77). The frontal lobe, has also been linked to the activation and modification of cortical tone necessary for continued mental activity. This finding was linked to frontal lobe functioning, as impairment only occurred if there had been damage to the frontal lobe area. This cortical tone is, according to Luria (1976:198), important for the "formation of plans and intentions that are stable enough to become dominant and to withstand any distracting or irrelevant stimulus." According to Kirby and Williams (1998:68), planning for unfamiliar tasks is effortful. However, with time, this strategy becomes automatic requiring less effort stored in memory.

The processing required in the solving of a problem is diagrammatically well illustrated in the figure provided by Das et al., (1994b:18). For the problem solving processes the learner firstly needs to become aware that a plan is needed. Once this is achieved then a strategy is located from previous experience or a new one is developed. This process may require the gathering of additional information to devise a plan of action. Strategy level according to Kirby and Williams (1998:68), requires the use of a specific plan. Intervention at this level usually involves teaching specific strategies. The difficulty here is one of generalisation to other contexts. With regard to strategies, Kirby et al., (1998:215) demonstrate an exercise to show poor planning. This involves the memorising of different words. An efficient strategy would be to categorise the words. Kirby et al., (1998:215) maintain that if a learner with a learning problem is provided this strategy, their task performance does improve, indicating that the difficulty is related to the learner's automatic application of a planning strategy. They note that this difficulty is further compounded if the learner has previously experienced failure in that particular subject or if basic content knowledge is missing. This would contribute to what Kirby et al., (1998:216) have referred to as "learned helplessness" and the use of strategies such as "guessing, or waiting for
someone to supply the answer." The ideal, as seen with adult functioning, is the automatic use of strategies freeing up the working memory.

The attentional skills are of particular importance at this point, as the individual will need to select relevant from irrelevant information. The strategy of acquiring that information may be successive or simultaneous. Each time a plan of action is decided upon, there needs to be a process of evaluating and monitoring as to whether the strategy is working or not so that the task can be completed. In addition there is the level of selective attention. Selective attention skills enable the pupil to devote all his/her energies to the important components of the task. Kirby et al., (1998:68) identify this as selective attention that is controlled by planning and not the automatic type associated with Unit One. Difficulties at this level are described by Kirby et al., (1998:69) as being "impulsive, lacking in self-control, inattentive, distractable and that these can originate from planning and or attention difficulties." The selective attention has, according to Kirby et al., (1998:69), been found to improve with age and is therefore developmental in nature. However, there are negative consequences of school failure. A strategy suggested to improve this area is verbal self control where the learner is encouraged to verbalise out loud thought/metacognitive processes.

Das et al., (1994b:83) also discuss the concept of metacognition and its role in planning. In clarifying this concept, the opposite is clarified, as this is what is often the focus at schools. This involves the focus on content acquisition, "skills and procedural knowledge," but not the process or generalisation of that knowledge. A metacognitive level, involves thinking about one's thinking. In the words of Kirby et al., (1998:70), metacognition involves "the conscious awareness of ways of approaching tasks, of processing information and of monitoring success." In exploring the idea of intervention, Kirby et al., (1998:70) found that there is reason to believe that the deciding factor does appear to be the selective attention.

Kirby et al., (1998:71), claim that learners with learning problems have been found to have difficulties with metacognition. The difficulty lies in knowing whether the poor metacognitive skills have caused the low achievement, or whether the poor metacognition is due to poor skills development. It is thus proposed that activities that will promote metacognition should be part of an intervention programme. Kirby et al., (1998:218) reiterate that, because all the processes are interrelated, a problem in planning is "unlikely to exist in isolation." Information that is processed is done by utilising either the successive or simultaneous skills. Consequently Kirby et al., (1998:218) believe that a planning problem is also a processing problem. The types of planning problems identified by Kirby et al., (1998:220) are:

- a passive or misguided plan.
• employment of the wrong plan;
• loss of place within a correct plan;
• being unable to adapt and change a that is not working.

2.7 INTERACTION BETWEEN THE THREE FUNCTIONAL UNITS

Luria (1976:99) points out that "each form of conscious activity is always a complex functional system and takes place through the combined working of all three brain units, each of which makes its own contribution." When discussing perception, Luria (1976:100) states that all three functional units are necessary for perception. The first provides the necessary cortical tone, the second carries out the analysis and synthesis of incoming information, and the third provides for the necessary controlled searching movements which give perceptual activity its active character. This is, according to Luria, also relevant for voluntary movement and action. Movement requires a constant flow of impulses, providing information on the state of the joints and muscles, the position of the segments of the moving system, and the spatial coordinates within which the movement takes place (Luria, 1976:101).

Kirby et al. (1998:70) argue that the "entire cognitive system is involved in the production of intelligent actions and school achievement." By studying all the systems involved, a picture is gained of the learner experiencing learning problems. On reviewing literature, Das and Abbott (1995) state that each functional unit is distinct and that there is "support for the tasks specified to measure planning, attention, simultaneous and successive processing."

2.8 THE COGNITIVE ASSESSMENT SYSTEM (CAS)

The Cognitive Assessment System is based on the PASS model and was published in 1997 by Riverside Publishing. Das and Abbott (1995) cite the research that shows the validity of the CAS tasks (Campbell-Wachs & Harris, 1988; Mishra, Lord & Sabers, 1989; Naglieri, 1989; Naglieri, 1993; Naglieri & Das, 1997; Naglieri & Reardon, 1993). Kranzler and Keith (1999:30) do not however agree with the latter. Kranzler et al. (1999) used the Confirmatory Factor Analysis (hereafter abbreviated as CFA) to look at the various CAS tests. Based on their results, they maintain that "they do not support the construct validity of the CAS." Some of their findings are that the "constructs measured by CAS are overlapping and related and that planning and attention are virtually indistinguishable."
Kranz et al. (1999:28) also believe that "planning and attention are indications of processing speed" and that "successive scale is a measure of short-term memory." They are of the opinion that McGrew's (1997) three stratum theories are "an excellent framework for understanding the constructs measured by new intelligence tests such as the CAS." In response to theirs article, Naglieri submitted a manuscript that "went through a peer review process and follows the Kranzler article" (1999b:21). Naglieri's (1999:145) research article, sets out to provide data that is "contrary to suggestions made by Kranzler et al., (1999). Some issues covered are that of construct validity, that planning reflects strategy and not speed, and that the "CAS predicts achievement better than any test of ability." In addition, Naglieri (1999a:134) states that clinically, the CAS can provide a match between a cognitive weakness and achievement, awareness of discrepancies between cognitive processes and achievement and an explanation for the "academic problem."

The CAS has four scales matching each of the processing dimensions. Within each of these processing dimensions, there are three subtests scored for the standard battery and two if the basic battery is used. Naglieri (1999b) claims that this does not imply a hierarchical structure but provides improved score reliability.

2.8.1 Clinical Application of CAS

Learner's with learning difficulties have in the past been identified by a discrepancy between their ability, as measured by traditional IQ tests, and their "(low) level of achievement." This, according to Naglieri (1999a:135), implies that the "IQ test was not sensitive to an intellectual problem that might be responsible for the academic failure." The CAS is according to Naglieri et al., (1997a:9), "intended to predict academic achievement in children" and "differentiate exceptional children (e.g., those with Learning Disabilities and Attention Deficits" (Naglieri, 1999b:21).

The individual PASS Scales have relevance to successes and failures in specific areas of academic performance (Kirby et al., 1998) and are analysed by identifying three aspects. The first is a discrepancy between the higher CAS score and the low achievement scores, a consistency between the low achievement score and a matching cognitive weakness, and finally, "a cognitive explanation for the academic problem" (Naglieri, 1999a:135). Naglieri and Reardon (1993:130) in their comparative study of PASS processes and reading achievement, found that children with reading difficulties presented with significantly lowered pseudo words score which significantly correlated with their successive processing score.
Naglieri (1999), citing Naglieri et al. (1997a), provides data to show that children with Attention-Deficit Hyperactivity Disorder (hereafter abbreviated as AD-HD) were found to have "difficulty with planning (self-regulation, inhibition of responses, control of behaviour) as measured by the CAS. Attention sub-test scores are also expected to be low for these children, but especially for those with the inattentive type of AD-HD." Other groups of children who were identified, are the gifted and low ability children (Grabmeier, 1997). A systematic, sequential process is recommended for this analysis and starts with the analysis of the Full Scale Score.

2.8.1.1 Recommended steps to interpretation

Step one involves looking at the Full Scale Standard Score. The Full Scale Score is derived from equal weighting of all four cognitive processes and represents, according to Naglieri (1999a:26), an overall level of an individual's level of cognitive functioning. If, however, there is a significant variation in one of the processing scores, then the full scale is obscure, and deductions made "should be avoided." Consequently, if all four PASS Scale scores are similar and no significant differences are found, then the Full scale score is regarded as a good indicator of cognitive processing and the best overall predictor of achievement (Naglieri, 1999a). However, Naglieri (1999a:145) points out that the "total score is not intended to suggest that a hierarchical model is implied or to reflect general ability." All individual PASS scales and the Full Scale have a mean of 100 with a standard deviation of 15. Naglieri (1999a:27) emphasises that the "PASS scales and not the subtests are the focus of the CAS interpretation." For the Standard Battery there are 12 subtests and for the Basic Battery there are eight subtests. The mean for the subtests is 10 with a standard deviation of 3.

For step two the comparing of the four PASS standard scores provides a profile of the learner's strengths and weaknesses and relates to specific areas of academic performance. These scores compare the learners to the group on which the test was standardised. Confidence scores provide a range in which the child's scores are likely to fall (Naglieri, 1999a:72). For the 95% interval, it describes "the range within which a child's true scores are found 95% of the time."

The Ipsative method is then used to identify whether, any specific cognitive area is regarded as significant for that particular learner. This is done by using tables and comparing the mean score of the child to the four processing scores obtained. The significant score is then categorised as either a relative or cognitive weakness. A relative weakness is a score regarded as significant when compared to the learner's mean Ipsative score, but over 90. The term "significant cognitive weakness" is used if the obtained score is below 90.
Naglieri (1999a:80) argues that for step three, the subtests scores within each of the scales are compared and can be meaningful. The mean of the subtests is 10, with a standard deviation of 3. "The scaled score for the learner's subtests are compared to the child's mean" to determine significance. This according to Naglieri (1999a:82) would only be done to decide the weighting of one sub test on the score for that particular scale. However, according to Naglieri (1999a:82) reliability is lowered with subtests analyses and is not recommended.

Comparing the Full Scale and the PASS Standard Scores with Achievement scores is recommended for step four. Naglieri (1999a:84) notes that the CAS scores can be used "to help determine if the child's achievement is below expectations and to assist with interpretation and intervention." Two methods for calculation are suggested and can "discover if the child has a PASS cognitive weakness and an associated academic weakness."

2.8.1.2 Simple Difference Method

The simple difference method, described by Naglieri (1999a:85), involves comparing two scores (CAS + ACHIEVEMENT) to a tabled value, to identify if the difference is significant.

This strategy in the CAS involves identifying if the CAS "Full Scale or separate PASS Scale standard scores are significantly higher than his or her achievement scores" to identify if there is an ability-achievement discrepancy or consistency (Naglieri, 1999a:93). A higher ability score will then provide a discrepancy with a lowered achievement score. There may, however, be a link or consistency between a specific area of achievement and one of the cognitive processes. The CAS, therefore, allows the practitioners to decide if there is a cognitive explanation for an academic problem or if other factors need to be considered. In the past, a discrepancy between the IQ and the achievement level was used for this purpose. The difficulty with that approach was that it did not provide any specific idea as to where the breakdown was occurring and therefore inhibited intervention strategies.

2.8.1.3 Predicted Difference Method

The predicted difference method is regarded by Naglieri (1999a:94) to have less "psychometric limitations" than that of the discrepancy or consistency model. This involves the comparing of the results of both the CAS and the Woodcock Achievement tests and then the results studied through a process of four steps (Naglieri, 1999a:96).

a) First, the CAS scores are used to predict the achievement scores.

b) Next, the obtained and predicted achievement scores are recorded.

c) Thirdly, the differences between these two scores (predicted and obtained) are compared and ascertained whether it is regarded as significant by comparing them to
tabled values. If the value is equal to, or greater than, the tabled value, they are then regarded as significant.

d) Finally, this score is compared to the PASS scales in order to obtain insight into the possible cause for the discrepancy.

This is the strategy that will be used in the final stages of this research, to ascertain if the learners Full Scale score, as a group, was predictive of achievement, as measured by the WDRB.

2.9 CORRELATION BETWEEN THE PASS MODEL AND ACHIEVEMENT

The task of researchers in developing a theory of intelligence or an assessment tool is, according to Kirby and Das (1998:325), to provide comprehensive understanding of the theory. For Naglieri (1999a:123) "one of the most important dimensions of validity for a test of cognitive ability is the relationship to achievement. Whether one views intelligence as a general ability construct or from a multi-dimensional perspective (PASS theory), the prediction of achievement offers an important way to evaluate the utility of the test's performance. If there is a strong relationship to achievement without content overlap, then whatever the test of ability measures can be said to include variables that are important for scholastic performance. Moreover, high correlations with achievement would also suggest explanatory power for exceptional children, something traditional IQ tests have had a difficulty doing." This is why Siegel (1989), states that "IQ is irrelevant to the definition of learning disabilities." Kirby et al., (1998:70) utilise and link the PASS model of cognitive processing to areas of reading, spelling, arithmetic and mathematics.

Reading and other scholastic tasks involve many complex components, such as knowledge base, culture and various cognitive tasks. Kirby et al., (1998:83) describe eight interactive levels involved with reading. These involve the identification of various features that make up the letters, such as letter knowledge and matching particular letters with particular phonetic sounds. In addition, there are words which may be regular (phonetic) or irregular in nature (sight words) and stored in memory. Moreover, these are phrases, ideas (simple comprehension), main ideas and themes (underlying message). This bottom up process can also occur as a top down process causing the reader to "predict or expect" (Kirby et al., 1998:83). All these levels involve cognitive areas proposed in the PASS model. Furthermore, the automatic application at lower levels dictate the efficiency of functioning at higher levels.
Automatic functioning starts with what Kirby *et al.*, (1998:57) refer to as 'working memory.' Incoming information is screened at a pre-attentive level of information is selected for processing, it is then held in working memory. The difficulty is that working memory is limited in the quantity of information that it can hold. This is, according to Kirby *et al.*, (1998:55), the "core of the information processing system" and involves the data that "we are actively thinking about." The quantity held in working memory can be extended if it can be chunked into meaningful wholes. At this stage Kirby *et al.*, (1998:57) maintain that there are about twenty seconds of life for this data and that during that time, three different things can happen to this information. It can either be deleted, rehearsed to increase its life span, or recorded for storage in long term memory. This recoding involves creating meaning from the information so that working memory can hold more data.

In Kirby *et al.*, (1998:71) they diagrammatically represent their model of how learning problems are caused by cognitive difficulties in the "three functional units." The level one impact would be the attention and arousal level followed by planning. This would be followed by simultaneous and successive processing and eventually academic achievement, leading onto secondary implications. Each of these cognitive areas, according to Kirby *et al.*, (1998:71), impact on specific areas of academic achievement but the "higher the source of the problem the broader the problem."

**FIGURE 2: IMPACT OF COGNITIVE PROCESSES ON LEARNING** (Kirby *et al.*, 1991:71)
Naglieri et al. (1993:131) and Kirby and Robinson, (1987:243) therefore maintain that, the practical implication is that although "overall achievement may be effectively predicted by some combination of the PASS processes, that it is also possible to link cognitive deficits with specific areas of reading achievement. One such example is that "phonological coding appears to be best predicted by successive processes" (Naglieri et al., 1993:131). Siegel, (1999:307) identifies what she believes should be included in a reading assessment process. These are pseudowords for phonological awareness, word recognition and comprehension. According to Kirby et al., (1998:85) two areas of focus on reading breakdown have been "the letters-to-sound-to words area (successive) and words-to chunks-to propositions area (simultaneous)."

2.9.1 Correlation of Cognitive Processing And Reading Skills

Being able to link and understand the impact of the various cognitive processing areas to reading achievement, allows for improved intervention. For further reading, Kirby et al., (1987:244) has identified various studies that have "associated superior performance on reading tasks with higher simultaneous and successive processing skills (Ryckman 1981; Leong 1980; Kirby 1980; Das, Cummins, Kirby & Jarman, 1979; Randhawa & Hunt 1979; Das, Leon & Williams 1978; Kirby & Das 1977; Cummin & Das, 1977)." Kirby et al., (1987:244) cite research that found good readers use syntactic (simultaneous) cues to aid the extraction of meaning (Driver & Elkins, 1981; Fay, Trupin & Townes, 1981; Rousch & Cambourne, 1979; Watson & Clay, 1975; Kolars, 1972; Weber, 1970; Clay, 1968;). "Simultaneous processing has been more strongly related to comprehension and successive processing more strongly related to word decoding" (Kirby, Booth & Das, 1996:443). However, successive processing has been found in children with learning difficulties (Kirby et al., 1987:244, citing Krywaniuk & Das, 1978; Leong, 1980). Some of this research linking specific cognitive processes to aspects of reading, will now be discussed.

2.9.1.1 Poor Successful Processing

Das (1994b:240) cite the finding by Kirby et al., (1987) that children with dyslexia found successive processing particularly difficult. Successive processing has also been linked to decoding or phonological skills (Kirby et al., 1987:243 citing Kaufman & Kaufman 1979; Krywaniuk & Das, 1978). Naglieri and Reardon (1993:130) found that the "pseudoword reading scores were significantly predicted by successive processing." Siegel (1989:474) in her study, found that the pseudo-words of the Woodcock Word Attack subtest (Woodcock, 1973) was a better predictor of reading difficulties than the child's IQ score. Other successive processing measures found to be of value when looking at a learner's successive processing skills are "Word Series, Speech Rate and Naming Time."
Other tests that distinguished the dyslexic readers, involved "articulation or phonological coding: Expressive Attention (Stroop), Receptive Attention (name match) and Phonemic Segmentation (nonsense words) (Das et al., 1994a:240). Siegel, (1999:306) states that there is evidence available that clearly shows that "adults with dyslexia have deficits in phonological processing." When looking at successive processing, what is tested is the successive memory span of working memory (Kirby et al., 1998:166).

Specific reading achievement areas identified by Kirby et al., (1998:161) which link with poor successive processing are: lack of word analysis skills; inability to 'sound-out' unknown words; guessing of words from context and/or first letters; lack of comprehension of syntactic structure; failure to realize importance of word order; failure to read with 'expression,' failure to form syntactic chunks and lack of comprehension of story sequence.

Kirby et al., (1987:243) cite Luria stating that "syntactic skills, that is, knowledge of rules governing the way words are sequentially arranged into sentences, are based largely on successive processing." In an article by Aaron, Joshi and Williams (1999:130), they found that a major portion of poor readers had poor phonological skills. Poor successive processing could, according to Kirby et al., (1998:71), "affect word analysis in reading, resulting in overemphasis on visual cues in spelling and inability to follow a plan in problem solving."

2.9.1.2 Poor Simultaneous Processing Skills

"The essence of simultaneous processing is that a number of independent elements are present at the same time in working memory, such that the relationships are observed between them" (Kirby et al., 1998:181). They go on to claim that simultaneous tasks are evident in spatial and verbal tasks. Another aspect found to require simultaneous processing is inductive and deductive reasoning (Kirby et al., 1998:166). In research, Naglieri and Readon (1993:130) found that with students that were not experiencing reading difficulties, their highest correlation involved simultaneous processing and pseudowords. However, reading difficulties attributed to difficulties with simultaneous processing involve; "failure to recognise sight words or word shape cues; failure in interpret word meaning; failure to interpret sentence meaning; and failure to interpret passage meaning" (Kirby et al., 1998:188; McLeod, 1978 cited by Kirby, 1990:326).

2.9.2 Poor Planning

Kirby et al., (1998:211) reiterate that planning is the "end result of integrated functioning of the attention, processing and planning systems." For practical reasons, they divide planning into the three aspects of selective attention, strategies and metacognition. In a study by Kops and
Belmont (1985:13), it was found that the group with reading difficulties were slower than the other children and did poorer than them on the non-language maze task. Other implications of poor planning, suggested by Kirby et al. (1998:219) are: no plan, employing the wrong plan, loss of place in the plan, and an inability to switch a plan for a more effective one. Specific to reading, planning difficulties are seen with, "inability to switch word identification strategy according to task; inability to employ second or third word identification strategy if first fails; 'recognition' of incorrect word; not corrected after further reading; inability to extract main idea or theme stated or implied in the passage."

2.9.3 Poor Arousal / Attention

In the area of attention, difficulties with attention may be identified according to Kirby et al., 1998:135) by "excessive movement; impulsivity; distractability; short attention span; aggressiveness; social immaturity; poor peer relationships.

2.9.4 Knowledge Base And Culture

Within this model there is recognition of a knowledge base which Das et al., (1994b:19) refer to as the "cumulative result of a persons experiences... gained through formal and informal means." The development of these higher cognitive functions requires, according to Vygotsky, (cited by Das 1995:94) an interaction of the learner with his or her environment. This interaction involves social and cultural aspects, conveyed through language. Das (1995:94), citing an article by Tomasello, Kruger and Ratner (1993), identifies three types of cultural learning, imitative, instructed and collaborative. Through these various types of learning, the child constructs a meaning of reality. So, for Das (1995:96), the development of intellectual functioning "proceeds within a context of cultural learning." The extent to which a child has taken on the cultural learning and higher cognitive tools of his or her environment, will influence the development of intellectual functioning. Thus, learning problems can stem from factors other than information processing and this would involve a "lack of knowledge relevant to the particular content area" Kirby et al., (1998:72).
2.10 RESEARCH ON THE IMPACT OF INTERVENTION USING THE PASS READING ENHANCEMENT PROGRAMME (PREP)

The research study of Carlson and Das (1997:98) provides results that show "substantial improvement." In addition, Das, Mishra and Pool (1995b:67) cite other research articles supporting the effectiveness of the intervention programme at improving cognitive processing and reading skills (Kaufman & Kaufman, 1987; Snart & Das, 1984; Brailsford, Snar & Das 1984; Crawford & Das, 1984; Krywaniuk & Das, 1976).

2.11 RESEARCH TO SUPPORT VALIDITY

In response to an article by Kranzler et al., (1999), Naglieri produced a paper entitled "How Valid is the Pass Theory and CAS?" to provide empirical evidence as to the validity of the PASS theory and the CAS. The aim of the paper by Naglieri, Das, Stevens and Ledbetter (1991) was to clearly demonstrate that the four-factor PASS model provided the best conceptualisation of the underlying interrelationships among a set of tasks administered to a sample of 247 individuals ranging in age from 5 to 19 years. According to Das et al., (1994b:25), the results were replicated in other studies, again finding that the PASS was found to be a better fit than "Verbal-Nonverbal, Memory-Reasoning and "g" alternatives. Das et al., (1994a:240) also provide empirical evidence showing that, successive cognitive processing measures, separated the dyslexic from non dyslexic children better than IQ scores. Das et al., (1994b:26), thus claim that not only does the PASS model provide a theoretical framework for conceptualising intelligence and cognition, but also provides a theoretical model for an analysis of school achievement. It was also found that Simultaneous and Successive processing complements the work of Luria. These findings were published in Das (1972) and in Das, Kirby and Jarman (1975, 1979). Of particular interest to this research is that Das et al., (1994b:23) report a vast body of research supporting the idea that these processes are evident across cultures, language and socio-economic groupings.
This chapter provided a brief history of intelligence testing. It was argued in this section of the study, that traditional IQ assessments are irrelevant when trying to define learning difficulties (Siegel, 1989; Das et al., 1994a). The work of Das, Kirby, Naglieri, and Kaufman who advocate the need for a theoretical framework of intelligence was investigated. These researchers reason that this is imperative to drive an accredited concept of intelligence which will lead to the development of an aligned cognitive assessment tool. The extensive research of Luria was used by the above researchers in the development of the PASS model of intelligence.

The design and research into the CAS was presented within a theoretical framework. Also covered was the research showing that the CAS correlated and predicts academic functioning. The greatest asset being the linking of scores obtained from the CAS to intervention and remediation. The concerns of Kranzler et al., (1999) as to the validity and reliability of the CAS were also discussed.

The value of this chapter has been the increased awareness of what is available internationally in the area of cognitive processing and assessment. This could lead to the incorporation of assessment and intervention tools by professionals in the field, based on sound theoretical principles (Das et al., 1995a).
CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In chapter two, a review of the relevant research literature was presented pertaining to perspectives on intelligence. Also covered was the research in neuropsychology and cognitive psychology with particular emphasis on the work of Luria (1976). As a result of the latter research, the PASS model of intelligence was designed. The CAS assessment tool was then developed to measure cognitive processes that are regarded as modifiable. The focus of this research involves investigating the possibility of the CAS being a predictor of achievement for the urban black learner.

This chapter will focus on the process used for this research, including statistical methods, instruments used, the variables involved, sample selection, consent obtained, data collection, and limitations. This quantitative research is being done, in an attempt to identify a standardised cognitive test that may predict achievement for the urban black learner.

3.2 QUANTITATIVE RESEARCH

This research has been conducted quantitatively and involves the allocating of a number or a score to an identified variable with the intention of being able to compare those variables. The allocation of a number is regarded as an "orderly method of making an observation, that is converted into a standardised, equal sized units" (Wright, 1976:45). These equal sized data units are usually represented by numbers and reflect certain assumptions about the world (Vockel & Asher, 1995:453).
3.3 INSTRUMENTS USED

The two instruments used in this study are two normed measures, the CAS and the WORB. The WORB is acknowledged by Siegel (1999:310) as an "appropriate tool for identifying a reading problem." The one non-standardised instrument involves the learner's school subject results, at the end of December 2000, and June 2001. The data obtained from the three instruments, are to be correlated to establish whether the CAS assessment tool correlates with achievement, (as measured by an objective instrument, WORB), and the learners' school subject results. Finally, the CAS Full Scale score will be used to ascertain the predicted WORB scores, using tables in the CAS manual (1997:209). The predicted scores will then be correlated with the achieved scores, to establish whether the CAS can be said to be predictive of achievement.

3.3.1 Cognitive Assessment System (CAS)

The CAS is an individually administered cognitive processing test for children aged 5 to 17 years. It is organised into four scales (Planning, Attention, Simultaneous and Successive) according to the PASS theory and a Full Scale standard score, each with a mean of 100, and a standard deviation of 15. The average internal reliabilities for the PASS scales are as follows: Planning = .88; Simultaneous = .93; Attention = .88; Successive = .93; and Full Scale = .96. The CAS was standardised on 2,200 persons aged 5 years 0 months to 17 years 11 months who closely matched the U.S. population on the bases of region, classroom placement, and educational classification. Perhaps most important, the PASS scales' overall correlation with achievement in several academic areas (.70, N = 1600) was higher than the correlation between Wechsler Intelligence Scale for Children - Third Edition (Wechsler, 1991) and achievement (.59, N = 1284)" (Naglieri et al., 2001:432).

For each of the scales, there are three subtests that were administered for the standard battery. For further detail and clarification on each of these sub-tests, the reader may refer to Naglieri (1999a) and Naglieri et al., (1997a). Each of these cognitive areas also have three separate items, making a total of 12 individual items. Therefore, a standard score is obtained for each of the cognitive processes, and a Full Scale standard score. Owing to the physical size of the test materials, it could not be included as an attachment, but a copy of the test will be available from the supervisor.
3.3.2 Woodcock Diagnostic Reading Battery (WDRB)

The Woodcock Diagnostic Battery is a norm-based reading assessment that provides scores for ten different items deemed vital to the reading process. The items involve letter-word identification, word attack, reading vocabulary, passage comprehension, incomplete words, sound blending, oral vocabulary, listening comprehension, memory for sentences and visual matching. These items are then combined, in specific combinations, to provide age scores for total reading, broad reading, basic reading skills, reading comprehension, phonological awareness and oral comprehension. For further detail and clarification on each of these sub-tests the reader may refer to Woodcock (1997). Owing to the physical size of the test materials, it could not be included as an attachment, but a copy of the test will be available from the supervisor.

3.4 DATA CATEGORIES AND COLLECTION

The term data is derived from the Latin word meaning 'facts' or 'figures' from which conclusions are drawn (Wright, 1976:45). For Naglieri (1999a:123), "one of the most important dimensions of validity for a test of cognitive ability is, the relationship to achievement. The prediction of achievement offers an important way to evaluate the utility of the test's performance."

The derivation of the following research data is from three main areas. Firstly from the CAS, secondly the WDRB, and finally the scholastic marks for each learner obtained from the school for December 2000 and June 2001. The data will be used to establish whether the CAS assessment tool, based on cognitive processing, "is a good predictor of achievement" in the South African context (Naglieri et al., 1997a:61). For, if found to be a good predictor of achievement, it could then be used diagnostically to investigate reasons for breakdown in achievement. To establish the CAS as a possible predictor of achievement, four phases will be performed. For the first phase, the CAS will be correlated with objective scores, derived from the WDRB. Secondly, the CAS will be correlated with the learners scholastic results. The third phase will involve, correlating the WDRB with the learner's scholastic marks. As a final part of the process, the Full Scale score achieved by the learners for the CAS, will be correlated with the predicted scores for six WDRB tests. The WDRB predicted scores, based on the CAS Full Scale scores, are provided by Naglieri et al., (1997c:209). This final phase will identify whether the Full Scale score of urban black learners correlated with predicted achievement scores obtained from WDRB. Details of variables in each instrument will now be specified.
3.4.1 Cognitive Assessment System (CAS)

Five data areas are obtained from the CAS assessment tool. Four of these areas reflect specific cognitive processes needed for learning, and the fifth is the Full Scale score, a tabulated standard score based on the functioning of the four cognitive processes. All of these areas have been discussed in detail in chapter two.

1. Planning
2. Simultaneous Processing
3. Attention
4. Successive Processing
5. Full Scale Score

3.4.2 Woodcock Diagnostic Reading Battery (WDRB)

The data obtained from the standardised WDRB involve ten subtests and five cluster scores. The ten sub-test data areas are listed below and briefly described. For further detail the reader may refer to the Woodcock Examiner's Manual (1997:8).

1. Letter-Word Identification
   Identification implies recognition of irregular type words that are "used less frequently in written English." "This test has a median reliability of .94 in the age 5 to 18 range."

2. Word Attack
   Word Attack requires the application of "phonetic and structural analysis skills to the pronunciation of unfamiliar (pseudo) words." "This test has a median reliability of .90 in the age 5 to 18 range."

3. Reading Vocabulary
   Reading vocabulary measures the "subject's skill in reading words and supplying the appropriate meaning" by means of synonyms and antonyms. "This test has a median reliability of .92 in the age 5 to 18 range."

4. Passage Comprehension
   The skill required for this sub-test involves "the subject's skill in reading a short passage and identifying a missing key word." "This test has a median reliability of .88 in the age 5 to 18 range."
5. Incomplete Words
This sub-test is a tape-recorded auditory closure task. "This test has a median reliability of .72 in the age 5 to 18 range."

6. Sound Blending
"Sound Blending involves phonological synthesis, the ability to integrate and then say whole words after hearing parts (syllables and/or phonemes of the words). "This test has a median reliability of .86 in the age 5 to 18 range."

7. Oral Vocabulary
"Knowledge of word meaning" is tested by requiring that the tester provide antonyms and synonyms. Information gathered from this sub-test provides insight into the subject's receptive and expressive vocabulary, as well as his or her ability to retrieve the appropriate word within a restricted context. "This test has a median reliability of .88 in the age 5 to 18 range."

8. Listening Comprehension
Listening comprehension requires that the subject listen to a tape presented passage, and provide a "single word missing at the end of the oral cloze procedure." "This test has a median reliability of .83 in the age 5 to 18 range."

9. Memory for Sentences
Phrases and sentences are presented and the subject is required to repeat them. "This test has a median reliability of .86 in the age 5 to 18 range."

10. Visual Matching
Visual matching is a test of "visual processing speed and has a "median reliability of .86 in the age 5 to 18 range."

3.4.3 Woodcock Diagnostic Reading Battery Cluster Scores
(Cluster Scores Involving Combinations of Sub-tests)

1. Total Reading Cluster
The total reading cluster provides a "comprehensive measure of reading achievement and is "comprised of four tests: Letter-Word Identification, Word Attack, Reading Vocabulary, and Passage Comprehension. This cluster has a median reliability of .98 in the age 5 to 18 range."

2. Broad Reading Cluster
"This cluster is a brief measure of broad reading achievement. ...This cluster test has a median reliability of .95 in the age 5 to 18 range."

3. Basic Reading Skills Cluster
The Basic Reading cluster is comprised of two tests: Letter-Word Identification and Word Attack with a "cluster median reliability of .96 in the age 5 to 18 range."

4. **Reading Comprehension Cluster**
This cluster is regarded as a "broad measure of reading comprehension. ...The two tests included are: Reading Vocabulary and Passage Comprehension. This cluster test has a median reliability of .96 in the age 5 to 18 range."

5. **Phonological Awareness Cluster**
Phonological Awareness measures the "ability to analyze and synthesize phonemic information" and involves two tests: Incomplete words and Sound Blending.

6. **Oral Comprehension Cluster**
"This cluster is a measure of oral language comprehension at the word and passage levels" and involves two tests: Incomplete Words and Sound Blending.

7. **Reading Aptitude Cluster**
Reading Aptitude cluster relates to the "predicted performance score for comparison to the reading achievement tests. This cluster is comprised of tasks logically and statistically associated with proficiency in reading, but uncontaminated with the content.

3.4.4 **The School Marks For December 2000**

The marks provided will involve the subject areas of English, Afrikaans, Maths, Science, Geography, History and an average score of all subject areas. The mark in each subject represents the average mark obtained by the learner for that year. The marks were allocated to the child by the various teachers for the different subject areas. The teachers for the year 2000 were not made aware at any stage of the research project, nor did they have access to any results of the CAS and the WDRB.

3.4.5 **School Results For The End of Term Two in 2001**

The data collected and investigated for June 2001 focussed on the following:
The school marks for the second term's work, given to the learner by the various subject teachers for the end of June 2001. The subject areas include English, Afrikaans, Maths, Science, Geography and History. The mark in each subject area represents the average mark obtained by the learner for that term only. The teachers involved with the learner's during 2001 were aware of a research project being conducted, but did not at any stage have access to the data obtained from the CAS nor the WDRB.
Scores obtained from this research will be used to calculate correlations listed below.

1. Identify correlations between the CAS standard scores and the WDRB reading achievement score for the subtests and clusters.
2. Identify correlations between the CAS and school marks obtained in 2000.
3. Identify correlations between the CAS and school marks obtained in 2001.
4. Identify correlations between the WORB and school marks obtained in 2000.
5. Identify correlations between the WORB and school marks obtained in 2001.

3.5 SAMPLE SELECTION

The 32 participants of this research came from a regular school situated in a Northern suburbs of Johannesburg. The participants were all black, English Second Language Learners, and all came from the same Grade six class and were of mixed educational status. This particular class, out of three in the Grade six level, was randomly selected as time available for testing would not impact on the learner's weekly routine.

The reasons for selecting this specific school was multi-factorial. Firstly, the staff at the school were remarkably receptive to research projects that might assist them with insight into understanding the educational dynamics of their learners. In addition, this school provides instruction in English and is attended by a high percentage of black urban pupils. The Grade six level was selected so as to ensure that all participants had received a minimum of one and a half years instruction through the medium of English. All the participants live in the urban environment of Johannesburg, even though they are fairly widely distributed geographically. Children repeating their Grade 6 year, or who were new to the school, were excluded as they did not have a comparable December 2000 academic record for correlational purposes. Learners that had previously repeated any other grade, were not excluded.

Factors related to the participants which could not be identified or isolated, include the following:

- Socio-economic factors. There was a mix of nuclear families, extended families, single parents, an orphan, grandparents as caregivers, professional parents, small families, large families, and those involved with semi and unskilled areas of employment;

- Geographical factors. It was not possible to include an interview with the caregivers owing to the wide geographical distribution, language barriers and transport difficulties. It was
thus not possible to screen out learners who had been exposed to trauma or emotional upheaval. However, an interview with the teacher was conducted to determine whether any of the learner’s may have been exposed to traumatic incidents during the previous twelve month period, that could have had a negative emotional impact on their academic performance. Their class teacher reported no knowledge of specific trauma related to any one of the 32 participants, but did provide information relating to very difficult living conditions and or behavioural circumstances for about 26% of the children. Some of these factors related to poverty, ill health of caregivers, travel difficulties, impulsivity and ‘acting out’ behaviour.

3.6 CONSENT PROVIDED BY CAREGIVERS AND THE SCHOOL

In order to do the testing and obtain the data, a letter of consent was signed by the caregiver of each child. Telephonic contact was available if caregivers wished to discuss any concerns. Of the thirty two children in the sample group, four caregivers phoned prior to signing the consent. The concerns of the caregivers involved the implication of test results for their particular child. Each caregiver needed the reassurance that the results were not to be used for alternative placement of their child. Added to this, was the fact that this research was supervised by the Rand Afrikaans University and involved an exploratory study into the validity of assessment tools available, to improve the quality of educational instruction.

Consent to conduct this research was given by the principal of Parkhurst Primary School, Ms. J. Stragen (APPENDIX A). A room was arranged to ensure consistency across the range of tests. Two mornings per week were set aside for the two testers.

3.7 PROCEDURES

The participants were all individually tested and two female testers were involved. Both testers received extensive training on the procedures required to ensure accuracy of test administration, marking and scoring. All testing procedures advocated, were followed. All marking and scores, were double checked for errors. The first test to be administered involved the WDRB, conducted by one tester, followed by the CAS which was administered by the second female tester, on another day. An important agreement was reached between the two testers and the class teacher not to at any stage, share findings or reflections on a child, so as to avoid contaminating
any testing procedure. All testing occurred in the morning, during the school day, starting on the 22nd February and ending on the 26th July. Interruptions, during this time, included two holiday periods. The order of the pupil testing was random and not alphabetical. Every effort was made to ensure that the pupils were as comfortable as possible so as to ensure the best possible level of functioning. The environmental considerations were implemented to ensure privacy, limit external noise and prevent interruptions. The two testers were at no stage exposed to the data relating to the scholastic achievement of the children. Neither were there any discussions with the class teacher as to achievement levels prior to full collation of all the data. Only when all the standard scores were available were discussions with the class teacher held, to share qualitative profiles by examining the learner’s results of the CAS and the Woodcock. At this informal level, their class teacher was “very impressed” with “how it matched” the child’s scholastic classroom functioning. The data was then filed on a computer and the statistical calculations were performed and supervised by the statistical support services of the Rand Afrikaans University.

3.8 STATISTICAL AND ADMINISTRATIVE PROCEDURES TO BE EMPLOYED

Being a quantitative study, the accuracy of all score allocation and calculations were double checked. This process began with checking raw score allocation through to the recording of standard scores on test booklets and the transference of data to spread sheets for the statistical department. Scores derived from the CAS, WDRB and school results were then all correlated. “A correlation is a measure of the relation between two or more variables. The coefficients can range from -1.00 to +1.00. The value of -1.00 represents a perfect negative correlation while a value of + 1.00 represents a perfect positive correlation. A value of 0.00 represents a lack of correlation (Statsoft.com 2001). For the purposes of this research, correlation refers to ‘Pearson correlation’ (hereafter called correlation), which assumes that the two variables are measured on at least interval scales, and determines the extent to which values of the two variables are “proportional” to each other” (Statsoft.com 2001).

The final stage of the process involved the recording of the Full Scale score obtained for each learner. This was done to identify from the CAS manual (1997:209) the learners’ predicted score in six areas, namely: letter word recognition; word attack; passage comprehension; broad reading; basic reading and reading comprehension. These predicted scores were then correlated with the obtained scores achieved, in the same areas to ascertain if a correlation existed between the obtained score and predicted score. According to Peets(1996:29), predictive validity is the “extent to which the test score predicts some subsequent criterion variable of interest.”
This is, according to Peers (1996:27), important since a "single mark or achievement score for a pupil acquires meaning only when it is interpreted together with other data such as achievement scores obtained by individuals on the same test or when compared with achievement norms."

3.9 SUMMARY AND CONCLUSION

The diagram below, represents a summary of the various steps undertaken for this study. The start of the study involved the selection of the a school willing to allow a research team investigate the validity of the CAS as a diagnostic instrument in South African Schools. Each participant needed to have at least one and a half years of instruction in the medium of English. An important component involved obtaining consent from all caregivers. Only once consent had been obtained were the two tests administered and records of school marks obtained for December 2000 and June 2001.

Once all the data was recorded the scores were correlated to ascertain if CAS correlated with achievement as measured by the WDRB and the learner's school marks. The next phase involved investigating if the CAS would correlated with WDRB predicted scores based on the CAS Full Scale score. The final stage involves reporting of findings, discussing limitations of this study and exploring other possible study ideas.

FIGURE 3: STEPS FOR RESEARCH STUDY

Selection of participants
* Specific grade level at Parkhurst Primary of mixed Educational status.
* Minimum of one and a half years English as medium of instruction.
* No traumatic experiences within the last 12 months
* Learners currently repeating or new to the school were excluded from study
* Consent obtained

First Administer
* WDRB

Second Administer
* CAS

Gather school marks for,
* December 2000
* June 2001

LOOK AT CORRELATIONS BETWEEN
* CAS results and scholastic performance
* CAS results and WDRB
* WDRB and the School results for 2000 & 2001

REPORT ON FINDINGS
* Is the CAS predictive of WDRB and School results
* Limitations
CHAPTER FOUR

EMPIRICAL DATA ANALYSIS

4.1 INTRODUCTION

In this study, the tendency to avoid standardised assessment tools is being questioned, and possible standardised testing tools examined for predictive and diagnostic value. There is the general understanding that, this tendency to avoid standardised tests, is due to discriminatory practices, such as, the inappropriate placement of learners (Foxcroft, 2000). These kinds of tests are viewed by various researchers as reflecting, "socio-economic, linguistic and cultural factors rather than psycho-educational factors" (Donald, et al., 1997:277; Limbos, et al., 2001; Lidz, 1994).

It is argued that there are two possible consequences of avoiding standardised tests. Firstly, it takes away the "preventive opportunities and possibilities of instituting remediation strategies" (Limbos et al., 2001:136). Secondly, there is a reliance on and use of non-standardised type testing techniques, such as informal type assessments (Limbos et al., 2001:136). However, Lidz (1994:24) and Deno (1985:220), question the reliability and validity of the informal and dynamic type assessment strategies. Lidz's (1994:24) particular concern with dynamic assessment is whether the "assessors viewing the same performance, arrive at similar conclusions and recommendations." Siegel (1999:307), supports the use of standardised methods, stating that with informal assessment, it is "impossible to know whether an individual has made the number and type of errors, that are typical of his or her age group and, ...whether these errors are atypical and unexpected and therefore, indicative of a problem." In order to provide the latter, the assessment tools used would need to also provide validity and reliability.

For Naglieri (1999a:123),

"one of the most important dimensions of validity for a test of cognitive ability is, the relationship to achievement. If there is a strong relationship to achievement without content overlap, then whatever the test of ability measures can be said to include variables that are important for scholastic performance. Moreover, high correlations with achievement would also suggest explanatory power for exceptional children, something traditional IQ tests have had a difficulty doing."

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Thus, the claim by Naglieri and Das (1997a:1), that the cognitive processes as measured by the CAS, is a good predictor of achievement, provides the basis for hypothesis generation. The three variables to be correlated are the CAS, WDRB and the scholastic school marks of 2000 and 2001.

**FIGURE 4: THE THREE MAIN AREAS OF CORRELATION: CAS, WDRB AND SCHOOL MARKS**

CAS = Cognitive Assessment System
WDRB = Woodcock Diagnostic Reading Battery
SCHOOL MARKS 2000 = End of year mark for all four terms in 2000
SCHOOL MARKS 2001 = School marks only for the second term of 2001

The categories of data correlation and analysis involves six areas:

1. Identify correlations between the CAS standard scores and the WDRB reading achievement score for a few of the subtests and clusters.
2. Identify correlations between the CAS and school marks obtained in 2000.
3. Identify correlations between the CAS and school marks obtained in 2001.
4. Identify correlations between the WDRB and school marks obtained in 2000.
5. Identify correlations between the WDRB and school marks obtained in 2001.
6. Correlation of the WDRB achieved scores and learner’s predicted scores (based on the CAS Full Scale score).
4.2 GENERAL BACKGROUND DETAILS

The gender mix of the 32 participants were 14 girls and 18 boys, making it 43.8% girls and 56.2% boys. The average age of the class in January 2001 was 12 years 7 months with no difference between the mean ages of boys and girls. The learners ranged from 10.83 years to 13.87 years.

TABLE 1: THE MEAN SCORES OBTAINED FOR PASS AND FULL SCALE OF THE CAS FOR GRADE 6, BLACK URBAN LEARNERS:

<table>
<thead>
<tr>
<th></th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n= 32)</td>
<td>Full Scale</td>
</tr>
<tr>
<td>Mean</td>
<td>83.4</td>
</tr>
</tbody>
</table>

From the above it is noted that the mean scores for the PASS cognitive areas are generally below the 90 to 109 which is the range expected for the average group of the norm sample. Only the successive processing score falls in the average range and the others in the low average range which is between 80 and 89 (Naglieri, et al., 1997a:95). Scores are, however being generated for correlational and diagnostic purposes and not for placement or categorisation purposes.

4.3 DATA ANALYSIS OF EACH AREA OF INVESTIGATION

In order to establish the validity of the CAS as a fair diagnostic instrument the relationship between the PASS cognitive processing measures and achievement tests will be examined to establish the validity of the CAS as a predictor of academic performance (Naglieri, 1997a:60).

4.3.1 Statistical Analyses of Correlations Between CAS and WDRB

The CAS and the WDRB are being investigated to identify if there is a relationship between them, even though they do not share content. If there is no content overlap, but a strong relationship, then the test of ability can be regarded as having variables that are important for achievement (Naglieri, 1999a:123). In order to examine the relationship of the CAS and the WDRB, various aspects of these tests will be analysed for correlations reported in the literature, in relation to this research (Naglieri, et al., 1997a:84-85).
4.3.2 Hypotheses Regarding The Relationship Between The CAS Cognitive Test And The WDRB Reading Achievement Test

Null - Hypotheses

Ho.1. There is no statistically significant correlation between the Full Scale score of the CAS and the reading aptitude score of the WDRB.

Ho.2. There is no statistically significant correlation between the Full Scale score of the CAS and reading comprehension of the WDRB.

Ho.3. There is no statistically significant correlation between the Successive processing of the CAS and the word attack of the WDRB.

Ho.4. There is no statistically significant correlation between the Successive processing score of the CAS and the phonological awareness score of the WDRB.

Ho.5. There is no statistically significant correlation between the Successive processing score of the CAS and the memory for sentences score of the WDRB.

Ho.6. There is no statistically significant correlation between the Simultaneous score of the CAS and the area of oral comprehension score of the WDRB.

Ho.7. There is no statistically significant correlation between the Simultaneous score of the CAS and the area of reading comprehension score of the WDRB.

Ho.8. There is no statistically significant correlation between the mean score of the CAS and the reading aptitude score of the WDRB.

Ho.9. There is no statistically significant correlation between the planning score of the CAS and oral comprehension of the WDRB.

Ho.10. There is no statistically significant correlation between the attention score of the CAS and the total reading score of the WDRB.

Alternative Hypotheses

Ha.1. There is a statistically significant correlation between the Full Scale score of the CAS and the reading aptitude score of the WDRB.

Ha.2. There is a statistically significant correlation between the Full Scale score of the CAS and reading comprehension of the WDRB.

Ha.3. There is a statistically significant correlation between the Successive processing of the CAS and the word attack of the WDRB.

Ha.4. There is a statistically significant correlation between the Successive processing score of the CAS and the phonological awareness score of the WDRB.

Ha.5. There is a statistically significant correlation between the Successive processing score of the CAS and the memory for sentences score of the WDRB.

Ha.6. There is a statistically significant correlation between the Simultaneous score of the CAS and the area of oral comprehension score of the WDRB.
Ha.7. There is a statistically significant correlation between the Simultaneous score of the CAS and the area of reading comprehension score of the WDRB.

Ha.8. There is a statistically significant correlation between the mean score of the CAS and the reading aptitude score of the WDRB.

Ha.9. There is a statistically significant correlation between the planning score of the CAS and oral comprehension of the WDRB.

Ha.10. There is a statistically significant correlation between the attention score of the CAS and the total reading score of the WDRB.

### TABLE 2: CORRELATIONS BETWEEN THE CAS AND THE WDRB TESTS OF READING ACHIEVEMENT (N = 32).

<table>
<thead>
<tr>
<th>WDRB</th>
<th>Full Scale</th>
<th>Mean</th>
<th>Planning</th>
<th>Simultaneous</th>
<th>Attention</th>
<th>Successive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WOODCOCK SUB-TESTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Letter/word Identification</td>
<td>.613*</td>
<td>.595*</td>
<td>.339</td>
<td>.419*</td>
<td>.288</td>
<td>.688**</td>
</tr>
<tr>
<td>2. Word Attack</td>
<td>.473**</td>
<td>.437*</td>
<td>.122</td>
<td>.223</td>
<td>.214</td>
<td>.653**</td>
</tr>
<tr>
<td>3. Reading Vocabulary</td>
<td>.792**</td>
<td>.771**</td>
<td>.815**</td>
<td>.728**</td>
<td>.375*</td>
<td>.593**</td>
</tr>
<tr>
<td>4. Passage Comprehension</td>
<td>.734**</td>
<td>.718**</td>
<td>.593**</td>
<td>.606**</td>
<td>.380*</td>
<td>.575**</td>
</tr>
<tr>
<td>5. Incomplete words</td>
<td>.401*</td>
<td>.410*</td>
<td>.329</td>
<td>.350</td>
<td>.217</td>
<td>.322</td>
</tr>
<tr>
<td>6. Sound Blending</td>
<td>.437*</td>
<td>.477**</td>
<td>.278</td>
<td>.400*</td>
<td>.350*</td>
<td>.369*</td>
</tr>
<tr>
<td>7. Oral Vocabulary</td>
<td>.597**</td>
<td>.562**</td>
<td>.470**</td>
<td>.640**</td>
<td>.240</td>
<td>.350*</td>
</tr>
<tr>
<td>8. Listening Comprehension</td>
<td>.654**</td>
<td>.647**</td>
<td>.407*</td>
<td>.713**</td>
<td>.265</td>
<td>.524**</td>
</tr>
<tr>
<td>9. Memory for Sentences</td>
<td>.714**</td>
<td>.679**</td>
<td>.432*</td>
<td>.557**</td>
<td>.274</td>
<td>.720**</td>
</tr>
<tr>
<td>10. Visual Matching</td>
<td>.478**</td>
<td>.450**</td>
<td>.555**</td>
<td>.464**</td>
<td>.228</td>
<td>.172</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WOODCOCK CLUSTERS</strong></th>
<th><strong>SUB-TESTS</strong></th>
<th>1-2-3-4</th>
<th>1-4</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7-8</th>
<th>6-7-9-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total Reading</td>
<td>.716**</td>
<td>.688**</td>
<td>.461**</td>
<td>.533**</td>
<td>.339*</td>
<td>.688**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Broad Reading</td>
<td>.697**</td>
<td>.680**</td>
<td>.466**</td>
<td>.522**</td>
<td>.342*</td>
<td>.688**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Basic Reading</td>
<td>.597**</td>
<td>.578**</td>
<td>.281</td>
<td>.382*</td>
<td>.303</td>
<td>.684</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Reading Comprehension</td>
<td>.768**</td>
<td>.752**</td>
<td>.606**</td>
<td>.680**</td>
<td>.374*</td>
<td>.592**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Phonological Awareness</td>
<td>.448*</td>
<td>.511**</td>
<td>.390*</td>
<td>.433*</td>
<td>.405*</td>
<td>.301</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Oral Comprehension</td>
<td>.666**</td>
<td>.643**</td>
<td>.469**</td>
<td>.721**</td>
<td>.264</td>
<td>.466**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Reading Aptitude</td>
<td>.760**</td>
<td>.735**</td>
<td>.585**</td>
<td>.707**</td>
<td>.358*</td>
<td>.553**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2 tailed)
* Correlation is significant at the 0.05 level (2 tailed)
4.3.3 Hypotheses Testing

1. In testing the correlation between the Full Scale score of the CAS and that of the reading aptitude of the WDRB, hypothesis Ho1 is rejected in favour of Ha1 on the 0.01 level of significance. A positive correlation of .760 exists between the Full Scale score of the CAS and reading aptitude of the WDRB.

2. The empirical data supports Ha2 and Ho2 is rejected. There is a correlation of .768 at the 0.001 level of significance between the Full Scale score of the CAS and reading comprehension of the WDRB.

3. Hypothesis Ho3 is rejected in favour of Ha3 since empirical data showed that the successive processing of the CAS showed a correlation of .653 significant at the 0.01 level with the word attack of the WDRB. No other significant correlation exists. It is interesting to note that Siegel (1989:474), in her study, found that the pseudowords of the Woodcock Word Attack sub-test (Woodcock, 1973), was a better predictor of reading difficulties than the child’s IQ score.

4. Ha4 is rejected and Ho4 supported as there is a statistically significant correlation between the Successive processing score of the CAS and the phonological awareness score of the WDRB. The correlation obtained was only .301.

5. The data obtained supports the hypothesis that there is a correlation between the Successive processing score of the CAS and the memory for sentences score of the WDRB. Thus, Ha5 is accepted and Ho5 rejected. The correlation of .720 was identified at the 0.01 level of significance.

6. Ha7 is supported and Ho7 rejected as a correlation of .721 at the 0.01 level of significance was found between the Simultaneous processing score of the CAS and the oral comprehension score of the WDRB.

7. The empirical data obtained supports Ha7 showing that there is correlation of .680 between the Simultaneous score of the CAS and the area of reading comprehension score of the WDRB. This significance is at the 0.001 level. Ho7 is rejected.

8. Hypothesis Ho8 is rejected in favour of Ha8 as there is correlation of .735 between the mean score of the CAS and the reading aptitude score of the WDRB at the 0.01 level of significance.

9. There is a correlation between the planning score of the CAS and oral comprehension of the WDRB providing a basis to support Ha9 and reject Ho9. This correlation of .469 occurred at the 0.01 level of significance.

10. Ha10 is supported and Ho10 is rejected as a correlation of .339 is obtained between attention score of the CAS and the total reading score of the WDRB at the 0.05 level of significance.
The ability to link and understand the impact of various cognitive processing areas on reading achievement, allows for improved diagnostic skills and therefore intervention possibilities.

The second chapter of this study (2.9.1) discusses the research involved in the founding of these correlations.

With reference to TABLE 2, various correlations were identified to establish correlations between the CAS and the WDRB. These possible correlations were drawn from findings described in the literature and discussed in chapter two. As shown in this table, the Full Scale score of the CAS correlated at the 0.01 level of significance with the WDRB in the areas of reading aptitude and reading comprehension. This implies that there is a strong relationship between the cognitive processes as measured by the CAS and that of reading achievement as measured by the WDRB. The correlation is evident, even though the mean scores for the CAS, as seen in TABLE 1, do not all fall in the average range.

Of the ten WDRB sub-tests, the Ha4 hypothesis was rejected in favour of Ho4. This particular correlation involved looking at the possible relationship between successive processing and phonological awareness. Although this is regarded as a strong correlation that is documented in the literature (Siegel, 1999:307; Kirby et al., 1998:85; Kirby et al., 1987:243; Naglieri, et al., 1993:131; Naglieri & Reardon, 1993:130), this correlation was not found in this study. Some of the possible explanations may involve the fact that the tests in the Phonological Awareness (Sub-tests 5 and 6) require the use of a tape recorder. The accent of the taped voice is American and may have contributed to the lower than expected correlation between successive processing and phonological awareness. A further considered possibility is that second language leamer's perhaps make use of different processing skills when acquiring a second language. The highest correlations between the CAS and the WDRB occurred in the area of Simultaneous processing. Of the ten sub-tests for the WDRB, 70% of the highest correlations occurred in the area of simultaneous processing. The Simultaneous processing correlation of .707 at the 0.01 level of significance, was the highest correlate with Reading Aptitude.

The number of significant correlations between the CAS and the WDRB cluster scores, at the 0.01 level, is six of the seven sub-tests, with the seventh being significantly correlated at the 0.05 level. The CAS Full Scale correlated with the WDRB tests from .401 to .792. These values demonstrate that the PASS cognitive processes are strongly related to reading achievement as measured by the WDRB tests of reading achievement.
Another important correlation is a correlation of .716 between the CAS Full Scale score and the Total Reading Score. This suggests that the CAS correlates well with the "aggregate measure of basic reading skills and reading comprehension" (Woodcock, 1997:11). There are serious implications for assessment and diagnostic use. If a learner scores well on the CAS and is not attaining the same level of functioning in the area of reading, an assumption can be made that the breakdown in reading achievement is owing to factors other than cognitive factors. Some of these factors may be emotional, socio-economic, scholastic and/or educational in nature.

4.3.5 Statistical Analyses of Correlations Between CAS And School Marks For 2000

The CAS and the school marks for the year 2000 are being investigated to identify if there is a relationship between them, even though they do not share content. If there is no content overlap, but a strong relationship, then "whatever the test of ability measures can be said to include variables that are important for scholastic performance" (Naglieri, 1999a:123). In order to examine the relationship of the CAS and the school marks various aspects of these two instruments will be analysed for correlations.

Null - Hypotheses

Hypotheses regarding the relationship between the CAS cognitive test and the School marks for 2000:

Ho.1. There is no statistically significant correlation between the Full Scale score of the CAS and the learner's average year mark.

Ho.2. There is no statistically significant correlation between the Full Scale score of the CAS and the learner's obtained mark for each of the subjects.

Ho.3. There is no statistically significant correlation between the Simultaneous and successive processing scores of the CAS and the learner's English year mark.

Ho.4. There is no statistically significant correlation between the Simultaneous processing score of the CAS and the learner's Maths mark.

Ho.5. There is no statistically significant correlation between the Simultaneous processing score of the CAS and the learner's Science mark.

Alternative Hypotheses

Ha.1. There is a statistically significant correlation between the Full Scale score of the CAS and the learner's average year mark.
Hypothesis Testing

1. The Full Scale score does correlate with the learner's average year mark with a correlation of .603 at the 0.01 level of significance. Ha1 is therefore supported and Ho1 is rejected. This correlation is in fact the highest correlation between the Full Scale and the school subjects.

2. The empirical data supports Ha2 in that the Full Scale score does correlate with the learner's obtained subject year mark. The correlations range from .383 at the 0.05 level of significance for English through to .601 for Science at the 0.01 level of significance.
Ho2 is rejected.

3. Ha3 is supported. Ho3 rejected as the simultaneous and successive processing do correlate with the learner's English average year mark at the 0.05 level of significance. The correlation with simultaneous processing is .380 and successive processing is .392. This implies that both these areas are regarded as important factors in the acquisition of English.

4. Ha4 is supported as the Maths mark for the year does correlates with Simultaneous processing at .520 on the 0.001 level of significance. Ho4 is rejected.

5. Empirical data supports the Ha5 in that there is a correlation between the Simultaneous processing score of the CAS and the learner's Science mark. Ho5 is therefore rejected.

4.3.7 STATISTICAL ANALYSIS FOR CORRELATIONS BETWEEN CAS AND SCHOOL MARKS FOR 2001

The CAS and the School marks for 2001 are being investigated to identify if there is a relationship between them, even though there is no content overlap. If there is no content overlap, but a strong relationship, then "whatever the test of ability measures can be said to include variables that are important for scholastic performance" (Naglieri, 1999a:123). In order to examine the relationship of the CAS and the school marks for 2001 various aspects of these tests will be analysed for correlations. A reminder is that the marks for 2001 are only results of assessments done for the second term.

Null - Hypotheses

Hypotheses regarding the relationship between the CAS cognitive test and the school marks for 2001:

Ho.1. There is no statistically significant correlation between the Full Scale score of the CAS and the learner's average term mark.

Ho.2. There is no statistically significant correlation between the Full Scale score of the CAS and the learner's obtained term mark for each of the subjects.

Ho.3. There is no statistically significant correlation between the Simultaneous scores of the CAS and the learner's English term mark.

Ho.4. There is no statistically significant correlation between the Simultaneous processing score of the CAS and the learner's Maths term mark.

Ho.5. There is no statistically significant correlation between the Simultaneous processing score of the CAS and the learner's Science term mark.
Alternative Hypotheses

Ha.1. There is a statistically significant correlation between the Full Scale score of the CAS and the learner's average term mark.

Ha.2. There is a statistically significant correlation between the Full Scale score of the CAS and the learner's obtained term mark for each of the subjects.

Ha.3. There is a statistically significant correlation between the Simultaneous scores of the CAS and the learner's term English year mark.

Ha.4. There is a statistically significant correlation between the Simultaneous processing score of the CAS and the learner's Maths term mark.

Ha.5. There is a statistically significant correlation between the Simultaneous processing score of the CAS and the learner's Science term mark.

TABLE 4: CORRELATIONS BETWEEN THE CAS AND SCHOOL MARKS OBTAINED IN 2001

<table>
<thead>
<tr>
<th>SCHOLASTIC</th>
<th>CAS</th>
<th>Full Scale</th>
<th>Mean</th>
<th>Planning</th>
<th>Simultaneous</th>
<th>Attention</th>
<th>Successive</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English 2001</td>
<td></td>
<td>.386*</td>
<td>.407*</td>
<td>.218</td>
<td>.364*</td>
<td>.292</td>
<td>.313</td>
</tr>
<tr>
<td>Afrikaans 2001</td>
<td></td>
<td>.218</td>
<td>.152</td>
<td>.164</td>
<td>.169</td>
<td>-.056</td>
<td>.187</td>
</tr>
<tr>
<td>Maths 2001</td>
<td></td>
<td>.615**</td>
<td>.584**</td>
<td>.507**</td>
<td>.582**</td>
<td>.258</td>
<td>.417*</td>
</tr>
<tr>
<td>Science 2001</td>
<td></td>
<td>.206</td>
<td>.222</td>
<td>.110</td>
<td>.218</td>
<td>.115</td>
<td>.201</td>
</tr>
<tr>
<td>Geography 2001</td>
<td></td>
<td>.238</td>
<td>.260</td>
<td>.166</td>
<td>.246</td>
<td>.077</td>
<td>.272</td>
</tr>
<tr>
<td>History 2001</td>
<td></td>
<td>.456**</td>
<td>.446*</td>
<td>.260</td>
<td>.366*</td>
<td>.217</td>
<td>.456**</td>
</tr>
<tr>
<td>Average 2001</td>
<td></td>
<td>.414*</td>
<td>.403*</td>
<td>.280</td>
<td>.376*</td>
<td>.172</td>
<td>.362*</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2 tailed)
** Correlation is significant at the 0.01 level (2 tailed)

4.3.8 HYPOTHESIS TESTING

1. The Full Scale score does correlate with the learner's average year mark for 2001 with a correlation of .414 at the 0.05 level of significance. Therefore Ha1 is supported and Ho1 is rejected.

2. The empirical data supports Ha2 on the level of 0.05 for English and 0.01 for Maths
and History, therefore rejecting H02 is logical. H02 is nevertheless supported for Afrikaans, Science and Geography and Ha2 rejected. The subjects that were found to correlate are English (0.386*), Maths (0.615**) and History (0.456*).

3. Ha3 is supported as Simultaneous processing does correlate with the learner’s English average year mark. The correlation is .364 at the 0.05 level of significance. H0.3 is rejected.

4. The empirical data supports Ha4 as there is a correlation of .582 between Simultaneous processing and the learner’s maths mark at the 0.001 level of significance. H04 is rejected.

5. Ho5 is supported and Ha5 is rejected as the learner’s Science term mark does not correlate significantly with the learner’s average term mark.

4.3.9 General Discussion of the Findings From Tables 3 And 4

1. The reduced correlation between the CAS and the school marks for 2001 may be owing to the narrower range of assessment that would naturally occur in one term, as opposed to a years work.

2. Correlations between the CAS Full Scale score for all school subjects in 2000 were well correlated ranging from .383 at the 0.05 level, through to .603 at the 0.05 level. It is a point of interest that the composite CAS score correlated most highly with the scholastic composite mark which was the learner’s average year mark. This pattern of high correlation was not however consistent for June 2001. Nevertheless, the school average did still correlate with the CAS composite Full Scale score at .414 on the 0.05 level. For both year 2000 and year 2001, the Full Scale score correlated with English at .383 for 2000 and .386 for 2001.

3. Analysis of the correlations obtained for 2000 shows that in fact, when correlating the Full Scale score and Mean scores with scholastic work, the mean scores correlated more with scholastic subjects than did the Full scale score. This pattern was however, not consistent with results obtained from June 2001. This may be due to the fact that these are scores obtained only from one term of work, whereas the scores obtained from year 2000, are composite of the whole years work.

4. For year 2001, the highest correlation with the CAS Full scale, was with Maths at .615 at the 0.01 level.
The WDRB and the learner's school marks for 2000 are being investigated in order to identify whether a relationship exists between them. The WDRB involves an objective assessment of reading. The learner's work overlaps in that reading is involved in the process of learning. In order to examine the relationship of the WDRB and the learner's school marks for the year 2000, various aspects of these tests will be analysed for correlations.

Null - Hypotheses
Hypotheses regarding the relationship between the CAS cognitive test and the WDRB and the school marks for 2000:

Ho.1. There is no statistically significant correlation between the reading aptitude, as measured by the WDRB, and the learner's average year mark for 2000.

Ho.2. There is no statistically significant correlation between the total reading score, as measured by the WDRB, and the learner's average year mark for 2000.

Ho.3. There is no statistically significant correlation between the oral comprehension, as measured by the WDRB, and any of the learner's school subject marks for 2000.

Ho.4. There is no statistically significant correlation between the reading comprehension, as measured by the WDRB, and any of the learner's subject marks for the year 2000.

Alternative Hypotheses
Ha.1. There is a statistically significant correlation between the reading aptitude, as measured by the WDRB, and the learner's average year mark for 2000.

Ha.2. There is a statistically significant correlation between the total reading score, as measured by the WDRB, and the learner's average year mark for 2000.

Ha.3. There is a statistically significant correlation between the oral comprehension, as measured by the WDRB, and any of the learner's school subject marks for 2000.

Ha.4. There is a statistically significant correlation between the reading comprehension, as measured by the WDRB, and any of the learner's subject marks for the year 2000.
### Table 5: Correlations of the WOORB and School Marks for 2000

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WOOCOCK SUB-TESTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter/Word Identification</td>
<td>.689**</td>
<td>.393**</td>
<td>.577**</td>
<td>.473**</td>
<td>.721**</td>
<td>.604**</td>
<td>.637**</td>
</tr>
<tr>
<td>Word Attack</td>
<td>.393*</td>
<td>.401**</td>
<td>.426**</td>
<td>.207</td>
<td>.429*</td>
<td>.305</td>
<td>.360*</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>.721**</td>
<td>.681**</td>
<td>.598**</td>
<td>.543**</td>
<td>.753**</td>
<td>.613**</td>
<td>.681**</td>
</tr>
<tr>
<td>Passage Comprehension</td>
<td>.745**</td>
<td>.706**</td>
<td>.597**</td>
<td>.607**</td>
<td>.761**</td>
<td>.632**</td>
<td>.695**</td>
</tr>
<tr>
<td>Incomplete words</td>
<td>.531**</td>
<td>.454*</td>
<td>.419**</td>
<td>.376*</td>
<td>.528**</td>
<td>.486**</td>
<td>.529**</td>
</tr>
<tr>
<td>Sound</td>
<td>.494**</td>
<td>.522**</td>
<td>.393*</td>
<td>.430*</td>
<td>.475**</td>
<td>.423*</td>
<td>.419*</td>
</tr>
<tr>
<td>Oral Vocabulary</td>
<td>.676**</td>
<td>.625**</td>
<td>.438*</td>
<td>.593**</td>
<td>.750**</td>
<td>.522**</td>
<td>.641**</td>
</tr>
<tr>
<td>Listening Comprehension</td>
<td>.686**</td>
<td>.605**</td>
<td>.442*</td>
<td>.553**</td>
<td>.777**</td>
<td>.591**</td>
<td>.676**</td>
</tr>
<tr>
<td>Memory for Sentences</td>
<td>.649**</td>
<td>.664**</td>
<td>.399*</td>
<td>.485**</td>
<td>.733**</td>
<td>.537**</td>
<td>.641**</td>
</tr>
<tr>
<td>Visual Matching</td>
<td>.291</td>
<td>.060</td>
<td>.328*</td>
<td>.392*</td>
<td>.203</td>
<td>.250</td>
<td>.315</td>
</tr>
</tbody>
</table>

| **SCHOOL MARKS**                       |              |              |                |            |              |                |              |
| **WOCCOCK CLUSTERS**                   |              |              |                |            |              |                |              |
| Total Reading                          | .701**       | .682**       | .615**         | .499**     | .740**       | .590**         | .646**       |
| Broad Reading                          | .750**       | .738**       | .621**         | .554**     | .779**       | .643**         | .695**       |
| Basic Reading                          | .615**       | .619**       | .546**         | .409*      | .852**       | .525**         | .561**       |
| Reading Comprehension                  | .756**       | .723**       | .614**         | .587**     | .789**       | .636**         | .704**       |
| Phonological Awareness                 | .581**       | .551**       | .512**         | .497**     | .539**       | .515**         | .517**       |
| Oral Comprehension                     | .721**       | .645**       | .471**         | .603**     | .813**       | .609**         | .693**       |
| Reading Aptitude                       | .722**       | .649**       | .511**         | .642**     | .755**       | .605**         | .691**       |

** Correlation is significant at the 0.01 level (2 tailed)
* Correlation is significant at the 0.05 level (2 tailed)

### 4.3.11 Hypothesis Testing

Ha1, Ha2, Ha3 and Ha4 are supported with statistically significant correlations ranging from .701 to .756 at the 0.01 level of significance. Ho1, Ho2, Ho3 and Ho4 are rejected.

In addition, it was established in Table 2, that the learner's year average mark for the year
2000 correlates with the CAS Full Scale score at .603 at the 0.01 level of significance. There is also a correlation of .760 established between the CAS Full Scale, and the learner's reading aptitude, as measured by the WDRB. Since CAS does not have content overlap with either the WDRB or scholastic work, it can be deduced that the cognitive processes, as measured by the CAS Full Scale, are linked to reading and school achievement.

4.3.12 Statistical Analysis of Correlations Between The WDRB And School Term Results for 2001

Null Hypotheses
The following reflects the hypothesis regarding the relationship between the WDRB and the learner's school marks for the year 2001. The variables below have been selected in order to lead the reader to consider the hypothesis that no correlation exists between the WDRB and the learner's school marks in respect of each of the four variables considered below.

Ho.1. There is no statistically significant correlation between the reading aptitude as measured by the WDRB, and the learner's average year mark for the year 2001.
Ho.2. There is no statistically significant correlation between the total reading score as measured by the WDRB, and the learner's average year mark for the year 2001.
Ho.3. There is no statistically significant correlation between the oral comprehension as measured by the WDRB, and any of the learner's school subject marks for the year 2001.
Ho.4. There is no statistically significant correlation between the reading comprehension as measured by the WDRB, and learner's English subject mark for the year 2001.

Alternative Hypotheses
Ha.1. There is a statistically significant correlation between the reading aptitude, as measured by the WDRB, and the learner's average year mark for the year 2001.
Ha.2. There is a statistically significant correlation between the total reading score, as measured by the WDRB, and the learner's average year mark for the year 2001.
Ha.3. There is a statistically significant correlation between the oral comprehension, as measured by the WDRB, and any of the learner's school subject marks for the year 2001.
Ha.4. There is a statistically significant correlation between the reading comprehension, as measured by the WDRB, and the learner's English subject mark for the year 2001.
### TABLE 6: CORRELATIONS OF THE WDRB AND SCHOOL TERM MARKS FOR 2001

<table>
<thead>
<tr>
<th>SCHOOL TERM MARKS FOR 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOODCOCK SUB-TESTS</td>
</tr>
<tr>
<td>Letter/Word Identification</td>
</tr>
<tr>
<td>Word Attack</td>
</tr>
<tr>
<td>Vocabulary</td>
</tr>
<tr>
<td>Passage Comprehension</td>
</tr>
<tr>
<td>Incomplete words</td>
</tr>
<tr>
<td>Sound Blending</td>
</tr>
<tr>
<td>Oral Vocabulary</td>
</tr>
<tr>
<td>Listening Comprehension</td>
</tr>
<tr>
<td>Memory for Sentences</td>
</tr>
<tr>
<td>Visual Matching</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WOODCOCK CLUSTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Reading</td>
</tr>
<tr>
<td>Broad Reading</td>
</tr>
<tr>
<td>Basic Reading</td>
</tr>
<tr>
<td>Reading Comprehension</td>
</tr>
<tr>
<td>Phonological Awareness</td>
</tr>
<tr>
<td>Oral Comprehension</td>
</tr>
<tr>
<td>Reading Aptitude</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2 tailed)
* Correlation is significant at the 0.05 level (2 tailed)

#### 4.3.13 Hypothesis Testing

1. **Empirical data supports Ha1 in that there is a correlation between the reading aptitude, as measured by the WDRB, and the learner's average year mark for 2001. The correlation is .690 at the 0.01 level of significance. Ho 1 is therefore rejected.**

2. **The correlation of 0.579, at the 0.01 level of significance, was found to exist between the total reading score, as measured by the WDRB, and the learner's average year mark for 2001, thus supporting Ha2. Ho2 is therefore rejected.**
3. Ha3 shows that a correlation exists between the oral comprehension and the learner's school subject marks for 2001 is confirmed. Oral comprehension correlated with all school subjects at the 0.01 level of significance in a range from .462 to .760. Ho3 is therefore rejected.

4. The empirical data supports the Ha4, as there is a correlation of .698 between the reading comprehension, as measured by the WDRB, and the learner's English subject mark for the second term in 2001. This correlation is at the 0.01 level of significance. Ho4 is therefore rejected.

4.3.14 Correlations Between The Three Areas of Data

The data in the three areas will now be correlated, to identify the correlations that exist between them in a few selected areas.

**TABLE 7: CORRELATIONS BETWEEN THE THREE DATA AREAS OF:**

- THE WDRB READING APTITUDE;
- THE FULL SCALE SCORE OF THE CAS;
- AND LEARNER'S YEAR AVERAGE FOR 2000.

<table>
<thead>
<tr>
<th></th>
<th>WDRB reading aptitude</th>
<th>CAS : Full scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learner's year average (2000)</td>
<td>.722**</td>
<td>.603**</td>
</tr>
<tr>
<td>WDRB reading aptitude</td>
<td></td>
<td>.760**</td>
</tr>
</tbody>
</table>

1. The empirical data provided in Table 7 shows the correlation that exists between the reading aptitude, as measured by the WDRB, the CAS Full Scale score, and the learner's year average mark for 2000.

The learner's year average mark correlates with reading aptitude as measured by the WDRB. The correlation is .722 at the 0.01 level of significance. The learner's average year mark for 2000 has a correlation of .603 with the CAS Full Scale score at the 0.01 level of significance. Finally, it is empirically established that the CAS Full scale score has a correlation of .760 at the 0.01 level of significance with reading aptitude as measured by the WDRB.

Therefore, it can be inferred that there is a link between the cognitive processes, as measured by the CAS, and achievement in the area of oral comprehension and the learner's year average mark.
TABLE 8: CORRELATIONS BETWEEN THE THREE DATA AREAS OF:

- THE WORB ORAL COMPREHENSION;
- THE FULL SCALE SCORE OF THE CAS;
- AND LEARNER'S YEAR AVERAGE FOR 2000.

<table>
<thead>
<tr>
<th></th>
<th>Oral comprehension: WORB</th>
<th>CAS : Full scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learner's year average (2000)</td>
<td>.721**</td>
<td>.603**</td>
</tr>
<tr>
<td>Oral comprehension: WORB</td>
<td>.666**</td>
<td></td>
</tr>
</tbody>
</table>

The empirical data provided in Table 8 shows the correlation that exists between the oral comprehension as measured by the WORB, the CAS Full Scale score, and the learner's year average for the year 2000.

The year average mark correlates with oral comprehension, as measured by the WORB. The correlation is .721 at the 0.01 level of significance. The learner's average year mark for 2000 has a correlation of .603 with the CAS Full Scale score at the 0.01 level of significance. Finally, it is empirically established that the CAS Full scale score has a correlation of .666 at the 0.01 level of significance, with oral comprehension.

Therefore it can be logically deducted that there is a link between the cognitive processes as measured by the CAS and achievement in the area of oral comprehension, and the learner's scholastic year average.

4.4 TESTING PREDICTIVE VALUE OF THE CAS

Peers (1996:29), defines ‘predictive value’ as the "extent to which the test score predicts some subsequent criterion variable of interest." This implies being able to generate meaning from a score, when interpreting it in relation to other scores generated from other tasks, such as achievement tests, normed scores or scores obtained by other pupils on the same tests (Peers, 1996:27). The CAS Full Scale score, as mentioned before, is regarded by Naglieri et al., (1997a:9), as the best overall predictor of achievement. Therefore, the predictive value of the CAS will now be explored by investigating if WORB reading scores can be predicted from the learner's obtained CAS Full Scale score.

According to Naglieri et al., (1997a:103), the PASS and the Woodcock “achievement scores
can be evaluated using the Predicted-Difference approach using the values found in the Administration and Scoring Manual Appendix F. Tables F.1 - F. 32. These tables were computed following the formula provided by Reynolds (1990). This approach involves (a) the estimation of an achievement score as predicted from the Full Scale standard scores, (b) the comparison of the predicted with obtained achievement scores to determine if a significant difference is found and (c) determination of how frequently a difference between the obtained and predicted achievement score occurred in the normative sample.

For this research, the Full Scale score for each of the 32 participants was used to provide a predicted score for six of the WDRB tests. This predicted score was then compared to the obtained achievement score of each learner. The obtained achievement scores for each of these six tests were then compared to the predicted scores to determine if, in fact, there was a correlation between the obtained achievement and the predicted score, as predicted from the CAS Full Scale score. The aim of this study is to show that the cognitive processing, as measured by the CAS, can predict achievement, as measured by the WDRB.

4.4.1 Correlation of Passage Comprehension Achieved and Predicted Scores

Null Hypotheses

Ho.1. There is no statistically significant correlation between the WDRB obtained achievement score for Reading Comprehension and the predicted achievement score for Reading Comprehension, as predicted from the CAS Full Scale score.

Alternative Hypotheses

Ha.1 There is a statistically significant correlation between the WDRB obtained achievement score for Reading Comprehension and the predicted achievement score for Reading Comprehension, as predicted from the CAS Full Scale score.
FIGURE 5: GRAPH SHOWING:
- THE LEARNER'S WDRB ACHIEVED COMPREHENSION SCORE;
- PREDICTED SCORES BASED ON THE LEARNER'S CAS FULL SCALE SCORE.

TABLE 9: CORRELATIONS OF ACHIEVED AND PREDICTED SCORES FOR READING COMPREHENSION

<table>
<thead>
<tr>
<th>Reading comprehension</th>
<th>Reading comprehension predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading comprehension</td>
<td>Pearson Correlation 1.000</td>
</tr>
<tr>
<td></td>
<td>Sig. (2 tailed) .000</td>
</tr>
<tr>
<td></td>
<td>N 32</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading comprehension</td>
<td>Pearson Correlation .772**</td>
</tr>
<tr>
<td>Predicted</td>
<td>Sig. (2 tailed) .000</td>
</tr>
<tr>
<td></td>
<td>N 32</td>
</tr>
</tbody>
</table>

**. Correlations is significant at the 0.01 level (2-tailed).
4.4.2 Hypothesis Testing

1. Based on empirical evidence, H01 in rejected in favour of Ha1, as it was found that there are significant correlations of .772 at the 0.01 level of significance between the WDRB obtained achievement score for passage comprehension and the predicted achievement score for passage comprehension, as predicted from the CAS Full Scale score. The CAS has therefore been found to have predictive validity for passage comprehension, as measured by the WDRB.

4.4.3 Correlation of Achieved and Predicted Scores

Null Hypotheses

Ho.1. There is no statistically significant correlation between the WDRB obtained achievement score and the predicted achievement score, as predicted from the CAS Full Scale score.

Alternative Hypotheses

Ha.1 There is a statistically significant correlation between the WDRB obtained achievement score and the predicted achievement score, as predicted from the CAS Full Scale score.

TABLE 10: CORRELATION BETWEEN THE OBTAINED ACHIEVEMENT SCORE AND THE PREDICTED ACHIEVEMENT SCORES, AS PREDICTED FROM THE CAS FULL SCALE SCORE

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter-Word Identification</td>
<td>.65</td>
<td>.613*</td>
<td>.608 **</td>
</tr>
<tr>
<td>Passage Comprehension</td>
<td>.66</td>
<td>.734**</td>
<td>.731**</td>
</tr>
<tr>
<td>Word Attack</td>
<td>.61</td>
<td>.473**</td>
<td>.486 **</td>
</tr>
<tr>
<td>Broad Reading</td>
<td>.71</td>
<td>.697</td>
<td>.701 **</td>
</tr>
<tr>
<td>Basic Reading</td>
<td>.68</td>
<td>.597</td>
<td>.593 **</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>.72</td>
<td>.768</td>
<td>.772 **</td>
</tr>
</tbody>
</table>
4.4.4 Hypothesis Testing

Based on empirical evidence, $H_0$ was rejected in favour of $H_1$ as it was found that there were statistically significant correlations in each of the six subtests between the WDRB obtained achievement score and the predicted achievement score, as predicted from the CAS Full Scale score. These correlations range from 0.486 to 0.772 at the 0.001 level of significance. The CAS has therefore been found to have predictive validity of reading achievement, as measured by the WDRB.

4.5 CONCLUSION

The three instruments used in this study, namely the CAS, WDRB and the scholastic marks, were correlated to ascertain whether a strong statistical relationship could be found between them. The CAS correlated with the WDRB and the school marks for the year 2000 and the second term mark for the second term 2001. The school marks for the year 2000 year and the term 2001 also correlated significantly with the WDRB. From this hypothesis, it can be accepted that all three of these instruments are significantly correlated.

To establish the predictive value of the CAS, a three step process was followed. This involved comparing the WDRB achieved scores with predicted scores. The predicted score was obtained from previous research and was based on the CAS Full scale score. A significant correlation was found between the achieved and predicted scores, based on the CAS full scale score.

Chapter five will provide a summary of the literature survey, the process thus far, and finally a discussion of findings taken from the data. This study then ends with a number of conclusions deducted from the findings and a call for further research which could impact significantly on establishing valid diagnostic cognitive instruments in South African schools.
CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

5.1 INTRODUCTION

This study began with the contention that in South Africa there is a tendency to avoid using standardised tests particularly with black English second language learners. It was suggested that some of the reasons might be due to the fact that most of the tests available are dependent on adequate socio-economic standing, prior learning and exposure to Western cultural concepts and language. It is generally accepted that the assumptions based on these latter type testing tools are often discriminatory, especially when supporting a fixed innate theory of intellectual potential. Subject to a theoretical view of fixed intellectual potential, practices such as placement recommendations will occur, based on limited potential for intellectual modifiability. There is, however, assumed to be a link between the quality of assessment and the quality of intervention. This then raises the question as to what assessment tool(s) should be regarded as having quality diagnostic value for the black urban learner.

There has been a trend toward informal type assessments and dynamic (test-teach-retest) style assessments (Limbos et al., Geva, 2001:136; Siegel, 1999:307). The role and value of these types of strategies is not questioned. What is however questioned is whether the educational psychologists or those involved in the assessment process, will be in agreement as to their observations, interpretations and the interventions required (Deno, 1985:220). Confusion at this level of academic evaluation is a cause for concern since it could further add to the learner’s distress, and, in addition, generate a sense of helplessness among professionals. This confusion could hamper communication between professionals and ultimately impact negatively on the learner.

One of the possible solutions to this dilemma is, according to Foxcroft (2000:8), to be able to make use of available international research and adapt this knowledge to meet the needs of the South African learner. This study responds to the NCSNET & NCESS report (1997:85) and attempts to provide required proof that the CAS is a cognitive assessment tool that can be useful for “identifying barriers to learning and development.”
Thus, the problem for this study, was to investigate whether, the CAS correlates with achievement as measured by an objective reading test (WDRB) and the learner's scholastic marks for the end of the year 2000 and the second term of the year 2001. The study involved a sample of 32 black learner's and data areas were found to significantly correlate even without content overlap. This implies that the CAS does include factors important for scholastic functioning.

The final part of the study was to probe whether the scores achieved on six of the WDRB tests could be predicted from the learner's CAS Full Scale score, using tables provided by Naglieri et al. (1997a). The possible value of finding a correlation lies in its potential to assist in the understanding of "individual differences, ... provide a framework for assessment ... and link directly to theory-based remediation" (Das et al., 1994).

5.2 SUMMARY OF FINDINGS AND DEDUCTIONS

1. A statistically significant correlation was found between the three instruments used. These three instruments are the CAS, WDRB and the scholastic marks for the years 2000 and 2001. (See Figure 3).
2. The second major finding was that the Full Scale Score of the CAS is predictive of achievement as measured by the six sub-tests of the WDRB.
3. It has been established that there is a significantly strong relationship between the three instruments, namely the CAS, WDRB and the learner's school marks for the years 2000 and 2001 for black urban children in the Northern Suburbs of Johannesburg.
4. Since the CAS Full Scale score is able to predict achievement for six cluster WDRB scores, this implies that the cognitive processes are directly linked to the success or failure of reading. This explanatory power should have diagnostic value and improve the understanding of the cognitive processes involved, which in turn should enhance the intervention strategies employed.

5.3 RECOMMENDED STEPS FOR THE INTERPRETATION OF THE CAS SCORES

1. Step one involves looking at the Full Scale Standard Score and represents an overall level of an individual's level of cognitive functioning (Naglieri, 1999:26). If however there is a significant variation in one of the processing scores, then the full scale is obscure, and deductions made "should be avoided." Therefore if all four PASS Scale scores are
similar and no significant differences are found, then the Full Scale score is regarded as a good indicator of cognitive processing and the best overall predictor of achievement, (Naglieri, 1999).

2. Step two involves comparing the four PASS standard scores in order to provide a profile of the learner's strengths and weaknesses. This profile is then related to the specific areas of academic performance. The impact of the cognitive processes on scholastic performance was discussed in Chapter Two of this study. The Ipsative process is used to identify whether any specific cognitive area is regarded as statistically significant for that particular learner. This is done by using tables provided in the interpretative manual. The Ipsative method involves comparing the mean score of the learner to four processing scores obtained. If a significant score is found, it is then categorised as either a relative or cognitive weakness. A relative weakness is a score regarded as significant when compared to the learner's mean ipsative score, but over 90. The term significant cognitive weakness is used if the obtained score is below 90.

3. Naglieri (1999:80) states that for step three the subtests scores within each of the scales are compared and can be meaningful. The mean of the subtests is 10 with a standard deviation of 3. "The subtests scaled scores are compared to the child's mean" and significance is determined. This, according to Naglieri (1999:82) would only be done to decide the weighting of one sub test on the score for that particular scale. However, reliability is lowered with subtests analyses and is not recommended (Naglieri, 1999:82).

4. Comparing the Full Scale and the PASS Standard Scores with Achievement scores is recommended for step four. Naglieri (1999:84) notes that the CAS scores can be used "to help determine if the child's achievement is below expectations." If there is a higher CAS score, with a lower than predicted scholastic functioning, areas that will be investigated, would be emotional and/or educational factors. Poor scholastic functioning may however be associated with one of the lowered PASS processes. This would require linking the theoretical understanding of that process and the identified areas of weak scholastic functioning.

Two methods for calculation were suggested to identify if there is a PASS cognitive weakness and associated academic weakness. Both of these methods have been discussed in Chapter Two. Of the two, the predicted difference method, is regarded as having less psychometric limitations.
5.4 POINTS TO BE CONSIDERED WHEN USING THE CAS IN A SOUTH AFRICAN CONTEXT

One important diagnostic observation in this process is to identify whether the learner’s scholastic functioning is found to be below expectation, based on their CAS scores. However, the question may be asked, “What would happen in the case of a learner having a lowered CAS score? Would this imply limited intelligence and therefore the associated limited achievement output?” This is a vital point, as the mean scores obtained in this research (see Table 1) were considerably lower than that of the ‘norm’ group on which the CAS was standardised. Nevertheless, this study has shown that these same scores were found to not only correlate, but also to predict achievement. This implies that there are cognitive processes, as measured by the CAS, that are limiting the learner’s potential achievement levels. The value of this model of intelligence is that it is based on a concept of cognitive processes being modifiable. The possibility of cognitive improvement would therefore increase where there have been socio-economic factors limiting the learner’s opportunities to develop the cognitive skills considered vital for achievement. Thus, the ability to specifically identify cognitive processes that predict achievement, enables the professional to highlight those processes needing attention, and target them for intervention. Once the cognitive areas and associated achievement areas have been addressed, this will give learners the opportunity to achieve and overcome some of the effects of past discriminatory policies.

5.5 LIMITATIONS OF THE STUDY

The limitations of this study were many and varied, ranging from the cost of the instrument through to the characteristics of the sample. The sample of children was not representative of all South African children and therefore the findings cannot be generalised. All the children in this study were receiving instruction through the medium of English for at least 1 ½ years. This raises questions as to the applicability of the CAS to those children who have not yet acquired mastery of the English Language. In addition all the children were from one particular age grouping. Also geographically the children were from an urban environment and urban type educational milieu, highlighting the fact that such a research project in a rural area, might not generate the same level of correlation. The scores obtained from the CAS cannot be used normatively since the mean scores or distribution of scores were lower than those of the group on which the CAS was normed. However, even though the distribution of the scores were lower, they still correlated and predicted achievement. For the purposes of this study, there is very little information regarding the socio-economic environment of the learners, making it difficult to create links between functioning and environment. Aspects that might limit further research, relate to the expense of the testing equipment and the price of the workbooks which is dependent on...
exchange rates. Training in the use of the instrument is not particularly difficult, but access to such training could prove to be an inhibiting factor for further research.

5.6 RECOMMENDATIONS FOR FURTHER RESEARCH ARISING FROM THIS STUDY

Developing a common approach to assessment practices for educators in South Africa will ensure communication between professionals and timely and appropriate intervention, based on current research (Naglieri & Johnson, 2000:591). This knowledge could be adapted to meet the diverse needs of learners in South Africa. It is acknowledged that further research will need to be conducted. The reward for such a research could be a step forward from what could be regarded as out-dated assessment methods of the last century. The following research areas could be considered by those that may be interested in this particular aspect of assessment and intervention:

1. repeating the same research with a group of white children;
2. a national study to establish own norms;
3. repeating the same research but increasing the number of participants and the geographical distribution;
4. repeating the same research in a rural area where there is exposure to the English language;
5. comparing cognitive processing of children from various socio-economic groupings in order to identify impact on cognition;
6. exploring after administering the CAS assessment, the impact of intervention by retesting, using the CAS. This will provide insight as to intensity and type of intervention required to generate change in various cognitive processes;
7. using the CAS identify various groups of exceptional children (ADD-HD, learning difficulties, low functioning and gifted children) to determine whether they produce similar cognitive profiles.
Assessment in the areas of cognition and achievement is a controversial topic, with strong opinions varying as to what is in the best interests of the learner, and the society at large. This controversy is reflected in the South African arena where professionals are required to deal with referrals, and recommend interventions to suite diverse contexts. The current modus operandi is open to personal interpretation, is subjective in nature, is heavily dependent on the experience of the assessor, and is ultimately confusing communication between professionals, learners and parents. This study has attempted to explore the validity of the CAS as a fair diagnostic instrument in South African Schools. It was considered vital to explore the potential application of the CAS if we are to successfully address the educational needs within the diversity of the South African context. The results seem to be promising enough to warrant further research on the CAS in the South African context.


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To Parents of Pupils in Grade 6

Dear Parents

Ms K D Reid was involved in a school research project at our school last year and has been given permission to conduct another research project at our school, during school hours. This will involve the testing of all the Grade 6 pupils. The information collected will help to identify testing material that can be used to help all South Africans.

In addition, the information will help with the planning of any extra work that may be needed by pupils to provide them with the best possible education. Results of the testing will be made available to parents if they so wish. This will be a free service to the parents. I hope that we will have your support in this project. If you have any concerns or questions about this please would you phone Karen Reid on 083 289 9442.

J M STRACHAN (Miss)
Principal

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REPLY SLIP
Kindly complete the reply slip and return it to the class teacher by Tuesday 6 February.

I ____________________ give permission for ____________________ to be part of the research project conducted by Ms K D Reid and understand that this will involve testing that will be done at Parkhurst Primary School during school hours. As the parent/guardian/caregiver I can be contacted on the following telephone number:

______________________
Tel No.

______________________
Parent