THE JUNIOR SOUTH AFRICAN INDIVIDUAL SCALE AS PREDICTOR OF SCHOLASTIC ACHIEVEMENT AT SUB A, SUB B & STD ONE LEVELS

D.M. le Roux

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN CLINICAL PSYCHOLOGY,

UNIVERSITY OF CAPE TOWN

September 1987

ACKNOWLEDGEMENTS

I am greatly indebted to the many people who advised, assisted and supported me in the course of this project.

Andy Dawes, my supervisor, provided helpful guidance and was an encouraging mentor. Frank Bokhorst piloted me through the treacherous statistical waters with unfailing patience. I am very grateful for the considerable amount of time he spent assisting me.

Jennifer Stewart did the bulk of the typing, speedily, efficiently, and at very short notice. Barbara Donovan was responsible for the remainder of the typing and for the attractive, readable layout which she undertook with meticulous care. My thanks are due to Peter Aspinall, of Digitron Desk-top Publishing (Pty) Ltd, for making her services available to me.

My dear parents did most of the proof-reading in the early stages, and were a constant source of support and practical help. My friend, Lynn Adamson, was always available for discussion of knotty issues and also helped with the proof-reading.

The H.S.R.C. provided financial assistance.

CONTENTS **PAGE**

Acknowledgements		**(i)**
List of Tables		**(iv)**
Abstract		**(viii)**
CHAPTER I:	AIMS OF THE STUDY	1.
CHAPTER II:	INTELLIGENCE, INTELLIGENCE TESTING AND SCHOLASTIC ACHIEVEMENT: A brief historical perspective	3.
CHAPTER III:	GUILFORD'S STRUCTURE OF THE INTELLECT MODEL AND ITS APPLICATION IN THE DESIGN OF THE JSAIS	32.
CHAPTER IV:	METHOD	47.
	4.1 Sample	
	4.2 Measures	
	4.3 Procedure	
CHAPTER V:	RESULTS	64.
	5.1 The Pearson Product Moment Correlation Analysis	
	5.1.1 The Relationship Between the JSAIS Scales and Measures of Scholastic Achievement	
	5.1.1.1 The relationship between the Global Scale and measures of scholastic achievement	
	5.1.1.2 The relationship between the Verbal Scale and measures of scholastic achievement	
	5.1.1.3 The relationship between the Performance Scale and measures of scholastic achievement	

5.1.1.4	The relationship between the Numerical Scale and measures of scholastic achievement	
5.1.2	The Relationship between the JSAIS Subtests and Measures of Scholastic Achievement	
5.1.2.1	Form Board	
5.1.2.2	Vocabulary	
5.1.2.3	Number and Quantity Concepts	
5.1.2.4	Memory for Digits	
5.1.2.5	Picture Riddles	
5.1.2.6	Word Association	
5.1.2.7	Absurdities A	
5.1.2.8	Absurdities B	
5.2	The Stepwise Multiple Regression Analysis	
5.2.1	Regression Analysis Involving The JSAIS Scales	
5.2.2	Regression Analysis Involving The JSAIS Subtests	
5.3	The Test for Longitudinal Stability of the Correlation Matrix	

CHAPTER VI:	DISCUSSION AND RECOMMENDATIONS	86.
REFERENCES		96.
APPENDIX A	QUESTIONNAIRES	101.
APPENDIX B	SUPPLEMENTARY TABLES	106.

LIST OF TABLES

1. Correlations between various intelligence and scholastic achievement tests. 19.

2. Correlations between WPPSI scales and reading achievement. 21.

3. Correlations between WPPSI subtests and reading achievement. 23.

4. Correlations between the subtests comprising the eight subtest version of the JSAIS and the Numerical Scale, and teacher evaluations of Sub B Reading, Phonics and Mathematics in June and December: Venter, 1985. 25.

5. Correlations between the four subtests excluded from the shortened JSAIS, the twelve subtest Global, Verbal, Performance and Memory Scales, and teacher evaluations of Sub B Reading, Phonics and Mathematics in June and December: Venter, 1985. 26.

6. JSAIS subtests selected in the forward multiple regression analysis for prediction of Sub B Reading, Phonics and Mathematics: Venter, 1985. 28.

7. Comparison of the S01 Contents facet and the JSAIS Contents facet. 38.

8. Comparison of the S01 Operations facet and the JSAIS Process facet. 39.

9. Classification of the battery of 22 tests according to content and mental process. 41.

10. Composition of the twelve test battery according to content and mental process. 44.

11. Reliability coefficients (r_{tt}) and standard errors of measurement (SEm) of the twelve test battery. 45.

12. Composition of the eight test battery according to content and mental process. 46.

13. Distribution of this study's Sub A sample and the JSAIS standardisation sample of 7 year olds by sex, language, socio-economic status (SES) and urban/rural residence. 48.

14. The mean (X), standard deviation (S) and standard error (SEm) of the eight subtest JSAIS scores obtained by the Sub A sample. 49.

15. Results of the t-test for significance of differences between the Sub A sample and the standardisation sample on comparable sections of the test. 50.

16. Means (X), standard deviations (S), standard errors, (SEm) for each subject and the average of the subjects in each standard. 52.

17. Composition of the eight subtest JSAIS. 53.

18. Correlations between the Global Scale and measures of scholastic achievement. 65.

19. Correlations between the Verbal Scale and measures of scholastic achievement. 66.

20. Correlations between the Performance Scale and measures of scholastic achievement. 67.

21. Correlations between the Numerical Scale and measures of scholastic achievment. 68.

22. Correlations between the Form Board subtest and measures of scholastic achievement. 70.

23. Correlations between the Vocabulary subtest and measures of scholastic achievement. 71.

24. Correlations between the Number & Quantity Concepts subtest and measures of scholastic achievement. 72.

25. Correlations between the Memory for Digits subtest and measures of scholastic achievement. 73.

26 Correlations between the Picture Riddles subtest and measures of scholastic achievement. 74.

27. Correlations between the Word Association subtest and measures of scholastic achievment. 75.

28. Correlations between the Absurdities A subtest and measures of scholastic achievement. 76.

29. Correlations between the Absurdities B subtest and measures of scholastic achievment. 77.

30. Multiple regression analysis: JSAIS Verbal, Performance and Numerical Scales with Sub A Average. 79.

31. Multiple regression analysis: JSAIS Verbal, Performance and Numerical Scales with Sub B Average. 80.

32. Multiple regression analysis: JSAIS Verbal, Performance and Numerical Scales with Std One Average. 81.

33. Multiple regression analysis: JSAIS subtests with Sub A Average. 82.

34. Multiple regression analysis: JSAIS subtests with Sub B Average. 83.

35. Multiple regression analysis: JSAIS subtests with Std One Average. 84.

36. Reliability coefficients of selected JSAIS subtests for each age grouping of the norm group. 92.

APPENDIX B

A Correlations between JSAIS scales and Sub A subjects and average. 107.

B Correlations between JSAIS scales and Sub B subjects and average. 108.

C Correlations between JSAIS scales and Std One subjects and average. 109.

D Correlations between JSAIS subtests and Sub A subjects and average. 110.

E Correlations between JSAIS subtests and Sub B subjects and average. 111.

F Correlations between JSAIS subtests and Std One subjects and average. 112.

ABSTRACT

This study examines the relationship between the eight subtest form of the Junior South African Individual Scale (JSAIS - 8) and scholastic performance at Sub A, Sub B and Std One levels, as measured by teacher evaluations.

An unreferred sample of 104 pupils who had been tested on the JSAIS- 8 in their Sub A year were followed up at the end of Std One. The pupils' three sets of year-end symbols, as recorded in the official school records, were obtained.

Pearson correlations were calculated between the Global, Verbal Performance and Numerical Scales and each of the subtests on the one hand, and selected school subjects and a computed average of the subjects on the other. The JSAIS scales and subtests were regressed on the computed averages for each standard. A test was performed to evaluate the longitudinal stability of the correlation matrix of Pearson correlations. The results were compared with those of similar studies employing non-South African intelligence scales, and with a study employing the full, twelve subtest version of the JSAIS (JSAIS - 12).

The values of the correlations yielded were found to be of the same general magnitude as those reported in studies employing non-South African scales. The test for the longitudinal stability of the Pearson correlation matrix indicated that the test probably predicted equally over the three standard levels. The Global, Verbal and Numerical Scales and their associated subtests correlated moderately to highly with measures of scholastic achievement. The Performance Scale and its subtests yielded lower and sometimes non-significant correlations. Some discrepancies were noted between the results of the present study and that which employed the JSAIS - 12.

It was observed that three of the five subtests which yielded the highest correlations with scholastic achievement in the study employing the JSAIS - 12 are excluded from the JSAIS - 8. The possibility of substituting these subtests for three subtests currently incorporated in the JSAIS - 8 was explored. Limitations of the present study were discussed and the tentative nature of the findings emphasised. Suggestions were made for further research.

CHAPTER ONE
AIMS OF THE STUDY

The aim of this study is to examine the relationship between scores on a test of intellectual ability, the eight subtest form of the Junior South African Individual Scale (JSAIS), and scholastic performance at Sub A, Sub B and Standard One levels, as measured by teacher evaluations.

The JSAIS is used extensively by testers employed by the School Psychological Service of the Cape Education Department (CED). It constitutes one source of information which, together with reports from the class, remedial and speech teachers, the school medical record card and parent interviews, forms the data base for further educational planning.

At Junior Primary level (i.e. Sub A, Sub B, Std 1), which is the school going age group to which this test applies, assessments are usually performed with a view to identifying a pupil's strengths and weaknesses, with the object of planning appropriate remedial or didactic aid programmes (while the child remains within the ordinary class), or for determining the appropriateness of special class placement for that child.

Since intervention at this early stage of a pupil's school career can have such far reaching consequences, it is important that testers have a clear understanding of how the instruments they use relate to pupils' performance in the situation under consideration, i.e. the classroom. Testers need to know how much weight can be placed on the JSAIS test results in making predictions about a pupil's potential for scholastic achievement. Very little research information is, however, currently available upon which to base such predictions.

Regarding this issue of predictive validity, the JSAIS manual (Madge,1981) states that "the primary criterion to be predicted with the Global IQ score will presumably be future school achievement. The individual tests and scales should also be useful for predicting the possibility of specific kinds of learning problems (reading and arithmetic problems). However such data are not yet available" (p. 76).

A further problem in the use of the test is that the shortened form, the eight subtest version, is the form most frequently used by members of the School Psychological Service. Originally the JSAIS intelligence scale was designed as a twelve subtest instrument. Because of its lengthy administration time, four of the subtests were omitted and norms for an eight subtest version were published by the Human Sciences Research Council (HSRC) in November 1985. This norm booklet states that the Global IQ (GIQ) obtained from the eight-test battery is "a satisfactory substitute for the GIQ of the twelve tests" (van den Berg & Robinson, p.5). The user is however warned against treating the Verbal (VIQ) and Performance (PIQ) estimates derived from the shortened form as equivalent to the full VIQ and PIQ. Despite this stated limitation, test users will look at discrepancies in verbal and performance scores, and at relative performance on individual subtests to try to make inferences about a testee's functioning. Hence the necessity for research information to answer this need. To quote Tyter (1961), "What makes scores on any test meaningful is the total background of information on what such scores have been shown to predict. The test must have this background, the counseller must know it" (p.110).

This thesis will thus examine the relationship between the eight subtest JSAIS Global, Verbal, Performance and Numerical Scale scores, the individual subtest scores and scholastic achievement.

CHAPTER TWO

INTELLIGENCE, INTELLIGENCE TESTING AND SCHOLASTIC ACHIEVEMENT : A BRIEF HISTORICAL PERSPECTIVE

Many decades have passed since the 1904 Spearman-Thorndike debate on the nature of intelligence, yet today no widely accepted definition of intelligence exists.

One group of definitions emphasises the adjustment or adaptation of the individual to his environment. In this view intelligence is seen as general mental adaptability to new problems and new situations. A second type of definition places the emphasis on ability to learn - the extent to which a person is educable, in its broadest sense. A third view focusses on the capacity for abstract thinking - the effective use of concepts and symbols in dealing with situations, especially those requiring the use of verbal and numerical symbols. These three categories of definition are not mutually exclusive. Clearly, ability to learn provides the capability for adjustment and adaptation to changing circumstances. Learning capacity, however, involves more than the simple acquisition of information. It implies also the ability to reorganise and apply what is acquired when dealing with varied and new situations. Abstract thinking, itself the result of an individual's development and learning, in its turn promotes further learning, for it eliminates trial and error and enables one to evaluate past experience and future plans (Freeman, 1950).

Certain writers include non-intellectual factors in their definitions of intelligence. In Wechsler's view, drive and incentive are involved in intelligent behaviour (Wechsler, 1958). Stoddard (1943) includes "social value", "concentration of energy" and "resistance to emotional forces" as attributes of intelligence. While it is recognised that non-intellectual factors play an important role in an individual's general effectiveness, these are not introduced into tests of mental ability, for this would confuse efforts to achieve a reasonably valid measure of the level of intelligent activity at which a person is capable of operating, whether or not he operates at that level in all situations.

The foregoing definitions of intelligence are functional in character in that they state how intelligence operates: through learning, adaptation and abstract thinking. Psychologists have also tried to describe the nature and structure of intelligence by attempting to isolate its elements or components through the use of factor analysis. Matarazzo (1972) describes the group of researchers involved in this endeavour as the scholarly orientated "theorist psychologists", represented by people like Spearman, Thorndike, Thurstone and Guilford. He distinguishes them from the group of application orientated "practitioner psychologists", represented by Binet, Terman and Wechsler. Although the activities of the two groups overlapped to some extent, the nature of their contributions differed in emphasis. Each of the "practitioners" mentioned above, developed or refined an instrument or procedure for the assessment of the individual. Such assessments could have a very direct effect on the course of an individual's life. The "theorists", too, influenced the lives of individuals, but more indirectly, through their interest in the nature and structure of intelligence as a research question. The work of some of the most prominent theorists in the factor analytic tradition will now be discussed and evaluated. Then an outline will be given of the major milestones along the route taken by the practitioner psychologists.

The "Theorist Psychologists"

The British psychologist Spearman was the first to develop a theory of trait organisation on the basis of the statistical analysis of test scores. According to Spearman (1904) "all branches of intellectual activity have in common one fundamental function" (p. 284). In terms of his theory all intellectual activity is considered to be an expression of this fundamental function, also termed a general factor, or g. He postulated this g factor to explain correlations that he found between scores in various kinds of intellectual tasks. He also recognised the presence of specific or s factors, which were different from and independent of one another. In later years he acknowledged that group factors could also be identified in the analyses of some mental tasks. Nevertheless, he regarded the general factor, g, as the essential measure of intelligence. Freeman (1950) points out that Spearman's theory of general plus specific factors in intelligence is of significance to the field of mental testing because the techniques employed in the design of many modern mental tests rely upon the assumption that all forms of mental activity have something in common. Otherwise, psychologists could not justify including very diverse mental tasks in one instrument, and deriving from it a single total score to represent the testee's general intellectual level. Freeman argues that Spearman's model provides a basis for the selection of appropriate tests. In terms of this model, tests should be selected from among those which have been shown, by correlational analysis, to have high g loadings. Each test will of course also have specific content, but since these s factors are independent of one another, it is assumed that they will tend to cancel each other out.

In contrast with Spearman's "two-factor" theory, Thorndike (1927) postulated a multi-factor theory of intelligence. He conceived of intelligence as constituted of a multitude of separate elements. Yet, because certain mental activities had many elements in common, these elements could be grouped together. Thus, despite his atomistic view of the structure of intelligence, the test he designed to measure ability to deal with abstractions was composed of only four parts: sentence completion (C), arithmetic reasoning (A), vocabulary (V), and following directions (D).

The group factor theories, of which Thurstone was a major proponent, occupy a position between the theories of Spearman and Thorndike. According to the group factor theories intelligent activity is neither an expression of numerous independent factors, nor of a unitary general factor. Thurstone (1941) postulated the existence of a number of "primary mental abilities", which had been shown to be factorially distinct from one another. He stated that "each behaves as a functional unity that is strongly present in some tests and almost completely absent in many others" (p. 9). Although termed "primary" mental abilities, they were not assumed to be indivisible elements. Six primary factors were initially identified, in studies employing populations of college students. In 1941 Thurstone published the results of a further study aimed at determining whether primary mental abilities could also be identified in populations of younger subjects. Seven such primary factors were indeed isolated. Thurstone noted that the correlations between the primary factors in the youthful population were higher than those he had found in the college group. He thus conceded the possibility of a "second order" general factor, which he saw as inherent in the primaries and their correlations and not distinct from them.

The number of primary factors isolated in subsequent studies varied. Among those most frequently identified are the primary factors Verbal (V), Perceptual Speed (P), Inductive Reasoning (I), Number (N), Rote Memory (M), Deductive Reasoning (D), Word Fluency (W) and Space Visualisation (S) (Vernon, 1961).

The Chicago Tests of Primary Mental Abilities were based on Thurstone's theory. These tests do not yield a single index of performance like overall percentile rank, mental age or IQ. The testee is allocated a percentile rank on each of six subtests tapping primary mental abilities. The percentile ranks are then used to form a profile of the testee's abilities. In his evalution of the group-factor theories, Freeman (1950) asserted that the so-called primary factors identified by Thorndike, could equally be viewed as particular expressions of general ability, which develop through an individual's interaction with a particular culture. He argued that a given cultural environment will foster the development of particular mental abilities. Thus three of Thurstone's six primary mental abilities involve words and numbers, both of which are strongly emphasised in our culture. The spatial factor is seen to arise from people's experience with things in three dimensions, while reasoning and rote memory could be expected to be fostered, to varying degrees, in all cultures.

Although Vernon (1961) acknowledged that Thurstone's factorial analyses were as legitimate mathematically as Spearman's general-plus-group-factor solution, he believed that Thurstone failed to disprove the existence of g. Like Freeman, Vernon asserted that Thurstone's technique redistributed g amongst the group factors. This issue of the divisibility of factors is important, because more detailed analysis of particular primary factors frequently splits them up and it is not clear where factorisation should stop. Vernon (1961) believed that there was little point in isolating highly specialised factors which had little practical value. He argued that the aim of factor analysis should be to reduce large numbers of variables to the fewest components that account for the most variance. This approach contrasts with that of Guilford (1985), whose Structure of the Intellect Model postulates 150 distinct abilities or functions. Since Guilford's model provided the framework for the selection of the subtests comprising the JSAIS, it will be described further in the next chapter. In assessing this debate it is important to bear in mind that the factors extracted by factor analysis are mathematical abstractions and not "things" with physical reality. This point is strongly emphasised by Gould (1981) who criticises the tendency among factor analysts to reify the factors they extract. As regards Spearman's g, he asserts that one cannot reify g as a thing unless there is convincing, independent information to support it, beyond the fact of the correlation itself.

It is evident from the foregoing that no consensus has been reached as to the relative weight to be given to general, group or specific factors in developing a model of intelligence. Both Vernon (1961) and Freeman (1950) agree that most factorial theorists find a general factor necessary to explain the intercorrelations they observe. However, those at one end of the spectrum tend to make g as large as possible, while those at the other either introduce it as a second order factor, or minimise it. All theorists recognise group factors; some recognise broader, more comprehensive group factors, with subfactors descending from them; others accord similar status and variance to the group factors they extract.

One implication that these differing theories has for test construction has already been mentioned. That is, that the tests based on group factor theory yield separate scores on each of the primary factors tested and provide a profile of the testees' abilities, rather than a single index like mental age or IQ. In addition the individual subtests of a battery based on group factor theory must attempt to measure the factors in as "pure" a form as possible, and the subtests should have low intercorrelations. In contrast, in the Binet-type test and its descendants (to be discussed shortly), the subtests are not required to be factorially pure. It is expected that there should be substantial correlation, and a single composite score is yielded. As regards group intelligence tests, most arrange their items in groups of similar type, but the groupings are not factorially determined. Generally they yield a single score indicating rank order.

Despite the differences in theory described thus far, Freeman (1950) asserts that an examination of a sample of tests reveals that in practice these tests have a lot in common, irrespective of the theory on which they are based. Standardisation and test construction procedures are similar for all. All the tests must incorporate a variety of mental tasks to ensure that:

- those tests based on multi-factor theory can sample a sufficiently significant number of the many small factors,
- those based on group factor theory can sample the primary mental abilities adequately, and
- those based on the two-factor theory can tap g adequately.

A similar point of view is expressed by Wechsler (1971): "Notwithstanding their theoretical views, authors of intelligence scales tend to make use of the same sort of tasks and items. Procedures may vary, but the tasks themselves do not differ very much" (p.15).

Eysenck (1979), too, comments on the relationship between theories of intelligence and intelligence test construction: "It is often believed that intelligence tests are developed and constructed according to a rationale deriving from some scientific theory ... In actual fact ... intelligence tests are not based on any very sound scientific principles ... Because intelligence tests originally constructed in the early years of this century did such a good job when applied to various practical problems, psychologists interested in the problem tended to become technologists eager to exploit and improve these tools, rather than scientists eager to carry out the requisite fundamental research, most of which still remains to be done" (p. 8).

Having outlined some of the issues which occupied the attention of the theorist-psychologists working in the factor analytic tradition, and having related these to test construction practices, the contribution of the "practitioner psychologists" can shortly be traced. Before doing so, however, the work of Piaget, a theorist with a very different approach to those described thus far, must briefly be mentioned. Piaget was interested in the qualitative elements in the development of intelligence. Through careful observation of children he described the psychological processes which lead a child to aquire the concepts of self, other, animate-inanimate, number, quantity, time, movement, velocity, space, etc. He viewed intelligence as an aspect of biological adaptation (Matarazzo, 1972). His influence on test construction is evident in the composition of the Number and Quantity Concepts subtest of the JSAIS.

The "Practitioner Psychologists"

Alfred Binet was the first to introduce an objective and practical measure of intellectual functioning. His scale, released in 1905 and produced in collaboration with Theodor Simon, was devised in response to the need to differentiate levels of mental retardation in the school going population of Paris. Many of the tests included in the scale had been developed and reported on earlier. What was new about the scale was that the tests were ranked in order of increasing difficulty and careful instructions for administration were included. In contrast with earlier researchers in the field of mental testing, who had focussed on sensory-motor functioning, Binet's test sampled a wide range of functions. He considered judgement, comprehension and reasoning to be the most important elements of intelligence. Binet's scale was revised in 1908, at which time the items were grouped into clusters for different age levels, and the concept of mental age was introduced. A further thorough revision was undertaken in 1911, the year Binet died. Shortly thereafter Stern introduced the concept of the intelligence quotient, or IQ (du Bois, 1970).

In 1916, Terman of Stanford University revised and restandardised the test, using just over half of the original items (du Bois, 1970). It became known as the Stanford Binet and within a matter of years was translated into a number of languages.

The next major development in the field of mental testing occured in response to conditions generated by the outbreak of World War I. American involvement in this war created the need for an objective test of intelligence that could be applied on a group basis to large numbers of recruits. To fill this need, the Army Alpha and Army Beta were constructed by Yerkes and his colleagues. The former was a verbal test, the latter a non-verbal test. The application of these tests initiated the practice of large scale, impersonal testing which proliferated in the post-war years and spread to educational institutions and industry. Two streams, individual and group were thus formed in the testing movement.

In the field of individual intelligence testing, the next important milestone was the publication of the Wechsler Bellevue Scale of Intelligence in 1939. This scale incorporated adaptations of tests from both the Army Alpha and Army Beta, and thus had both verbal and non-verbal components. Subtest scores could be converted into standard scores, to facilitate comparison of performance on the subtests. A mental age score was dropped in favour of a point scale. A revision of the Wechsler Bellevue entitled the Wechsler Adult Intelligence Scale (WAIS), was released in 1955. Forms for school-age and pre-school children, the Wechsler Intelligence Scale for Children (WISC) and the Wechsler Pre-school and Primary scale of Intelligence (WPPSI) were published in 1949 and 1963 respectively (du Bois, 1970). The WISC was revised and released as the WISC-R in 1974 (Sattler, 1982).

Intelligence Test Development in South Africa

As was the case with Binet in Paris, in South Africa it was the problem of mental deficiency which stimulated interest in objective tests of intelligence. Initially, individuals attached to universities and education departments adapted tests brought from the USA. Later the Mental Hygiene Department of the Union Government became involved. In 1933 the National Bureau of Educational and Social Research was formed, with test construction as one of its functions.

After World War II the National Institute of Personnel Research (NIPR) was established under Biesheuvel, who had developed a number of tests used successfully in the selection of air-crew for the SA Air Force. The Test Construction Division of the NIPR is primarily concerned with the development of tests for use in commerce and industry. These tests are therefore chiefly devised for an adult population. (Huysamen, 1980).

The National Bureau of Educational Research was superceded by the Human Sciences Research Council (HSRC) in 1969. The HSRC's Institute for Psychometric Research (IPR) is now the chief source of tests for the school going populations of all language groups.

The first individual scale to be widely used in this country was that devised by Dr M L Fick, who had studied at Harvard University. It was an adaptation of the Terman revision of the Binet scale and was released in 1920. The 1939 revision of this scale has, until recently, been the most widely used intelligence test in this country (Malherbe, 1977).

A South African form of the Wechsler Adult Intelligence Scale, adapted to local conditions and standardised on a white South African norm group, was published in 1962. Two years later the New South African Individual Scale (NSAIS), based on the WISC, was released for use with white children. A revision of this test is currently being undertaken and will be released as the Senior South African Individual Scale (SSAIS), with common norms for the white, Indian and coloured population groups.

Since it was found that the NSAIS did not measure the intelligence of five and six year olds adequately, and there was a need for a test suitable for even younger children, the Junior South African Individual Scale (JSAIS) was commissioned. This test was originally designed for the white population group. The intention was to develop equivalent tests specifically for Indian and coloured children. This proposal was rejected by representatives of these groups, who preferred that the existing JSAIS should be employed. Separate norms will be made available for the Indian and coloured groups.

Individual intelligence tests are currently being constructed for Zulu, Xhosa, North Sotho and Tswana speaking children between the ages of 9 and 19 years. The rationale for each subtest is the same for each group but the content varies because of language differences. (Personal communication - Mr J. Landman, I.P.R. of the H.S.R.C., January 1987).

The first South African group test for whites was published in 1939. This test was revised from time to time. By 1965 ten different forms of the New South African Group Test had been developed, providing tests at three levels of difficulty, in both official languages (Huysamen, 1980).

These tests are currently being revised once more and will be released as the General Scholastic Aptitude Tests. Group intelligence tests are available for coloured and Indian school children.

Reaction to the Testing Movement

As mentioned earlier, during the years following World War I there was rapid growth in both the number and types of psychological tests, and they were applied in diverse settings. The control of these tests was thereby removed from the hands of trained clinicians, and left in the hands of teachers, administrators and others less adequately trained in their administration and interpretation. This led to inappropriate use of the tests and their results (Matarazzo, 1972).

In the USA opposition to the use of standardised tests grew. One major objection raised, especially with regard to personality questionnaires used for selection purposes, was the issue of invasion of privacy. A further criticism was that tests discriminated against minority groups (du Bois, 1970). In addition a slur was cast on the testing movement because a number of its historically key figures such as Terman & Spearman held strong hereditarian views and were active in the eugenics movement.

Ever since the publication of Yerkes' report in 1921 on the results of the psychological testing of US Army Personnel a flood of books and articles has appeared commenting on Yerkes' findings and questioning the validity of IQ testing. This so-called IQ controversy flared up afresh in 1968 after the publication of Jensen's article, "How much can we boost IQ and Scholastic Achievement?" (Jensen, 1969). This problem and the related question of the validity of IQ's is still a burning issue.

Jensen (1976) concluded that the poor performance of blacks on intelligence tests (one standard deviation below that of whites), and their apparent inability to benefit from previous attempts at compensatory education, derive from deeply rooted individual differences. He asserted that these differences are not so superficial that they can be erased by general cultural enrichment or verbal stimulation programmes lasting a few months. He observed that IQ tests in the USA were evolved to predict scholastic performance in curricula shaped by the abilities and needs of children from a largely North American middle-class population. He theorised that there are two broad categories of mental abilities: abstract reasoning ability (which he equated with intelligence) and associative learning (i.e. memory span, serial and paired associate rote learning). Test scores indicated large racial and social class differences in the distribution of abstract reasoning ability, but practically no difference for associative learning ability. Furthermore Jensen contended that the available evidence indicated that individual differences in intelligence, as measured by tests, are predominantly genetically determined.

He therefore recommended further research to delineate other types of abilities and further experimentation with intervention programmes aimed at developing particular strengths and potentials. He anticipated that his proposal to take the problem of individual differences seriously would be condemned and decried as leading to inequality of opportunity in education. However, he stated that one cannot escape from the fact that "one child's opportunity can be another's defeat" (p. 96).

The heat engendered by the ensuing controversy can be judged from Lewontin's (1976) response. He dismissed Jensen's article as not "an objective, empirical scientific paper" but "a closely reasoned ideological document springing ... from deepseated professional bias and permeated with an elitist and competitive world view" (p. 108). Numerous writers from a wide spectrum of academic disciplines participated in this debate. Among the more prominent was Gould (1981). His central theme was the mismeasure of man by the misuse of intelligence tests. In particular he inveighed against two invalid approaches to mental testing: the hereditarian theory, and the reification of intelligence as an entity by those employing the mathematical technique of factor analysis.

Of particular interest is his view that IQ tests have too often been used as a means of preserving the existing stratification of society, of justifying the existing rank order on the assumption that those with high IQ's are better than those with low scores. To quote Lewis and Sullivan (1985), "Such a belief system, supported by the set of a priori beliefs (which are always confirmed 'scientifically') has been labelled 'social Darwinism'" (p. 588).

The following conclusion by Vandenberg and Vogler (1985) will serve to wind up this discussion: "In its entirety, the body of literature we summarised justifies the conclusion that hereditary influences on intelligence exist" (p. 50). These authors have, however, reduced the estimates of genetic contribution from Jensen's 80% to a more moderate 30% to 40%. From the point of view of educationists it is encouraging that 60% to 70% of the variation in general cognitive ability is thus due to non-genetic influences, over which we may have some degree of control.

The Measurement of Academic Achievement

It is now necessary to turn briefly to developments in the measurement of academic achievement. Multiple and special aptitude tests, personality tests and interest questionnaires are outside the scope of this study and will not be dealt with here.

A pioneer in the field of scholastic testing was the American, Rice (du Bois, 1970). At the turn of the century he reported results of standardised spelling and arithmetic achievement tests, which had been applied to many thousands of children. Expected mean scores at each grade level were provided.

Rice's work drew the attention of E L Thorndike at Columbia University, which became a centre for the development of measures of academic achievement. The first tests developed by Thorndike's associates were for the evaluation of spelling, arithmetic and handwriting. Later, achievement tests were developed for a wide range of subjects, and standardised tests were also introduced at university level. The development of multiple-choice items, first used extensively in the Army Alpha, lent impetus to the growth of scholastic testing. By 1930 the use of objective tests for the measurement of academic achievement was well established in American education (du Bois, 1970).

In South Africa the first objective measures of scholastic achievement were developed in the 1920's. These tests were first used extensively in the Carnegie Poor White investigation from 1929-1931 and later again in the bilingualism survey of 1938. Standardised tests were used to compare the scholastic achievement of pupils in different parts of the country and the achievement levels of different population groups. They were also employed in the evaluation of the effectiveness of different teaching methods (Malherbe, 1977).

IQ as a Predictor of Scholastic Achievement

The relationship between intelligence test scores and scholastic achievement has been the subject of numerous studies. In his examination of 410 such studies Twaranovica (1973) observed that the correlations between measured intelligence (group and individual tests), and components of school achievement spanned a wide range, yet they tended to be positive. This wide range in the results yielded by various studies could be attributed firstly to the fact that different intelligence tests were used; secondly there were variations in the criteria for determining scholastic achievement; and thirdly the subject populations differed. These three factors will now be discussed.

1. Intelligence Tests Employed.

Among the individual and group measures of intelligence employed in studies of this nature are the Primary Mental Abilities Test (Clark, Bruininks & Glaman, 1978), the McCarthy Scales (Massoth & Levenson, 1982), the California Test of Mental Maturity (Machowsky & Meyers, 1975), the Slosson Intelligence Test (Wallbrown, Engin, Wallbrown & Blaha 1975), the Stanford Binet (Perry, Guidubaldi & Kehle, 1979) and the Boehm Test of Basic Concepts (Estes, Harris, Moers, & Wodwich, 1976). In these studies, the correlation between measured intelligence and the components of school achievement selected, ranges from .29 to .68. These findings are condensed in Table I.

TABLE 1.

CORRELATIONS BETWEEN VARIOUS INTELLIGENCE AND SCHOLASTIC ACHIEVEMENT TESTS.

Predictor Variable: Intelligence Test	Criterion Variable: Scholastic Achievement Test	Sample Size	Application of Predictor	Application of Criterion	CORRELATIONS Overall Score	Reading	Spelling	Mathematics
Boehm Test of Basic Concepts (a)	Stanford Achievement Test	278	Sub A	Sub A	,56	,45	,39	,56
California Test of Mental Maturity (b)	California Achievement Test	78	Sub A	Sub A		,29		
McCarthy Scales of Children's Abilities: GC1 (c)	Macmillan Reading Readiness Test	33	Pre-primary	Sub A		,53		
	Metropolitan Achievement Test	33	Pre-primary	Sub A	,39			
Stanford-Binet (d)	Wide Range Achievement Test	50	Pre-primary	Std I		,44	,41	,53
Slosson Intelligence Test (e)	Gates-Macgnite Reading Test	100	Pre-primary	Sub A		,46 - ,55		
Primary Mental Abilities Test: Number Facility (f)	Diagnostic Reading Scales (3 subtests)	79	Pre-primary	Sub A Sub B Std I		,36 - ,51 ,47 - ,61 ,57 - ,68		

Note.
(a) = Estes et al, 1976
(b) = Machowsky & Meyers - 1975
(c) = Massoth & Levenson - 1982
(d) = Perry et al, 1979
(e) = Wallbrown et al - 1975
(f) = Clark et al - 1978

The Wechsler Scales are the tests most extensively used in studies examining the relationship between measured intelligence and scholastic achievement. The age range covered by the Wechsler Pre-primary Scale of Intelligence (WPPSI) corresponds closest with that of the JSAIS. A closer examination of studies employing this Wechsler Scale is therefore pertinent. Table 2 summarises the results of studies investigating the correlations between the WPPSI, Verbal, Performance and Full Scales and a variety of reading tests.

With the exception of those of Plant & Southern (1968) and Krebs (in Sattler, 1982) the studies listed in Table 2 were conducted on middle class children. The validity of the WPPSI as a predictor of early school achievement with this group is considered to be satisfactory (Sattler, 1982). With ethnic minority children and those of lower socio-economic status, however, its predictive validity is somewhat more variable. Krebs (in Sattler, 1982) found higher correlations between WPPSI scores and reading in the lower socio-economic status group than in the upper socio-economic group. Yet Henderson & Rankin (1973), in their study employing Mexican-American children, reported that the predictive validity of the WPPSI, using Third Grade Metropolitan Test reading scores as criterion, was poor ($r = ,27$). They found an 18 point difference between the children's Verbal & Performance Scale IQ's (74 vs 92). A Study by Crockett, Rardin & Pasewark (in Sattler, 1982), using a sample of Head Start children, also yielded poor correlations between WPPSI scales and the Metropolitan Achievement Test. With subjects like these, of lower socio-economic status, who are bilingual and whose language development may have been atypical, Crockett et al advise that the WPPSI Verbal Scale be viewed with caution.

TABLE 2.

CORRELATIONS BETWEEN WPPSI SCALES AND READING ACHIEVEMENT

Study and Reading Test	SES	Sample size	Time 1 (a)	Time 2 (b)	Full Scale	Verbal Scale	Performance Scale
White & Jacobs, 1979 Gray Oral Reading	Middle	28	Nursey	Sub A	,58	,54	,51
Lieblich & Shinar, 1975 Standardised Israeli reading test	Middle	54	Sub A	Sub B	,63	,57	,63
Kaufman, 1973 Metropolitan Achievement	Middle	31	Pre-primary	Sub A	--	--	,36
Feshbach et al, 1975 (In Lieblich & Shinar, 1975) Gates MacGinite	Middle	433	Pre-primary	Sub A	,38	,47	,44
Plant & Southern, 1968 Stanford Achievement	Lower	56	Pre-primary	Sub A	,55	,43	,59
Krebs, E.G., 1969 (In Sattler, 1982) Gilmour Oral Reading	Lower and Upper	70	Pre-primary	Sub A	,62	,57	,58
Stanford Achievement					,68	,61	,63

Note.
(a) = Time 1 - Administration of WPPSI
(b) = Time 2 - Administration of reading test

A number of studies have reported the correlations between WPPSI subtest scaled scores and measures of scholastic achievement. Table 3 summarises the results of studies employing reading as scholastic criterion. Krebs (in Sattler, 1982) found all WPPSI subtests to be significantly related to reading scores on both the reading tests employed in her study. She reported that the two best subtests for predicting reading were Arithmetic and Geometric Design. White & Jacobs (1979) obtained significant correlations between reading and the Vocabulary, Arithmetic, Similarities and Geometric Designs subtests, with Arithmetic and Geometric Designs yielding the highest correlations. Plant & Southern (1968) also reported Arithmetic & Geometric Design amongst their highest correlations, while in the study by Lieblich & Shinar (1975) Geometric Design was again one of the subtests to correlate highest with reading achievement. Thus, the Arithmetic and Geometric Design subtests present consistently among the best predictors of reading achievement in the studies mentioned above.

It is of interest to note that on the study by Clark et al (1978), another arithmetic test, the Number Facility subtest of the Primary Mental Abilities Test, occurred most frequently as the single best predictor of reading achievement. Examination of this subtest shows that it is not simply a measure of number knowledge, for many items assess more complex language skills and mathematical vocabulary.

A number of studies using a South African individual test, The New South African Individual Scale, are reported. These do not deal with the correlation between test performance and scholastic achievement in an unreferred sample. They have as their focus the validity and diagnostic value of the test with selected samples, for example the learning disabled (Hamilton, 1974) and the brain injured (du Toit, 1976).

TABLE 3.

CORRELATIONS BETWEEN WPPSI SUBTESTS AND READING ACHIEVEMENT

WPPSI Subtests	STUDY				
	Krebs 1969 (in Sattler 1982) (a)	(b)	Plant & Southern 1975 (b)	Lieblich & Shinar 1975 (c)	White & Jacobs 1979 (d)
Information	,49	,52	,46	,34	,33
Vocabulary	,52	,53	,22	,49	,51
Arithmetic	,54	,58	,46	,44	,54
Similarities	,48	,53	,20	,53	,41
Comprehension	,36	,38	,29	,40	,27
Sentences	,54	,55	-	-	-
Animal House	,41	,46	,48	,46	,24
Picture Completion	,43	,47	,31	,44	,31
Mazes	,42	,47	,29	,44	,23
Geometric Design	,52	,54	,55	,51	,61
Block Design	,44	,49	,51	,26	,32

NOTE. (a) = Gilmore Oral Reading Paragraphs
(b) = Stanford Achievement Test
(c) = Israeli Objective Group Test
(d) = Gray Oral Reading Test

As regard the subject of this research project, ie the JSAIS, two studies report on its diagnostic value with learning disabled children (Muller, 1982, Robinson, 1986). Only one study examining the relationship between JSAIS test scores and scholastic achievement in an unreferred sample is reported (Venter, 1985). The results of Venter's study are presented at some length, as his findings are relevant to the discussion of the results of the present study.

When comparing the results of Venter's study with those of this study, it must be borne in mind that the studies differ from one another in a number of important respects. Venter used the twelve subtest version of the JSAIS, whereas the present study employed the eight subtest JSAIS. Both the JSAIS testing and the two sets of teacher-evaluations took place in Venter's subjects' Sub B year. In this study the JSAIS testing took place in Sub A, and the teacher-evaluations spanned three standards. Venter included Writing as one of his criterion variables. Venter's "Overall Impression" score was not derived in the same manner as this study's "Average" score.

Because of these differences, the only more or less comparable correlations are those between the eight subtests common to both studies and teacher-evaluations of reading, phonics and mathematics. The only equivalent JSAIS scale is the Numerical Scale because the Global, Verbal and Performance Scales of the twelve subtest version incorporate subtests that are not included in the eight subtest scale.

The ease of comparison with the results of this study, the correlations between the eight subtests and one scale common to both studies and teacher-evaluations of reading, phonics and mathematics in June and December of Venter's Sub B sample are presented in Table 4. The remaining correlations yielded by his study are presented in Table 5.

TABLE 4.

CORRELATIONS BETWEEN THE SUBTESTS COMPRISING THE EIGHT SUBTEST VERSION OF THE JSAIS AND THE NUMERICAL SCALE, AND TEACHER EVALUATIONS OF SUB B READING, PHONICS AND MATHEMATICS IN JUNE AND DECEMBER : VENTER, 1985.

	READING		PHONICS		MATHEMATICS	
	JUNE	DECEMBER	JUNE	DECEMBER	JUNE	DECEMBER
JSAIS SUBTESTS						
Form Board	,26	,27	,32	,37	,45	,53
Vocabulary	,29	,37	,36	,35	,40	,38
Number & Quantity Concepts	,41	,38	,45	,43	,58	,57
Memory for Digits	,38	,35	,31	,36	,58	,36
Picture Riddles	,31	,28	,33	,24*	,29*	,23
Word Association	,37	,32	,41	,35	,39	,38
Absurdities A	,37	,33	,40	,34	,38	,39
Absurdities B	,30	,24	,36	,29	,45	,40
NUMERICAL SCALE	,49	,45	,48	,50	,58	,57

Note.
* $p < .01$

All remaining correlations $p < .001$

TABLE 5.

CORRELATIONS BETWEEN THE FOUR SUBTESTS EXCLUDED FROM THE SHORTENED JSAIS, THE TWELVE SUBTEST GLOBAL, VERBAL, PERFORMANCE AND MEMORY SCALES, AND TEACHER EVALUATION OF SUB B READING, PHONICS AND MATHEMATICS IN JUNE AND DECEMBER : VENTER, 1985.

	READING		PHONICS		MATHEMATICS	
	JUNE	DECEMBER	JUNE	DECEMBER	JUNE	DECEMBER
JSAIS SUBTESTS						
Ready Knowledge	,47	,44	,46	,47	,50	,48
Block Design	,38	,39	,44	,44	,57	,57
Story Memory	,28	,23*	,21*	,24*	,32	,27
Form Discrimination	,43	,41	,44	,44	,50	,49
JSAIS SCALES						
Global Scale	,59	,52	,59	,57	,69	,67
Verbal Scale	,47	,45	,49	,45	,52	,48
Performance Scale	,47	,44	,53	,50	,64	,65
Memory Scale	,47	,43	,40	,43	,45	,45

Note.
* $p < .01$

All remaining correlations $p < .001$

An examination of these tables shows that the four subjects yielding the highest correlations in Venter's study are Ready Knowledge, Block Design, Form Discrimination and Number and Quantity Concepts. Only one of these four subjects is included in the eight subtest form of the JSAIS. The subtests yielding the lowest correlations in Venter's samples are Picture Riddles and Story Memory. Picture Riddles is included in the eight subject JSAIS.

Venter also undertook a multiple regression analysis to determine which combination of the subtests best predicted Reading, Phonics, Mathematics, Writing and a Total Impression in June and December of his sample's Sub B year. The subjects entered in his forward stepwise regression analysis for Reading, Phonics and Mathematics are listed in Table 6. An examination of this table shows that of the five subtests included in the different regression analyses two or more times, only two form part of the eight subtest JSAIS viz Memory for Digits and Word Association.

2. Measurement of Scholastic Achievement

Just as many different measures of intelligence have been used in studies, so too has the criterion of scholastic achievement been varied. Two types of evaluation, viz teacher evaluations and standardised achievement tests have been employed. Among the standardised achievement tests most commonly used in the USA are The Wide Range Achievement Test, The Metropolitan Achievement Test, The California Achievement Test and the Stanford Achievement Test (See Tables 1,2 & 3).

The only South African achievement tests for the Junior Primary level, standardised on a nation-wide white population, are those produced by the HSRC. No studies relating these tests to intelligence measures from an unreferred sample are cited in the literature.

TABLE 6.

JSAIS SUBTESTS SELECTED IN FORWARD MULTIPLE REGRESSION ANALYSIS FOR PREDICTION OF SUB B READING, PHONICS AND MATHEMATICS : VENTER, 1985

READING	PHONICS	MATHEMATICS
June	June	June
Ready Knowledge	Ready Knowledge	Number & Quantity Concepts
Form Discrimination	Block Design	Block Design
Memory for Digits	Form Discrimination	Form Discrimination
	Word Association	Memory for Digits
December	December	December
Ready Knowledge	Ready Knowledge	Block Design
Form Discrimination	Form Discrimination	Number & Quantity Concepts
Memory for Digits	Form Board	Form Board
	Memory for Digits	Form Discrimination
		Memory for Digits

The relative merits of the two types of measures of scholastic achievement, viz standardised tests and teacher evaluations, have been debated by various authors. Mercer (in Messe, Crano, Messe & Rice, 1979), objects to the use of standardised tests of achievement as criterion measures to establish the predictive validity of IQ scores. She asserts that this approach inflates the IQ-achievement correlation, as a result of common methods variance. She advocates more direct indicants of classroom performance of young children, such as teacher evaluations. A study by Archer (1982) lends support to Mercer's preference for the use of teacher evaluations, as opposed to standardised tests. Archer compared teacher judgements of pupils' achievement levels with their results on standardised tests, and found that there was considerable agreement between the majority of teachers and the tests constituting the battery, thus concluding that standardised test results contain relatively little new information for the teacher. However, the few studies that have assessed the relationship between scores of mental ability and elementary school classroom performance, as measured by teacher evaluations, have produced contradictory findings.

Gerard and Miller (in Messe et al., 1979) and Goldman and Hartig (1976) report relatively weak average correlations (r = .21 and ,27 respectively) between IQ scores and grades achieved. On the other hand, studies by McCandless, Roberts and Staines (1972), and Hartlage and Steele (1977) (both cited in Messe, 1979) suggest a considerably stronger relationship between IQ scores and classroom performance as measured by teacher evaluations. Hartlage and Steele report an average correlation of r = ,49 for full scale WISC-R scores and averaged grades in reading and arithmetic performance. McCandless et al (1972) found an overall correlation of r = ,56 between Grade Point Average (GPA) and scores on the California Test of Mental Maturity.

In his discussion of these contradictory reports Messe points out that in the case of the Gerard and Miller, and Goldman and Hartig studies, there was no standardisation of the criteria by which teachers were to assign grades, thus increasing the possibility of teacher-bias. Furthermore, in Goldman and Hartig's study the measure used, the GPA, was derived from a combination of traditional academic subjects and completely non-academic course grades. In the discussion of his own study's findings, Messe reports a substantial relationship (,51, ,53, ,52 for grades 2, 3 and 4) between the mental ability measures and within year reading-arithmetic GPA.

What seems to be of importance in this regard is that the criteria according to which teacher ratings are made need to be clearly specified. Even though a degree of subjectivity cannot be excluded, it appears that teacher ratings can represent a valuable source of criterion data.

This finding is of significance because teacher evaluations, in the form of year-end symbols or grades, are what are recorded in schools' official records. They are readily available for all pupils, and thus form the basis on which much further educational planning is based.

3. The Subject Populations

A third factor contributing to the wide range in reported correlations between measured intelligence and aspects of school achievement relates to differences in the subject populations studied. Some studies employed highly selected samples, resulting in a narrow range of test scores and, hence, lower correlations. The children in the different studies differed in age and standard, whether members of a referred or unreferred population, minority or majority group membership, and socio-economic status. The size of the samples was often small. Prediction rarely extended over periods of longer than a year (see Tables 1 & 2). Hence generalisations about the predictive value of the measures employed can only be made with caution.

CHAPTER THREE

GUILFORD'S STRUCTURE OF THE INTELLECT MODEL, AND ITS APPLICATION IN THE DESIGN OF THE JSAIS

The Junior South African Individual Scales (JSAIS), comprising twenty two tests, was released by the Human Sciences Research Council (HSRC) in 1981. The aim of the test battery is to establish the general intellectual level of children between the ages of 3 years 0 months and 7 years 11 months, and to evaluate a child's relative strengths and weaknesses in some significant facets of intelligence. Furthermore, it is expected that the nature of the test tasks would enable the tester to evaluate certain non-cognitive behaviours, including concentration, perseverance, attitude to task, activity level, impulsivity and distractibility.

The selection of the tests included in the scale was made "more or less" (Madge, 1981, p. 6) in accordance with the content and operations categories of Guilford's Structure of the Intellect (SOI) model. This model will now be described briefly.

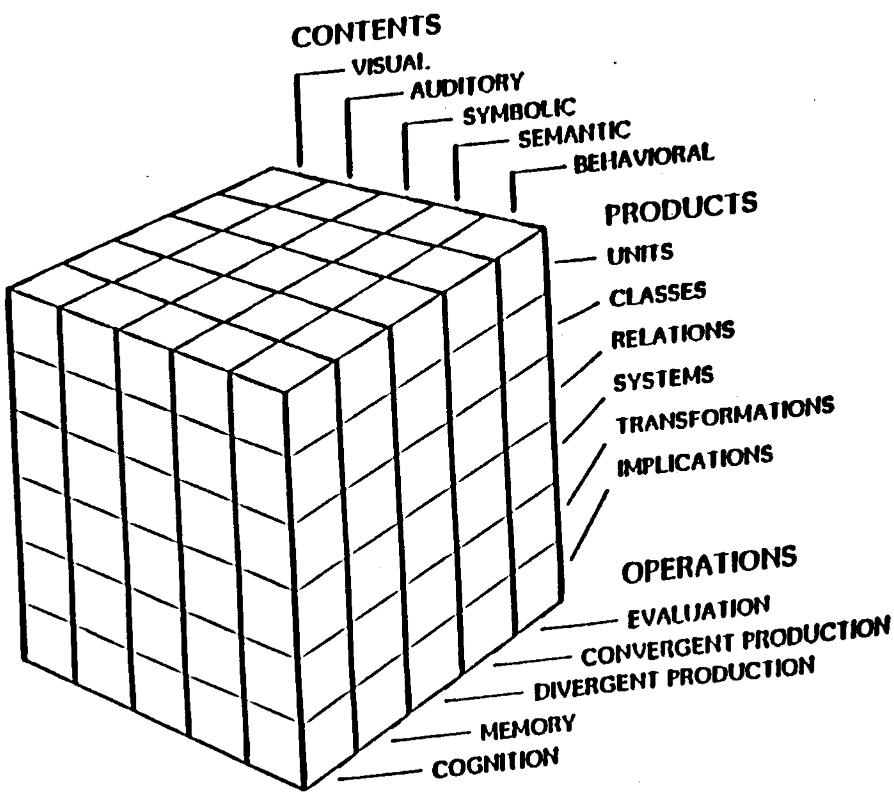
Guilford's Structure of the Intellect Model

Guilford defines intelligence as "a systematic collection of abilities or functions for processing information of different kinds in various ways" (Guilford, 1985, p. 231). His Structure of the Intellect model is a three way classification of "known and conceivable human intellectual abilities or functions" (Guilford, 1967, p. 155). Each ability is identified by its combination of three variables: the mental activity or operation involved, the informational content, and the informational product.

The model is represented by a three dimensional cube, as shown in Figure I (Guilford, 1977, p.151). The five kinds of operations are listed along one dimension of the cube, the six kinds of products lie along a second, and the five kinds of informational content are listed along the third dimension. Each of the three facets - operations, contents and products - is composed of a number of elements or categories.

FIGURE 1

STRUCTURE OF THE INTELLECT MODEL



Of the 150 distinct abilities or functions postulated by the SOI model, just over 100 have been investigated and demonstrated. A number have been confirmed by different studies. Guilford expects the remaining hypothesised intellectual-aptitude variables to be demonstrated with the development of appropriate tests and factor analysis (Guilford, 1985). A brief description of the facets and their categories follows.

Operations Facet

Five kinds of intellectual operations are differentiated.

- **Cognition:** Discovering, knowing and understanding are all instances of cognition. Seeing and recognising familiar objects constitute cognition of visual units. Knowledge of the meaning of words constitutes cognition of semantic units. Analogies tests are used for assessing cognition of relations in the symbolic and semantic areas.

- **Memory:** Once perceived, newly structured items of information may be stored by the next operation, memory. Items of information in the different content categories are not equally easy to store. In order to facilitate storage, it may be helpful to translate one kind of information into another. For example nonsense syllables, which are symbolic units, can be converted into a meaningful sentence, to form a semantic system. A differentiation is made between short-term memory, where information is held at a useable level for a period of seconds to a few minutes, and long-term memory. Stored items of information may be retrieved for future use.

- **Divergent and Convergent Production:** Retrieving or recalling information from storage involves two different kinds of operations. Where the search is a broad one, as when a variety of alternatives are sought, the operation is known as divergent production. On the other hand, if the search is focussed in order to find a particular item, the operation is called convergent production.

- **Evaluation:** Deciding whether or not, or how well, a certain item of information accords with certain logical requirements involves evaluation.

Content Facet

The content facet refers to the informational component: that is anything that is known, or "that which an organism discriminates". (Guilford, 1967, p. 221). Five content categories are recognised.

- **Visual:** Information arising from the stimulation of the retina, or indirectly in the form of images.

- **Auditory:** Information arising from the stimulation of the receptors of the ear.

- **Symbolic:** Items of information that stand for other kinds of items, such as digits or letters and their combinations.

- **Semantic:** Meanings, usually attached to word symbols.

- **Behavioural:** Items of information about the mental states and the behaviour of individuals, as conveyed by their expressions and actions.

Product Facet

This facet describes the way or form in which information occurs. Illustrations of products from all the content categories described above i.e. visual, auditory, symbolic, semantic and behavioural are given.

- **Unit :** An entity like an object, having its own unique combination of properties or attributes, such as a blue triangular patch, the sound of a musical chord, a printed word,the meaning of "crime", or a person's intention to hit someone.

- **Class :** A conception behind a set of similar units (or other kinds of products, even classes of classes), as given by a set of rectangles, or high-pitched tones, or words ending in -ing or set of occupations, or of doubting Thomases.

- **Relation :** An observed connection between two items, as one boy taller than another, two tones an octave apart, two names in alphabetical order, Alice married to Jim, or Maggie angry with Henry.

- **System :** Three or more items interrelated in a recognisable whole, as the arrangement of objects seen on your desk, a melody or a rhythm, a telephone number, a plan for a sequence of actions, or three persons interacting in a cartoon.

- **Transformation:** Any change in an item of information,including substitutions, as in a visually perceived movement of an object, a variation in a melody, a correction of a misspelling, a pun, or a revised impression of a person's mood.

- **Implications:** An item of information suggested by a given item of information, as adding a line to a doodle, thunder expected following lightning, seeing 4 x 5 and thinking 20, hearing the word light and thinking of heavy, or thinking what your frowning friend is likely to say or do next" (Guilford, 1985, p. 233).

At this point it is pertinent to note that although there is wide respect for the breadth and quality of Guilford's work, his theories and findings do not go unchallenged.
Vernon (1961) expresses "grave doubts regarding its ultimate validity" (p. 144) and points out that:

- "There is no good proof of the independence of anything like such a large number of factors, even in highly selected groups".

- "No other laboratory or research institution seems to have been convinced of the validity of Guilford's scheme, nor (with a few exceptions) to have used his factors as a basis for fresh experimentation" (p. 144). Vernon comments on the consistency of Guilford's findings from one study to another, yet points out that investigations by others have seldom confirmed them.

- There is little evidence that the new factors provide additional information about thinking ability in everyday life. Until empirical evidence of their role is produced Vernon questions whether they represent "not so much thinking abilities as abilities to do various kinds of psychological tests" (p. 144)

Similar views are expressed by Eysenck (1979), who believes there is inadequate empirical support for Guilford's theories.

The Relationship Between the Structure of the Intellect Model and the JSAIS

As mentioned earlier, the selection of the subjects of the JSAIS was made in accordance with the contents and operations categories of the SOI model. However, the categories of the SOI model and the elements of the JSAIS do not correspond exactly, and there is some difference in terminology. A comparison of the SOI and JSAIS Contents facets is presented in Table 7 below.

TABLE 7

Comparison of the SOI Contents Facet and the JSAIS Contents Facet

SOI CONTENTS FACET	JSAIS CONTENTS FACET
Visual	Spatial (ie objects, figures and pictures)
Auditory	
Symbolic	Quantitative/Numerical
Semantic	Verbal

The SOI Operations Facet is termed the Process Facet in the JSAIS. A comparison ofthese two Facets is presented in Table 8. As can be seen in this table, the SOI Category Cognition is labelled Concept Attainment in the JSAIS.

TABLE 8

Comparison of the SOI Operations Facet and the JSAIS Process Facet

SOI OPERATIONS FACET	JSAIS PROCESS FACET
Cognition	Concept Attainment
Memory	Memory
Divergent Production	Divergent Production
Convergent Production	Convergent Production
Evaluation	Evaluation

Composition of the full JSAIS, and the twelve and eight subtest intelligence scales.

The selection of the tests for the JSAIS was based on a content x process model, in which each of the three types of content (see Table 7) was combined with each of the five processes (see Table 8). This produced a matrix with 15 cells for which appropriate tests were required. However, it proved difficult to design tasks in which individual differences between children would rely on a single mental process. It was therefore decided to select test tasks in which the targeted process would be "if not of vital importance, useful for an acceptable performance. Thus, it was assumed that most of the variance in children's performance in a specific test would be attributable to the particular mental process. However, in more difficult items it is possible that different children may use different strategies to perform a task e.g. Number and Quantity Concepts and Memory for Digits" (Madge, 1981, page 9). A further important consideration in the selection of tests was the diagnostic value of particular test types.

The results of an experimental administration of preliminary tests indicated that it would be useful "to distinguish further between different levels in each cell, more or less in accordance with Guilford's (1967) Product category" (Madge, 1981, p. 9). It was intended that the tests and to some extent the items in each test, should fall along a continuum of difficulty, ranging from simple or concrete, to complex or abstract.

Thus, at an elementary level the testee would be working with units of information, while higher levels of difficulty would involve the other elements in the SOI Product category: classes, relations, transformations and implications.

Because of test time constraints and difficulty devising objective scoring, tests with numerical and spatial content were not designed for the Divergent Production element. Finally, the 22 tests set out in Table 9 were included in the scale (Madge, 1981, page 12).

TABLE 9

CLASSIFICATION OF THE BATTERY OF 22 TESTS BY CONTENT AND PROCESS

Process	**Content**
	Verbal
Concept Attainment (Cognition)	Vocabulary; Ready Knowledge
Convergent Production	Word Association; Picture Series
Evaluation	Picture Riddles; Picture Association/Analogies; Social Reasoning
Divergent Production	Word Fluency
Memory	Story Memory
	Numerical
Concept Attainment (Cognition)	Number and Quantity Concepts A (counting, simple number concepts)
Convergent Production	Number and Quantity Concepts A and B (ordering, simple calculations)
Evaluation	Number and Quantity Concepts A (conservation items, comparison of quantity, length, etc)
Memory	Memory for Digits
	Figural
Concept Attainment (Cognition)	Search Bag; Gestalt Completion; Form Board
Convergent Production	Block Designs; Grouping; Copying; Absurdities B
Evaluation	Form Discrimination; Absurdities A
Memory	Visual Memory (objects and figures)

It would appear from the foregoing, that the test tasks finally selected for inclusion in each cell of the model were not "pure" measures of the ability or function allocated to that cell, and that the JSAIS is based only loosely on the SOI model.

In the selection of the types of tests to be included in the Global IQ scale the following factors were considered important:

(a) A reasonably complete coverage of those intellectual skills essential for progress in the first year of primary school;

(b) the diagnostic and clinical value of tests, as evident in the relevant literature;

(c) the suitability and attractiveness of the test material for children of this age group;

(d) objectivity in scoring, (Madge, 1981 page 18).

It was never intended that all 22 tests of the JSAIS should be included in the intelligence scale. Some of the test types were included because they had been shown to have diagnostic value. The selection of the tests included in the 12 test battery to assess the global or general intelligence level (GIQ) was made on the basis of factor analytic studies and correlations with teacher ratings. Other considerations in the selection of these tests were their reliability, sex differences in performance, differences in performance between urban and rural children, and the tests' diagnostic value.

The tests comprising the twelve test intelligence scale are listed in Table 10, according to content and mental process. As can be seen from the table, in the Process category there are no tests for the element Divergent Production, and in the element, Memory, a Spatial test is lacking. Table 11 lists the reliability coefficients (r_{tt}) and standard errors of measurement (S Em) of the twelve subtests.

As mentioned in the introduction, the twelve test Global IQ Scale of the JSAIS takes a long time to administer (at least 1-1/2 hours). A set of eight JSAIS tests was therefore proposed which halves the administration time.

Three principles were applied in determining the composition of the reduced battery. Firstly, the administration time was to be limited to between 40 and 50 minutes. Due to the lengthy and unpredictable time required to apply the Blocks Design subtest, this test was omitted from the battery. Secondly, the composition of the reduced battery was to approximate the existing twelve subtest battery. Equal numbers of verbal and non-verbal elements were therefore included, numerical and memory tests were retained, overlap of content was avoided and the Structure of the Intellect model again provided the framework for the selection of test types in order that as wide a range of abilities as possible would be sampled. Thirdly, the shortened form was required to provide an adequate IQ score, correlating highly with the twelve subtest battery. Table 12 lists the tests selected for inclusion in the reduced battery, according to content and mental process. It is this battery which was employed as predictor variable in the present study. A description of the design of the study follows in the next chapter.

TABLE 10

COMPOSITION OF THE TWELVE TEST BATTERY
ACCORDING TO CONTENT AND MENTAL PROCESS

	Kind of Test Content		
Process	Verbal	Numerical	Spatial
Cognition (Concept Attainment)	Vocabulary Ready Knowledge	Number & Quantity Concepts	Form Board
Convergent Production	Word Association	Number & Quantity Concepts	Blocks Absurdities B
Evaluation	Picture Riddles	Number & Quantity Concepts	Form Discrimination Absurdities A
Memory	Story Memory	Memory for Digits	-
Divergent Production	-	-	-

TABLE 11

RELIABILITY OF COEFFICIENTS (r_{tt}) AND STANDARD ERRORS OF MEASUREMENT (SEm) OF THE TWELVE TEST BATTERY (Madge, 1981, p.63)

	7 yrs		Average	
Tests	r_{tt}	SEm	r_{tt}	SEm
<u>Verbal Scale</u>	,94	3,67	,95	3,35
Vocabulary	,78	1,39	,84	1,20
Ready Knowledge	,84	1,19	,85	1,16
Word Association [1)]	,84	1,21	,88	1,04
Picture Riddles	,74	1,53	,80	1,34
Story Memory [1)]	,86	1,13	,84	1,20
<u>Performance Scale</u>	,91	4,50	,93	3,97
Form Board	,72	1,60	,80	1,34
Blocks	,88	1,03	,89	,99
Absurdities A	,76	1,48	,81	1,31
Absurdities B	,67	1,73	,77	1,44
Form Discrimination	,79	1,36	,83	1,24
<u>Numerical Scale</u>	,87	1,08	,88	1,04
Number & Quantity Concepts	,88	1,03	,88	1,04
Memory for Digits	,75	1,50	,80	1,34

Note [1)]: The coefficients for these tests were calculated for 48 to 71 months and for 72 to 95 months respectively, and not for each age group. The coefficients listed are those for 72 to 95 months.

TABLE 12

COMPOSITION OF THE EIGHT TEST BATTERY ACCORDING TO CONTENT AND MENTAL PROCESS

	Kind of test content		
Process	Verbal	Numerical	Spatial
Cognition	Vocabulary	Number & Quantity Concepts	Form Board
Convergent Production	Word Association	Number & Quantity Concepts	Absurdities B
Evaluation	Picture Riddles	Number & Quantity Concepts	Absurdities A
Memory	-	Memory for Digits	Absurdities A
Divergent Production	-	-	-

CHAPTER FOUR

METHOD

4.1 SAMPLE

The sample employed in this study was drawn from a group of 197 pupils who were tested on the 8-test JSAIS in November of their Sub A year. They were tested by members of the School Psychological Service as part of an internal research project. At the time of testing all the pupils were between the ages of 7 years 0 months and 7 years 3 months. None had previously been referred to the School Psychological Service. This sample was composed of approximately the same proportions of children as were included in the stratification variables of the JSAIS standardisation group, and was thus reasonably representative of this group. For the purpose of the present study, as many as possible of the original sample was followed up at the end of their Std One year. The pupils' three sets of year-end symbols (i.e. those for Sub A, Sub B and Std I), as recorded in the official school records, were obtained. Examples of the questionnaire can be found in Appendix A.

In a number of instances questionnaires were not returned, or they were not sufficiently fully completed for inclusion in the sample. The questionnaires of 104 pupils were satisfactorily completed.

The distribution of the sample according to sex, language, socio-economic status and urban/rural residence.

The distribution of this group is presented in Table 13 according to sex, language, socio-economic status (SES) and urban/rural residence. For the purpose of comparison the same information is provided in respect of the JSAIS standardization sample of seven year olds. The results of the Chi-square test (Downie & Heath, p. 208) show that the Sub A sample differs from the standardisation sample in that there are significantly more English speaking subjects and more subjects from the upper socio-economic group

TABLE 13

COMPARISON OF THIS STUDY'S SUB A SAMPLE WITH THE JSAIS STANDARDISATION SAMPLE OF 7 YEAR OLDS BY SEX, LANGUAGE, SOCIO-ECONOMIC STATUS (SES) AND URBAN/RURAL RESIDENCE

STRATIFICATION VARIABLES		JSAIS TESTEES		STANDARDISATION SAMPLE		χ^2	df	p
		N_a	%	N_b	%			
Sex:	Male	57	55	180	50,4	,46	1	0,50
	Female	47	45	177	49,6			
Language:	Eng	54	52*	131	36,7	7,15	1	<0,01
	Afr	50	48	226	63,3			
SES:	Lower	7	7	57	15,5			
	Middle	56	54	236	66,1	23,14	2	<0,001
	Upper	41	39*	64	18,4			
Resi-dence:	Urban	66	63	250	70,3	1,32	1	0,25
	Rural	38	37	107	29,7			

Note:

$N_a = 104$

$N_b = 357$

* This percentage significantly larger than standardisation sample

The distribution of the sample's JSAIS scores

The distribution of the JSAIS scores obtained by the sample is presented in Table 14.

TABLE 14

THE MEAN ($\bar{X}$), STANDARD DEVIATION (S) AND STANDARD ERROR (SEm) OF THE EIGHT SUBTEST JSAIS SCORES OBTAINED BY THE SUB A SAMPLE

	$\bar{X}$	S	SEm
JSAIS Scale			
Global	104,4	12,1	1,2
Verbal	105,0	12,0	1,2
Performance	102,7	12,8	1,3
Numerical	11,0	2,9	,3
JSAIS Subtests			
Form Board	10,5	3,0	,3
Vocabulary	11,2	2,7	,3
Number & Quantity	10,1	3,2	,3
Memory for Digits	11,5	2,9	,3
Picture Riddles	10,7	2,8	,3
Word Association	10,7	2,9	,3
Absurdities A	11,3	2,7	,3
Absurdities B	9,6	3,9	,4

Note: None of the measures of kurtosis or skewness deviate more than 1,5 from zero.

N = 104

It was not possible to determine whether this sample's average Global, Verbal and Performance Scale scores differ significantly from those of the standardisation sample, because the scales of the eight and twelve test versions are not identical. The Numerical Scale is, however, composed of the same subtests. The result of the t-test shows that this sample's average for the Numerical Scale is significantly higher than that of the standardisation sample. So, too, are the averages of the Vocabulary, Memory for Digits, Picture Riddles, Word Association and Absurdities A subtests (See Table 15).

TABLE 15

RESULTS OF THE t-TEST FOR SIGNIFICANCE OF DIFFERENCES BETWEEN THE SUB A SAMPLE AND THE STANDARDISATION SAMPLE ON COMPARABLE SECTIONS OF THE TEST

	$\bar{X}$	t	p
JSAIS Scales			
Numerical	11,0	3,01	<,01
JSAIS Subtests			
Form Board	10,5	1,5	ns
Vocabulary	11,2	3,67	<,001
Number & Quantity Concepts	10,1	0,29	ns
Memory for Digits	11,5	4,52	<,001
Picture Riddles	10,7	2,12	<,05
Word Association	10,7	2,11	<,05
Absurdities A	11,3	3,97	<,001
Absurdities B	9,6	-1,11	ns

The slightly higher averages achieved by this study's sample are probably due to the fact that the sample is composed of a disproportionately high number of subjects from the upper socio-economic group.

Distribution of the sample's scores on measures of scholastic achievement.

The means, standard deviations and standard errors of the distribution of scores for each subject and each standard are presented in Table 16. The mid-point of the scale is 4,5. Most ratings tend to concentrate on the upper part of the scale, resulting in slightly negative skewness.

The samples on which the Pearson correlation analyses and the regression analyses were performed.

The group of 104 Sub A pupils presented in Tables 14 and 15 included eleven pupils who were subsequently referred to the School Psychological Service and/or received remedial teaching. These pupils were excluded from the correlation and regression analyses, as it was intended that the sample on which the analyses were performed should, as far as possible, consist of pupils without identifiable problems, warranting referral to the School Psychological Service. Of the four pupils who failed a standard, three were in the group that was referred, and they were excluded from the analyses for this reason. The data of the remaining pupil who failed was included in the year for which scholastic results comparable with those of the rest of the sample were available, i.e. the year prior to his repeat year. Subjects were also lost because of their departure from the Cape Province.

For the Pearson correlation analysis a total of 93, 92 and 90 pupils were finally included in the Sub A, Sub B and Std One samples respectively.

TABLE 16

MEANS ($\bar{X}$), STANDARD DEVIATIONS (S), STANDARD ERRORS (SEm) FOR EACH SUBJECT AND THE AVERAGE OF THE SUBJECTS IN EACH STANDARD

	SUB A				SUB B				STD I			
	$\bar{X}$	S	SEm	N	$\bar{X}$	S	SEm	N	$\bar{X}$	S	SEm	N
Reading	5,7	2,0	,2	103	5,8	1,9	,2	99	6,1	1,8	,2	97
Phonics	5,9	2,0	,2	103	5,7	2,0	,2	98	-	-	-	-
Spelling	-	-	-	-	-	-	-	-	5,9	2,0	,2	97
Mathematics	5,7	1,8	,2	104	5,8	2,0	,2	100	5,9	1,6	,2	96
Oral Language	5,6	1,8	,2	102	5,9	1,7	,2	96	6,0	1,6	,2	97
Written Language	-	-	-	-	5,3	2,0	,2	92	5,6	1,9	,2	96
Average	5,7	1,7	,2	104	5,7	1,6	,2	100	5,9	1,5	,2	97

In the case of the multiple regression analysis listwise deletion of missing data was employed. The sample size for the multiple regression analysis involving the JSAIS scales was 89, and that of the analysis involving the subtests was 90.

4.2 MEASURES

4.2.1 The Predictor - the JSAIS

The background to the development of the JSAIS, its aims, and the selection of the twenty-two subtests included in the scale were described in Chapter Three. As explained earlier, twelve of the twenty-two subtests constitute the original intelligence scale (Madge, 1981). A reduced scale of eight subtests was subsequently proposed, in order to reduce administration time (van den Berg & Robinson, 1985).

The composition of the eight subtest scale is presented in Table 17.

TABLE 17

COMPOSITION OF THE EIGHT SUBTEST JSAIS SCALES

GLOBAL	VERBAL	PERFORMANCE	NUMERICAL
Form Board		Form Board	
Vocabulary	Vocabulary		
Number and Quantity Concepts			Number and Quantity Concepts
Memory for Digits			Memory for Digits
Picture Riddles	Picture Riddles		
Word Association	Word Association		
Absurdities A		Absurdities A	
Absurdities B		Absurdities B	

Description of the eight subtests

The eight subtests comprising the eight-test battery of the JSAIS are described below, according to their content, aim and rationale, as summarised from the JSAIS manual (Madge, 1981).

Form Board

a) Content

The eleven items consist of geometric shapes cut into a wooden board. Each shape can be filled by two to four separate pieces. The testee is required to fit the separate pieces into the shapes on the board. Each item has a time limit, and time is taken into account in the scoring.

b) Aim

This test is intended to measure meaningful perception of forms.

c) Rationale

The assumption underlying this test is that "the synthesis of parts into an organised, integrated whole constitutes a significant facet of concept attainment in the visual spatial field ... According to Guilford, Form Board tests are the most suitable types of tests to measure the cognition of figural systems and figural transformations". (Madge, 1981, p.19)

Vocabulary

a) Content

This test consists of cards with pictures on. The testee must choose the picture that goes with an object, action, quality or characteristic named by the tester.

b) Aim

The test is intended to measure "the recognition, comprehension, identification and interpretation of verbal symbols (words) - that is basic receptive vocabulary (cognition of semantic units)". (Madge, 1981, p.20).

c) Rationale

The underlying assumption is that a testee's understanding of a word can be determined by the identification of a pictorial representation of that word. His performance on the test demonstrates his ability to understand the spoken language of other people.

Number and Quantity Concept

a) Content

Part A of this test consists of 31 items testing the child's ability to count, deal with simple concrete calculations, simple fractions and his knowledge of quantity concepts. The testee points to a picture on the card to indicate his answer, or gives a verbal response. Part B of the test comprises 15 mental arithmetic items presented and answered orally.

b) Aim

Part A measures the understanding of, and ability to manipulate quantitative material in a relatively concrete way. Part B measures more abstract mathematical reasoning ability and accuracy in mental arithmetic.

c) Rationale

It is assumed that the comprehension of numbers and quantity, and the ability to manipulate number concepts, are important aspects of the child's ability to function satisfactorily in school and other life situations. As the explicit use of numbers is only required in the more difficult items, it is assumed that "the easier items present a sound basis for the evaluation of basic concept attainment, quantitative judgement and reasoning ability in younger children" (Madge, 1981, p.23)

Memory for Digits

a) Content

The six items of Part A require that the testee repeat, in the same order, a series of numbers ranging from two to seven digits, after they have been spoken by the tester. The four items of Part B must be repeated in reverse order.

b) Aim

The test aims to measure auditory sequential short term memory. Part B requires more than simple auditory recall, in that it demands reorganisation of the stimuli.

c) Rationale

"The assumption is that quick intake and reproduction of information constitutes an important facet of intelligence" (Madge, 1981, p.24). Although not viewed as a good measure of general intelligence, this type of test is considered to have particular diagnostic value, since a deterioration in performance is often associated with certain kinds of organicity.

Picture Riddles

a) Content

The twenty-six items of this test comprise cards depicting one to four coloured objects. The questions are answered by pointing to a picture. The items range from concrete to relatively abstract.

b) Aim

The aim of the test is to measure concrete-practical judgement. It requires comprehension of language stimuli and the evaluation of pictorial stimuli in terms of a given standard.

c) Rationale

The child is required to integrate pictorial information with a verbal description in order to identify the picture representing the correct response. The assumption is that "when a child identifies concrete objects on the strength of a verbal description, he demonstrates his ability to comprehend relatively complex language" (Madge, 1981, p.28). Two further assumptions are made: that the test is a valid measure of a child's ability to redefine and transform relatively complex ideas in order to comply with new demands; that the ability to judge the suitability and effectiveness of ideas and symbols in terms of given criteria, is an important aspect of intellectual functioning.

Word Association

a) Content

The test consists of 36 incomplete sentences. These are spoken by the tester and must be completed by the child. Twenty of the items require the opposite of a key word. The remaining items require the naming of an appropriate action or object associated with a particular object, after an analagous relationship has been presented by the tester.

b) Aim

The test is intended to measure the ability to think relationally, employing only verbal stimuli (convergent production of semantic relations). Associative ability, conceptual thinking and verbal fluency are involved.

c) Rationale

Three assumptions underlie this test: that the ability to produce a word complying with the requirements demanded by a particular relationship is essential for scholastic progress; that the ability to think relationally represents an important aspect of intelligence; and that similar processes underlie associative thinking and analogical problem solving, which is viewed as one of the most reliable verbal measures of general intelligence.

Absurdities A : Missing Parts

a) Content

The twenty items consist of incomplete pictures. The testee has to identify the missing parts.

b) Aim

The test is intended to measure the ability to judge the correctness of units of figural information.

c) Rationale

It is assumed that the ability to identify the absence of essential rather than non-essential details in a visually presented, familiar object represents a significant aspect of intellectual functioning. Critical visual perception and judgement are considered to contribute most to individual differences in test scores.

Absurdities B : Absurd Situations

a) Content

The testee has to describe what is absurd about the situations depicted on the seventeen coloured pictures comprising the test.

b) Aim

The test measures the evaluation of figural systems and figural implications, in contrast with the evaluation of units of figural information as in Absurdities A.

c) Rationale

The test items of Absurdities B contain logical discrepancies. If the child is not familiar with the relevant laws which are being violated in the pictures (e.g.

that fish cannot survive out of water) he will not find the inconsistencies surprising. His view of what is to be expected and what is surprising is established by rules and norms abstracted from his experience. Thus, what he finds surprising depends upon his level of cognitive development.

Psychometric properties of the eight subtest JSAIS

Statistical data for the 8-test version of the JSAIS are reported in a booklet entitled "The Revision of the JSAIS Norms", by van den Berg & Robinson, published in 1985 by the HSRC. Of interest here are the correlations between the GIQ, VIQ and PIQ scales of the 8-test and 12-test forms, and the average reliability scores of the three scales.

The average correlation between the 8-test and 12-test Global IQ scores is ,974, with a range of less than ,01 among the various age groups. The combined correlation is associated with a standard error of estimation of 3,4 IQ points. These results indicate that the GIQ obtained from either 8 or 12 subtests can be used interchangeably.

The average correlation between the 8-test and 12-test Verbal IQ scores is ,943, with a range of between ,933 and ,956. The combined correlation is associated with a standard error of estimation of 5 IQ points.

The average correlation between the 8-test and 12-test Performance IQ scores was ,929, with a range of between ,911 and ,942. This correlation is associated with a standard error of estimation of 5,6 IQ points. According to van den Berg & Robinson (1985) this somewhat lower Performance Scale correlation is largely due to the lower reliability of the Performance tests in general.

The average reliability scores of 8-test GIQ, VIQ and PIQ scales are ,95, ,92 and ,89 respectively, as compared with average reliability scores of ,97, ,95 and ,93 for the 12-test battery.

4.2.2 The Criteria : Teacher Evaluations

The year end symbols allocated to pupils in selected subjects as well as the average of those subjects constituted the criteria for scholastic achievement. As regards Sub A, symbols were requested for Reading, Phonics, Maths and Oral Language. An additional symbol for Written Language was requested in Sub B. For Standard I separate symbols for Spelling and Phonics were requested, but because so many questionnaires were returned with symbols for only one or other of these subjects, the two were averaged and combined under the label Spelling. This was considered justifiable as an examination of the data showed that where both symbols were provided, these rarely differed by more than 2 points on the scale described below.

Symbols for each subject are allocated by class teachers according to criteria set out in the manual entitled, "The Planning of Work in the Junior Primary Phase" (Cape Eduaction Department). The allocation of symbols is as follows:

A : Rapid progress
B : Average progress
C : Slow progress
D : Progress too slow for promotion

Explanations of what constitute rapid, average, slow and too slow progress are detailed in the manual.

Symbols A to C are differentiated further by the addition of a + or a - sign, thus creating a 10-point scale. For the purposes of the statistical analysis the alphabetic symbols were transformed into numerical symbols, as indicated below:

A+ = 9
A = 8
A- = 7
B+ = 6
B = 5
B- = 4
C+ = 3
C = 2
C- = 1
D = 0

A year end average score was calculated for each child. Such an overall indication of performance level had not in all cases been provided by the schools, since the official records did not require it.

The criterion data available for each standard was thus:

Sub A	Sub B	Std 1
Reading	Reading	Reading
Phonics	Phonics	Spelling
Mathematics	Mathematics	Mathematics
Oral language	Oral language	Oral language
-	Written language	Written language
Average	Average	Average

4.3 PROCEDURE

Pearson product-moment correlations were calculated between the Global, Verbal, Performance and Numerical Scales, and each of the eight subtests on the one hand, and the teacher ratings in each subject and a computed average of the subjects, at each standard level, on the other. The results are reported in Tables 18 to 29.

Two stepwise multiple regression analyses were conducted. The one involved the JSAIS scales, the other the JSAIS subtests. In the first instance the Verbal, Performance and Numerical Scales were regressed on the computed average for each standard. In the second, the eight JSAIS subtests were regressed on the computed average for each standard. The results are reported in Tables 30 to 35.

The Statistical Package for the Social Services (SSPS Inc., 1983) was used for the above-mentioned analyses, as well as for the calculation of frequencies and distributions. Tests for significance of differences and t-values were calculated according to formulae presented in a standard text book of statistics (Downie & Heath, 1970).

A test was also performed to determine whether the fluctuations, over the three year period, in the correlations between the scales and subtests on the one hand and the standard averages on the other, were significant. The sample on which this test was performed was the same sample as that employed for the multiple regression analysis. The test employed was recommended by Steiger (1980) as being superior to other measures for testing the longitudinal stability of a correlation matrix, where the correlations are not independent of one another.

CHAPTER FIVE

RESULTS

5.1 THE PEARSON PRODUCT-MOMENT CORRELATION ANALYSIS

Pearson product-moment correlations were calculated between each of the JSAIS scales and subtests on the one hand, and the selected subjects and computed averages on the other.

5.1.1 The Relationship Between the JSAIS Scales and Measures of Scholastic Achievement

The results of the correlation analyses are presented here scale by scale (Tables 18 to 21). For a presentation of the correlations according to standard level see Appendix B.

5.1.1.1 The relationship between the Global Scale and measures of scholastic achievement

As can be seen in Table 18, the correlations between the Global Scale and the measures of scholastic achievement at each standard level are all significant at the ,1% level of confidence. Correlations range from ,378 for Sub B Phonics to ,665 for the Sub A Average.

TABLE 18

CORRELATIONS BETWEEN THE GLOBAL SCALE AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,516	,609	,635	,557	-	,665
	(92)	(92)	(93)	(91)	-	93)
Sub B	,467	,378	,505	,498	,415	,521
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	,440	,473	,580	,482	,491	,558
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N for each correlation is given in parentheses

In all cases $p < ,001$

Sub A: $t < 3,40$

Sub B: $t \leq 3,47$

Std I: $t < 3,59$

5.1.1.2 The relationship between the Verbal Scale and measures of scholastic achievement

As can be seen in Table 19, the correlations between the Verbal Scale and measures of scholastic achievement at each standard level are all significant at the ,1% level of confidence. Correlations range from ,411 for Sub B Mathematics to ,635 for the Sub A Average.

TABLE 19

CORRELATIONS BETWEEN THE VERBAL SCALE AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,518	,594	,526	,590	-	,635
	(92)	(92)	(93)	(91)	-	(93)
Sub B	,492	,434	,411	,534	,438	,527
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	,497	,486	,575	,466	,528	,578
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

In all cases $p \leq ,001$

Sub A: $t \leq 3,40$

Sub B: $t \leq 3,47$

Std I: $t \leq 3,59$

5.1.1.3 The relationship between the Performance Scale and measures of scholastic achievement

As can be seen in Table 20, correlations between this scale and measures of scholastic achievement appear lower than those yielded by the other scales. Correlations range from non-significant for Sub B Phonics and Std I Reading to ,534 for Sub A Mathematics. Significant correlations across all three standards, between this scale and measures of scholastic achievement are only found for the subjects Mathematics, Oral Language and the Averages of the standards.

TABLE 20

CORRELATIONS BETWEEN THE PERFORMANCE SCALE AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,341***	,382***	,534***	,346***	-	,466***
	(91)	(91)	(92)	(90)	-	92)
Sub B	,216*	,122ns	,340***	,329**	,229*	,286**
	((1)	(89)	(91)	(87)	(84)	(91)
Std I	,167ns	,236*	,311**	,247*	,219*	,266*
	(89)	(89)	(88)	(89)	(88)	(89)

Note: N is given in parentheses

* $p < ,05$

** $p < ,01$

*** $p < ,001$

Sub A: $t \leq 3,40$

5.1.1.4 The relationship between the Numerical Scale and measures of scholastic achievement

As can be seen in Table 21, the correlations between the Numerical Scale and measures of scholastic achievement at each standard level are all significant at the ,1% level of confidence. Correlations range from ,350 for Sub B Oral Language to ,594 for Std One Mathematics.

TABLE 21

CORRELATIONS BETWEEN THE NUMERICAL SCALE AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,424 (92)	,505 (92)	,565 (93)	,455 (91)	- -	,550 93)
Sub B	,463 (92)	,383 (90)	,514 (92)	,350 (88)	,380 (84)	,485 (92)
Std I	,447 (90)	,464 (90)	,594 (89)	,516 (90)	,522 (89)	,576 (90)

Note: N is given in parentheses

In all cases $p \leqslant ,001$

Sub A: $t \leqslant 3,40$

Sub B: $t < 3,47$

Std I: $t \leqslant 3,59$

5.1.2 The Relationship Between the JSAIS Subtests and Measures of Scholastic Achievement In All Three Standards

The correlations between each JSAIS subtest and the measures of scholastic achievement are presented here,subtest by subtest. For a presentation of the correlations according to standard level, see Appendix B.

5.1.2.1 Form Board

With the notable exception of a correlation of ,44 ($p <$,001) between Form Board and Sub A Mathematics, the correlations between this subtest and all measures of scholastic achievement over all three years are generally low, and range from ,08 to ,32. A number of the correlations are non-significant.

TABLE 22

CORRELATIONS BETWEEN FORM BOARD SUBTEST AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,201	,258*	,436***	,215*	-	,322*
	(92)	(92)	(93)	(91)	-	93)
Sub B	,166	,101	,299**	,236*	,147	,222*
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	,077	,205	,122	,255*	,187	,193
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* $p < ,05$

** $p < ,01$

*** $p \leqslant ,001$

5.1.2.2 Vocabulary

Significant ($t > 2,56$ $p < ,05$) correlations are found between Vocabulary and all measures of scholastic achievement in each of the years. The median correlations are: Sub A ,43; Sub B ,32; Std One ,36. Of note is the Vocabulary: Std One Mathematics correlation of ,45 ($p < ,001$).

TABLE 23

CORRELATIONS BETWEEN VOCABULARY SUBTEST AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,358***	,441***	,427***	,404***	-	,459***
	(92)	(92)	(93)	(91)	-	93)
Sub B	,321**	,264*	,323**	,349***	,281**	,348***
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	,341***	,334***	,446***	,312**	,364***	,405***
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* $p < ,05$

** $p < ,01$

*** $p \leq ,001$

5.1.2.3 Number and Quantity Concepts

Correlations between this subtest and all measures of scholastic achievement are statistically significant (t > 2,56 p < ,05) across all three years of the study. As would be expected, this subtest correlates highest with Mathematics at each level (Sub A: r = ,52 p< ,001; Sub B: r = ,44 p< ,001; Std One: r = , 51 p< ,001). Correlations of this subtest with Sub A, Sub B and Std One Averages are ,51; ,37; ,44 respectively, with p < ,001 in each case.

TABLE 24

CORRELATIONS BETWEEN NUMBER AND QUANTITY CONCEPTS SUBTESTS, AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,338***	,482***	,519***	,433***	-	,507***
	(92)	(92)	(93)	(91)	-	93)
Sub B	,332***	,266*	,436***	,306**	,264*	,374***
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	,293**	,322**	,505***	,460***	,392***	,443***
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* p < ,05

** p < ,01

*** p ≤ ,001

5.1.2.4 Memory for Digits

The correlations between this subtest and all measures of scholastic achievement are significant (t > 2,77 p < ,05). Median correlations for Sub A, Sub B and Std One are ,34 ,35 and ,45 respectively.

TABLE 25

CORRELATIONS BETWEEN MEMORY FOR DIGITS SUBTEST AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,285**	,336***	,371***	,282**	-	,348***
	(92)	(92)	(93)	(91)	-	93)
Sub B	,378***	,322**	,381***	,239*	,308**	,377***
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	,412***	,384***	,466***	,426***	,454***	,487***
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* p < ,05

** p < ,01

*** p ≤ ,001

5.1.2.5 Picture Riddles

This subtest yields the highest correlations with all measures of scholastic achievement at Sub A and Sub B levels (t > 4,9 p < ,001). The median correlations for Sub A, Sub B and Std One are ,53 ,42 and ,39 respectively.

TABLE 26

CORRELATIONS BETWEEN PICTURE RIDDLES SUBTEST AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,505***	,526***	,437***	,548***	-	,582***
	(92)	(92)	(93)	(91)	-	93)
Sub B	,444***	,408***	,403***	,501***	,416***	,496***
	(92)	(90)	(92)	(88)	(84)	(92)
Std One	,388***	,384***	,426***	,378***	,450***	,460***
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* p < ,05

** p < ,01

*** p ≤ ,001

5.1.2.6 Word Association

Correlations between this subtest and all measures of scholastic achievement at Sub A and Std One levels are significant (t > 2,03 p < ,01) and range from ,34 to ,45. At Sub B levels the correlations range from ,21 to ,35 (p < ,05).

TABLE 27

CORRELATIONS BETWEEN WORD ASSOCIATION SUBTEST AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,362***	,432***	,367***	,430**	-	,452***
	(92)	(92)	(93)	(91)	-	93)
Sub B	,349***	,310**	,209*	,367***	,301**	,351***
	(92)	(90)	(92)	(88)	(84)	(92)
Std One	,386***	,378***	,403***	,344***	,373***	,429***
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* p < ,05

** p < ,01

*** p ≤ ,001

5.1.2.7 Absurdities A

Correlations between this subtest and all measures of scholastic achievement, with the exception of Std One Oral Language, are significant (t > 2,64 p < ,05) and range from ,27 to ,40.

TABLE 28

CORRELATIONS BETWEEN ABSURDITIES A SUBTEST AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,369***	,353***	,357***	,290***	-	,403***
	(92)	(92)	(93)	(91)	-	93)
Sub B	,363***	,302**	,307**	,412***	,369***	,396***
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	,363***	,305**	,272**	,197	,283**	,327**
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* p < ,05

** p < ,01

*** p ⩽ ,001

5.1.2.8 Absurdities B

This subtest correlates poorly with all measures of scholastic performance at each standard level. In some instances small negative correlations are yielded. Correlations range from -,06 to ,30. Only four of the seventeen correlations reach statistically significant levels: three at the 5% level of confidence, and one at the 1% level of confidence.

TABLE 29

CORRELATIONS BETWEEN ABSURDITIES B SUBTEST AND MEASURES OF SCHOLASTIC ACHIEVEMENT

	Reading	Phonics/ Spelling	Mathematics	Oral Language	Written Language	Average
Sub A	,159	,200	,303**	,227*	-	262*
	(92)	(92)	(93)	(91)	-	93)
Sub B	-,001	-,062	,132	,091	,005	,048
	(92)	(90)	(92)	(88)	(84)	(92)
Std I	-,005	,071	,238*	,081	,068	,099
	(90)	(90)	(89)	(90)	(89)	(90)

Note: N is given in parentheses

* p < ,05

** p < ,01

*** p ≤ ,001

5.2 THE STEPWISE MULTIPLE REGRESSION ANALYSIS

In order to determine what combination of predictor variables (the JSAIS scales and the eight subtests) produce the optimum prediction of the computed average from Sub A to Std One, stepwise multiple regression analyses were undertaken.

Definitions of the symbols employed in the tables follow:

B = Weight of predictor in regression equation
Beta = Weight of predictor relative to other predictors
t = Student's t for predictor's contribution
p = Significance of predictor weight in final step
R = Multiple correlation, (adjusted)
R^2 = Proportion of variance shared between predictors & criteria (adjusted)
F = Overall F ratio for final step
D.f. = Degrees of freedom

5.2.1 Regression Analyses Involving the JSAIS Scales

In order to test the hypothesis that scholastic achievement at Sub A, Sub B and Std One levels can be predicted by the JSAIS Verbal, Performance and Numerical Scales, these scales were regressed on the computed averages for Sub A, Sub B and Std One. The analysis for the hypothesis of no association between dependent and independent variables indicates that the Verbal and Numerical Scales together are significant predictors of achievement scores: Sub A $F(2,86)$ 26,66 $p < ,0001$; Sub B $F(2,86)$ 20,87 $p < ,0001$; Std One $F(2,86)$ 33,39 $p < ,0001$.

As can be seen in Tables 30, 31 and 32, the Verbal Scale was entered first in the equation for each standard ($p < ,001$ in each case). The Numerical Scale followed (Sub A $p < ,01$; Sub B $p < ,05$; Std One $p < ,001$). In no standard did the Performance Scale reach a sufficiently high level of significance for inclusion in the equation.

At Sub A level the total percentage of variance shared between the predictors and the criterion is 37%. Employing the data in Table 30, the predicted average for Sub A for this sample is as follows:

Predicted Sub A Average = (,0578 x Verbal Scale) + (,1476 x Numerical Scale) - 1,74.

TABLE 30

MULTIPLE REGRESSION ANALYSIS: JSAIS VERBAL, PERFORMANCE AND NUMERICAL SCALES WITH SUB A AVERAGE

VARIABLE	B	BETA	t	Sig. t
Verbal Scale	,0578	,42	4,17	,0001
Numerical Scale	,1476	,27	2,70	,005

Constant = 1,74

$R = ,61$ F = 26,66 ($p < ,0001$)

$R^2 = ,37$ D.f. = 2;86

At Sub B level the total percentage of variance shared between the predictors and the criterion is 31%. Employing the data in Table 31 the predicted average for Sub B for this sample is as follows:

Predicted Sub B Average = (,0572 x Verbal Scale) + (,1572 x Numerical Scale) - 1,91.

TABLE 31

MULTIPLE REGRESSION ANALYSIS: JSAIS VERBAL, PERFORMANCE AND NUMERICAL SCALES WITH SUB B AVERAGE

VARIABLE	B	BETA	t	Sig. t
Verbal Scale	,0572	,38	3,59	,0005
Numerical Scale	,1572	,26	2,50	,0140

Constant = -1,91

$R = ,56$ F = 20,87 ($p < ,0001$)

$R^2 = ,31$ D.f. = 2;86

At Std One level the total percentage of variance shared between the predictors and criterion is 42%. Employing the data in Table 31, the predicted average for Std One is as follows:

Predicted Std One Average = (,053 x Verbal Scale) + (,2076 x Numerical Scale) - 1,90.

TABLE 32

MULTIPLE REGRESSION ANALYSIS: JSAIS VERBAL, PERFORMANCE AND NUMERICAL SCALES WITH STD ONE AVERAGE

VARIABLE	B	BETA	t	Sig. t
Verbal Scale	,0530	,37	3,88	,001
Numerical Scale	,2076	,37	3,86	,001

Constant = -1,90

R = ,65   F = 33,39 (p < ,0001)

R^2 = ,42   D.f. = 2;86

5.2.2 Regression Analyses Involving The JSAIS Subtests

In order to test the hypothesis that scholastic achievement at Sub A, Sub B and Std One levels can be significantly predicted by a combination of the JSAIS subtests, the subtests were regressed on the computed averages for Sub A, Sub B and Std One.

As can be seen in Table 33, at Sub A level the Picture Riddles subtest is entered first in the equation ($p < ,0001$), and is followed by Number and Quantity Concepts ($p < ,01$). The total percentage of variance shared between these predictors and the criterion is 35%. ($F (2;87) = 25,17$ $p < ,0001$).

TABLE 33

MULTIPLE REGRESSION ANALYSIS:
JSAIS SUBTESTS WITH SUB A AVERAGE

VARIABLE	B	BETA	t	Sig. t
Picture Riddles	,2473	,42	4,56	,0001
Number & Quantity Concepts	,1500	,30	3,32	,0013

Constant = 1,81

R = ,59	F = 25,17 (p < ,0001)
R^2 = ,35	D.f. = 2;87

As is evident in Table 34, at Sub B level the Picture Riddles subtest is again entered first ($p < ,0001$), and is followed by Memory for Digits ($p < ,01$). The total percentage of variance shared between the predictors and the criterion is 32%. ($F(2;87) = 21,75$ $p < ,0001$).

TABLE 34

MULTIPLE REGRESSION ANALYSIS: JSAIS SUBTESTS WITH SUB B AVERAGE

VARIABLE	B	BETA	t	p
Picture Riddles	,2908	,45	5,07	,0001
Memory for Digits	,1593	,29	3,32	,0013

Constant = ,88

R = ,56	F = 21,75 (p < ,0001)
R^2 = ,32	D.f. = 2;87

At Std One level (see Table 35) three subtests are entered in the equation: Memory for Digits ($p < ,0001$), Picture Riddles ($p < ,0005$) and Word Association ($p < ,05$). The total percentage of variance shared between these predictors and the criterion is 41%. ($F (3,86) = 21,43$ $p < ,0001$).

TABLE 35

MULTIPLE REGRESSION ANALYSIS:
JSAIS SUBTESTS WITH STD ONE AVERAGE

VARIABLE	B	BETA	t	p
Memory for Digits	,1951	,38	4,53	,0001
Picture Riddles	,1937	,31	3,60	,0005
Word Association	,1226	,22	2,51	,0136

Constant = ,275

R = ,64	F = 21,43 (p < ,0001)
R^2 = ,41	D.f. = 3;86

5.3 TEST FOR THE LONGITUDINAL STABILITY OF THE CORRELATION MATRIX

This test was performed to determine whether the predictor: criterion correlation remained constant over the three year period of the study.

The null hypothesis was that the correlations between the scales and subtests on the one hand, and computed standard averages on the other could be treated as equal across the three standards, i.e. the fluctuations observed are random. (Chi-squared Goodness of Fit Test).

In the analysis involving the JSAIS scales the null hypothesis that the differences between the correlations at each standard were equal was not rejected (Chi-square = 11,55; df = 6; p = ,072). Similarly, in the analysis involving the JSAIS subtests, the null hypothesis was also not rejected (Chi-square = 12,02; df = 14; p = .10). In the light of these results, interpretation of the changes in the correlations yielded by this sample over the three standards is inappropriate.

CHAPTER SIX

DISCUSSION AND RECOMMENDATIONS

It is evident from the results of this study that the values of the correlations are of the same general magnitude as those reported in studies employing non-South African intelligence tests.

The Global, Verbal and Numerical Scales correlate moderately to highly (,49 to ,67 $p < ,001$) with computed standard averages over all three years of the study The Performance Scale has poorer predictive validity in this sample. Results of the analysis testing the longitudinal stability of the correlation matrix yielded by these scales with the computed standard averages indicate that the fluctuations observed are probably random. Thus the predictive strength probably does not vary over the three years.

As regards the individual subtests of the JSAIS, the analysis of the matrix of correlations between the individual subtests and the computed standard averages indicates that these values also remain constant over the period of the study. Five of the subtests (Vocabulary, Number & Quantity Concepts, Memory for Digits, Picture Riddles and Word Association) correlate satisfactorily (,35 to ,58) with the standard averages. Absurdities A drops below ,35 at the Std One level only. Form Board and Absurdities B correlate poorly with the standard averages over all three years.

As indicated earlier the eight subtest JSAIS Performance Scale correlates poorly with standard averages in this sample. Part of the explanation for this appears to lie in the subtests which consititute the scale.

In this sample, the Performance Scale subtest, Absurdities B, yields the lowest and largest number of non-significant correlations with measures of scholastic achievement. Although Venter (1985) found this subtest to be one of the poorer predictors of scholastic performance, in his study all the correlations produced by this test reached statistical significance at the 1% level of confidence. The discrepancy between the two studies in the strength and significance levels of these correlations may arise from this subtest's relatively low reliability at the seven year level (r_{tt} = ,67 SEm = 1,73) (Madge 1981, p.63). This is well below the desirable level of ,80 or above for reliability coefficients. Sampling effects might also contribute to the discrepancy.

Furthermore, in discussions with testers in the Psychological Services of the Cape Education Department, it has been observed that the poor quality of the drawings and inadequacies in the colour printing (leaving parts of objects without colour) introduce ambiguity into the stimulus cards which was presumably not intended by the designer of the subtest. It has been noted by testers that there is a tendency for children to fall out on three particular items in succession, thereby discontinuing scoring of the subtest, while the testees are frequently thereafter able to give correct responses for the remaining items of the subtest.

A second Performance Scale subtest, Form Board, is the only other subtest which, in the present study, does not produce statistically significant correlations with pupils' computed averages over all three years. It has the second lowest reliability coefficient (r_{tt} = ,72 SEm = 1,6) at seven year level. These two subtests, Absurdities B and Form Board, constitute two of the three Performance Scale subtests in the eight subtest JSAIS.

When comparing the correlations produced in this study by the remaining six subtests, with those of Venter's study, it is evident that the values of the correlations of Vocabulary, Number & Quantity Concepts, Memory for Digits, Word Association and Absurdities A are comparable. A noteworthy discrepancy is, however, evident between this study and that of Venter in the values of Picture Riddles' correlations. This subtest has the third lowest reliability, at the seven year level (r_{tt} = ,74 SEm = 1,53). As is the case with Absurdities B, some of the pictures are poorly drawn, such that they are not readily identifiable by some children. For example, there is a cow that looks like a dog, except that it has (purple) udders. Another item early in the test, appears to be inappropriate at that level for English speaking children. The correct response, "bleat", is less commonly used with English speaking children of the target age than its Afrikaans equivalent, "blêr", is with Afrikaans children.

In short, apart from the subtests mentioned, where there is a noteworthy discrepancy between the correlations yielded by the two studies, the results of comparable elements of the studies are generally consistent with one another, although there is a tendency for the present study's correlations to be lower than those of Venter's study. This is possibly due to greater "examiner variance" (Anastasi, 1968, p.86) in the case of the present study, where 41 testers were involved in the application of the JSAIS, and an even larger number of class teachers allocated the scholastic ratings over the three year period.

Turning to the results of the multiple regression analysis involving the three scales constituting the Global Scale, it was found that the Verbal and Numerical Scale together are adequate predictors of scholastic performance at all three levels, whereas the Performance Scale contributes little. Hale (1978), in a study examining the relationship between the WISC-R scales and scholastic achievement, found that the WISC-R Performance Scale also failed to contribute significantly to the prediction of achievement. He cautioned, however, that his analysis was based on a referred population. Examination of a summary table of concurrent validity studies for the WISC-R (Sattler, 1982, p.150) also reveals generally lower correlations between the Performance Scale and scholastic achievement as measured by the Wide Range, California, and Metropolitan Achievement Tests. (The size and nature of the samples studied are not indicated by Sattler.)

That this situation is not uniformly encountered, however, is demonstrated in a study by Kitson & Vance (1982) in which a large disparity between the predictive validity of the Verbal & Performance Scales was not found.

As regards the multiple regression analyses involving the subtests, the Sub A and Sub B equations include a subtest each from the Verbal and Numerical Scales, while the Std One equation includes two Verbal subtests and one Numerical subtest.

A curious finding of this study is that the multiple correlations of the best predictors of the computed Sub A and Std One averages appear to increase slightly between Sub A and Std One. The Verbal and Numerical Scales account for 37% of the variance at Sub A level, and 42% at Std One level. In the regression analysis employing the individual subtests as predictors, the two subtests selected at Sub A level, i.e. Picture Riddles and Number & Quantity Concepts, account for 35% of the variance in this standard. At Std One level Picture Riddles, Memory for Digits and Word Association together account for 41% of the variance. These changes were not tested for significance, because it is assumed that the multiple correlation would exaggerate differences already found to be non-significant for Pearson's r. Multiple R is always slightly inflated. These slight increases are nevertheless interesting in the light of other research reported. Clark et al (1978) noted a similar trend in their study involving the prediction of reading achievement.

A possible mathematical explanation for the increase in R^2 is that the variance shared between the Verbal and Numerical Scales relates more highly with the residuals of the criterion of scholastic performance at Std One level than at Sub A (i.e. supression: Howell, 1987).

Psychologically, the increase in the multiple correlations of the best predictors with the criterion of scholastic performance could arise from changes in the nature of the scholastic task between Sub A and Std One, such that the elements measured by the IQ test correlate more highly with the work at Std One level than at Sub A level. In the subject Reading, for example, the requirement at Sub A level is the development of a sight word vocabulary, and the decoding and encoding skills used to identify new words. At Std One level the evaluation of Reading involves assessment of higher level skills like comprehension and the ability to read for information. With regard to reading, there is agreement that the correlation between reading and measures of intelligence is greater in groups of older children, as compared with groups of younger children (Pikulski, 1978). Harris (1970), in summarising the results of a number of studies, reports that in Sub A correlations between intelligence measures and reading are generally in the ,40's and ,50's and rise to the ,70's and ,80's by Std Two.

This study indicates that certain of the measures of the eight subtest JSAIS provide predictive data equivalent to that provided by the twelve subtest version, and by many non-South African intelligence scales. In view of the results of Venter's study, however, the question arises as to whether the subtests selected for the shorter form are indeed the ones that provide optimum predictive power. As mentioned earlier, of the four subtests excluded from the eight subtest battery, three (Ready Knowledge, Block Design and Form Discrimination) are amongst those with the highest Pearson correlations with Venter's measures of scholastic achievment. These three, plus Number & Quantity Concepts and Memory for Digits (which are included in the eight subtest form and which were selected in the regression analyses in this study) also occured most frequently in Venter's multiple regression analyses.

While it would be premature to advocate reorganising the eight subtest scale on the basis of only two studies, it is nevertheless worth considering the implications of substituting Block Design, Form Discrimination and Ready Knowledge for three of the subtests currently included in the eight subtest scale, and which have lower predictive ability.

Bearing in mind the principles applied in the selection of the subtests for the shortened battery, one of which was to reduce the administration time (see Chapter 3), it does not appear that Block Design could be included in the eight subtest JSAIS because, short of redesigning the subtest, there is no way to get around its lengthy and unpredictable administration time.

This is unfortunate, because Block Design and Absurdities B share the same cell in the Content x Process model (see Table 9) and the poor performance of Absurdities B in this study suggests that it could be advantageous to drop this subtest from the eight subtest scale. If Absurdities B cannot be replaced by Block Design, because of administration time considerations, and it is considered desirable to adhere to the structure of the Intellect Model, the alternative would be to select one of the subtests from the remainder of the battery, which is also grouped in this cell.

A possible choice could be Design Copying. Perusal of this test indicates that it is very similar to the WPPSI Geometric Design subtest, which in the studies reported in Chapter Two, was found consistently to be one of the best predictors of reading achievement in the Junior Primary grades. Comparison of Design Copying's reliability coefficients with those of Absurdities B (Table 36) reveals that Design Copying's reliability coefficients appear equal to, or higher than, those of Absurdities B.

The substitution of Form Discrimination for one of the existing subtests poses less of a problem, because it shares the same cell as Absurdities A. As can be seen in Table 36 the reliability coefficients of Form Discrimination appear slightly higher than those of Absurdities A, except in one instance.

TABLE 36

RELIABILITY COEFFICIENTS OF SELECTED JSAIS SUBTESTS FOR EACH AGE GROUPING OF THE NORM GROUP

Subtest	3 years	4 years	5 years	6 years	7 years	Average
Design Copying	a	,84	,87	,91	,87	,87
Absurdities B	,87	,84	,74	,74	,67	,77
Form Discrimination	,83	,86	,83	,84	,79	,83
Absurdities A	,85	,81	,82	,82	,76	,81
Ready Knowledge	,84	,86	,85	,87	,84	,85

Note: a = Test not administered to this group

The subtest of the eight subtest JSAIS which shares a cell with Ready Knowledge is Vocabulary. As it would be undesirable to drop a vocabulary test from the scale, Ready Knowledge could only be incorporated by departing from the framework of the model and substituting it for a test from a different cell. Since, as was indicated earlier, it appears that the JSAIS tests are based only loosely on Guilford's model, and the model itself is seriously questioned, such a departure is unlikely to have significant implications. Besides, as was pointed out in Chapter Two, intelligence tests have established themselves on the basis of their pragmatic value and not on the basis of their association with one or other widely accepted theory of intelligence.

Ready Knowledge could then be substituted for one of the two other verbal subtests, i.e. Picture Riddles or Word Association. In view of the discrepant findings with regard to the predictive validity of Picture Riddles, this subtest may prove to be the one of choice to eliminate.

The inclusion of a test like Ready Knowledge in the eight subtest scale is supported not only by the results of Venter's study, but by a similar study employing the WISC, in which it was found that the Information subtest (which is similar to Ready Knowledge) together with Vocabulary, were the two subtests most consistently related to achievement in reading and arithmetic (Stevenson, Parker, Wilkinson, Hegion & Fish, 1976). Furthermore, the Information subtest is one of the four so-called ACID tests (the others being Comprehension, Arithmetic and Digit Span) which, in heterogeneous groups of learning disabled students, have been found to be the four subtests with which this group has the most difficulty (Sattler, 1982). Another important consideration is that Ready Knowledge is the only Verbal subtest that does not simply involve a single word response or pointing to a picture, but can require the formulation of a response in sentence form. Thus, inclusion of this subtest provides the tester with an opportunity to assess the testee's expressive language.

While it is of value to consider ways in which the eight subtest JSAIS could be improved, the tentative nature of these suggestions must be emphasised, since the limitations of this study cannot be disregarded.

One of the problems common to predictive validity studies of this nature is attrition rate. In the present study the attrition rate was considerable. Suitably completed questionnaires were finally available for only 104 of the 197 pupils initially tested on the JSAIS. Factors contributing to attrition were: the pupils simply could not be located; they had left the Cape Province and, because the grading systems in other provinces differ, their criterion data could not be used; the schools did not return the questionnaires; or the questionnaires were not adequately completed. There is no reason to believe that the attrition did not occur on a random basis.

Nevertheless, examination of Tables 13 and 15 indicates that the sample of 104 pupils differs from the standardisation sample in a number of respects. There are significantly more English-speaking subjects. There are also more subjects of higher socio-economic status. Perhaps this accounts for the slightly higher scores that the sample achieved on the JSAIS Numerical Scale and certain of the subtests. Because of these differences generalisations must be made with caution.

The reduced sample size also had implications for the statistical procedures employed. This study's sample size was acceptable for the use of the Pearson correlation analysis. A larger sample would nevertheless have been an advantage, in view of the instability of correlations. As regards the regression analyses, a larger sample would have been advisable. Hence, it is necessary to regard the results of these analyses with caution. A larger sample size would also have made it possible to examine the influence of sex, home language, urban/rural residence, and socio-economic status. These need to be investigated in further research projects.

As regards the predictor variable, the JSAIS, the possible impact of examiner variance on the results of this study has been mentioned. When considering the criterion variable, the issue of teacher ratings versus scores on standardised achievement tests has already been discussed. While teacher ratings may not be as free of bias or as reliable as scores from standardised tests, they are readily available and, since they are referred to when educational decisions are made, they are highly relevant. Hence, whatever the short-comings of the predictor and criterion variables employed, these are the data available in the field, and it is the relationship between these variables in the practical situation which is the focus of this study.

Clearly, there is scope for a great deal of further research. The discrepancies between the results of this study and that of Venter need to be examined. The effect of substituting Ready Knowledge, Design Copying and Form Discrimination for three ofthe existing subtests of the shortened JSAIS could be explored. Data on the predictive validity of the JSAIS at the Senior Primary level would be useful. In the past, very little research has been conducted on South African psychometric tests. This has greatly limited their value to the tester in the field. It is to be hoped that the initially promising results yielded by the JSAIS will stimulate further research interest.

REFERENCES

ARCHER, P. A comparison of teacher judgements of pupils and the results of standardized tests. Dissertation Abstracts International, 1982, 43(4), 883.

ANASTASI, A. Psychological Testing, 3rd Ed. London: The MacMillan Co., 1968.

CLARK, C.R., BRUININKS, R.H., & GLAMAN, G.V. Kindergarten predictors of three aspects of reading achievement. Perceptual & Motor Skills, 1978, 46, 411-419.

DU BOIS, P.H. A History of Psychological Testing. Boston: Allyn & Bacon, 1970.

DU TOIT, J.P. Die Nuwe Suid-Afrikaans Individuele Skaal as diagnostiese hulpmiddel by die bepaling van linker-regterhemisfeer-breinbesering. Unpublished M-thesis, Rand Afrikaans University, 1976.

DOWNIE, N.M. & HEATH, R.W. Basic Statistical Methods. New York: Harper & Row, 1970.

ESTES, G.D. HARRIS, J. MOERS, F. & WODRICH, D. Predictive validity of the Boehm Test of Basic Concepts for achievement in the first grade. Educational and Psychological Measurement, 1976, 36, 1031-1035.

EVANS, B. & WAITES, B. IQ & Mental Testing: An Unnatural Science & its Social History. New York: The Macmillan Press, 1981.

EYSENK, H.J. The Structure and Measurement of Intelligence. New York: Springer-Verlag, 1979.

FREEMAN, F.S. Theory and Practice of Psychological Testing. New York: Henry Holt & Co., 1950.

GOLDMAN, R.D. HARTIG, L.K. The WISC may not be a valid predictor of school performance for primary grade minority pupils. American Journal of Mental Deficiency, 1976, 80, 583-587.

GOULD, S.J. The Mismeasure of Man. Penguin Books: Middlesex, 1981.

GUILFORD, J.P. The Nature of Human Intelligence. New York: McGraw-Hill, 1967.

GUILFORD, J.P. Way Beyond The IQ. New York: Creative Education Foundation, 1977.

GUILFORD, J.P. The Structure of Intellect Model. In B. Wolman (Ed.), Handbook of Intelligence. New York: John Wiley & Sons, 1985.

HALE, R.L. The WISC-R as predictor of WRAT performance. Psychology in the Schools, 1978, 15, 172-175.

HAMILTON, J.H. Die plek en optimale benutting van die Nuwe Suid-Afrikaanse Individuele Skaal by die ondersoek van 'n kind met leerprobleme. Unpublished M-thesis, University of Stellenbosch, 1974.

HARRIS, A.J. How to Increase Reading Ability. New York: David McKay, 1970.

HARTLAGE, L.C. & STEELE, C.T. WISC and WISC-R correlates of academic achievement. Psychology in the Schools, 1978, 15(2), 172-175.

HOWELL, C.H. Statistical Methods for Psychology, 2nd Ed. Boston: Duxbury Press, 1987.

HUYSAMEN, G.K. Psychological Testing in South Africa. Pretoria: Academia, 1980.

JENSEN, A.R. Race and the genetics of intelligence: A reply to Lewontin. In N.J. Block & G. Dworkin (Ed.), The IQ Controversy. New York: Random House, 1976.

JENSEN, A.R. How much can we boost IQ and academic achievement? Harvard Educational Review, Winter, 1969.

KAUFMAN, A.S. Comparison of the WPPSI, Stanford-Binet, & McCarthy Scales as predictors of First Grade achievement. Perceptual & Motor Skills, 1973, 36, 67-73.

KITSON, D.L. & VANCE, H.B. Relationship of the Wechster Intelligence Scale for Children - Revised and the Wide Range Achievement Test for a selected sample of young children. Psychological Reports, 1982, 50, 981-982.

LEWIS, M. & SULLIVAN, M.W. Infant intelligence and its assessment. In B. Wolman (Ed.), Handbook of Intelligence. New York: John Wiley & Sons, 1985.

LEWONTIN, R.C. Further remarks on race and the genetics of intelligence. In N.J. Block & G.Dworkin (Eds.), The IQ Controversy. New York: Random House, 1976.

LIEBLICH, A. & SHINAR, M. The predictive validity of the WPPSI with Israeli children. Educational and Psychological Measurement, 1975, 35, 473-475.

MADGE, E.M. Manual for the Junior South African Individual Scales. Pretoria: Human Sciences Research Council, 1981.

MALHERBE, E.G. Education in South Africa (Vol 2). Cape Town: Juta & Co., 1977.

MACHOWSKY, H. & MEYERS, J. Auditory discrimination, intelligence and reading achievement at Grade I. Perceptual and Motor Skills, 1975, 40, 363-368.

MASSOTH, N.A. & LEVENSON, L. The McCarthy Scales of Children's Abilities as predictors of reading readiness and reading achievement. Psychology in the Schools, 1982, 19(3), 293-296.

MATARAZZO, J.D. Wechsler's Measurement and Appraisal of Adult Intelligence. Baltimore: Williams & Wilkins, 1972.

MESSE, L.A.; **CRANO, W.D.; MESSE, R. & RICE, W.** Evaluation of the predictive validity of tests of mental ability for classroom performance in elementary grades. Journal of Educational Psychology, 1979, 71, 233-241.

MULLER, A. 'n Ondersoek na die geldigheid en die diagnostiese waarde van die Junior Suid-Afrikaanse Individuele Skaal by leergestremde leerlinge. Unpublished M-thesis, University of Port Elizabeth, 1982.

PERRY, J.D.; GUIDUBALDI, J. & KEHLE, T.J. Kindergarten competencies as predictors of third-grade classroom behaviour and achievement. Journal of Educational Psychology, 1979, 71, 443-450.

PIKULSKI, J.J. Assessing information about intelligence and reading. The Reading Teacher, 1985, November, 157-163.

PLANT, W.T. & SOUTHERN, M.L. First grade reading achievement predicted from WPPSI & other scores obtained 18 months later. Proceedings of the 76th Annual Convention of the American Psychological Association, 1968, 3, 593-594.

RANKIN, R.J. & HENDERSON, W.H. WPPSI reliability and predictive validity with disadvantaged Mexican-American children. Journal of School Psychology, 1973, 11, 1.

ROBINSON, M. 'n Ondersoek na die waarde van die Junior Suid-Afrikaanse Individuele Skaal as diagnostiese hulpmiddel vir leergestremde kinders met lees probleme. Unpublished M-thesis, University of Pretoria, 1986.

SATTLER, J.M. Assessment of children's intelligence and special abilities. Boston: Allyn & Bacon Inc., 1982.

SPEARMAN, C. "General Intelligence", objectively determined and measured. American Journal of Psychology, 1904, 15, 201-293.

SSPS INC. SSPS(X) User's Guide. New York: McGraw-Hill, 1983.

STEIGER,J.H. Tests for comparing elements of a correlation matrix. Psychological Bulletin, 1980, 2, 245-251.

STEVENSON, H.W.; PARKER, T.; WILKINSON, A; HEGION, A. & FISH, E. Longitudinal study of individual differences in cognitive development and scholastic achievement. Journal of Educational Psychology, 1976, 68(4), 377-400.

STODDARD, G.D. The Meaning of Intelligence. New York: The MacMillan Co., 1943.

THORNDIKE, E.L.; BREGMAN, E.O.; COBB, M.V. & WOODWARD, E. The Measurement of Intelligence. New York: Teachers College, 1927.

THURSTONE, L.L. & THURSTONE T.G. Factorial Studies of Intelligence. Psychometric Monograph, No. 2. Chicago: University of Chicago Press, 1941.

TWARANOVICA, J.A. A study of reported relationships between intelligence and school acvhievement as measured by standardised tests. Dissertation Abstracts International, 1974, 34(9A), 5734-5735.

TYLER, L.E. The Work of the Counselor. New York: Appleton-Century-Crofts, 1961.

VANDENBERG, S.G. & VOGLER, G.P. Genetic determinants of intelligence. In B. Wolman (Ed.), Handbook of Intelligence. New York: John Wiley & Sons, 1985.

VENTER, D.P. Die geldigheid van die Junior Suid-Afrikaanse Individuele Skaal as voorspeller van skool prestasie by Sub B-leerlinge. Unpublished M-thesis, University of Stellenbosch, 1985.

VERNON, P.E. The Structure of Human Abilities. London: Methuen, 1961.

WALLBROWN, J.D.; ENGIN, A.W.; WALLBROWN, F.H. & BLAHA,J. The prediction of First Grade reading achievement with selected perceptual-cognitive tests. Psychology in the Schools, 1975, 12(2), 140-149.

WECHSLER, D. The Measurement and Appraisal of Adult Intelligence, 4th Ed. London: Bailliere, Tindall & Co., 1958.

WECHSLER, D. Intelligence: Definition, Theory and the IQ. In R. Cancro (Ed.), Intelligence. New York: Grune & Stratton, 1971.

WHITE, D.R. & JACOBS, E. The prediction of First-Grade reading achievement from WPPSI scores of pre-school children. Psychology in the Schools, 1979, 16(2), 189-192.

APPENDIX A.

QUESTIONAIRES.

QUESTIONNAIRE : JSAIS RESEARCH PROJECT

Code no. of pupil .... Date of birth ..../..../76 Boy/Girl

IDENTIFYING DATA - at time of testing. November 1983.

School ....
SASSE/DSE ....
Father's occupation ....
Mother's occupation ....

IDENTIFYING DATA - current. November 1985.

School : Name .... Address .... Tel ....
SASSE/DSE ....
Father's occupation ....
Mother's occupation ....

NB If this pupil has left your school please provide whatever information is available from your records, complete the section below, and return the form to me as soon as possible.

Date pupil left this school ....
School that requested his/her record cards ....
Address ....

PUPIL'S SCHOLASTIC RECORD : Please circle the appropriate symbol.

1983 : i.e. Sub A - 4th term

Reading	A+	A	A-	B+	B	B-	C+	C	C-	D
Phonics	A+	A	A-	B+	B	B-	C+	C	C-	D
Mathematics	A+	A	A-	B+	B	B-	C+	C	C-	D
Oral Language	A+	A	A-	B+	B	B-	C+	C	C-	D

Pass / Fail

1984 : i.e. Sub B - 4th term (or, where applicable, Sub A repeat)

Reading	A+	A	A-	B+	B	B-	C+	C	C-	D
Phonics	A+	A	A-	B+	B	B-	C+	C	C-	D
Mathematics	A+	A	A-	B+	B	B-	C+	C	C-	D
Oral Language	A+	A	A-	B+	B	B-	C+	C	C-	D
Written Language	A+	A	A-	B+	B	B-	C+	C	C-	D

Pass / Fail

1985 : i.e. Std 1 - 4th term (or, whatever standard is applicable. Sub .....)

Reading	A+	A	A-	B+	B	B-	C+	C	C-	D
Phonics	A+	A	A-	B+	B	B-	C+	C	C-	D
Spelling	A+	A	A-	B+	B	B-	C+	C	C-	D
Mathematics	A+	A	A-	B+	B	B-	C+	C	C-	D
Oral Language	A+	A	A-	B+	B	B-	C+	C	C-	D
Written Language	A+	A	A-	B+	B	B-	C+	C	C-	D

Pass / Fail

Please answer the following questions by circling the relevant responses.

* Has this pupil repeated a standard? Yes/No
  If so, which standard and in which year? Sub , in 198 .

* Since being tested in November 1983, has this pupil been referred to a School Psychologist? Yes/No

  If so, indicate the reason for the referral and describe any intervention undertaken.

  ....

  ....

  ....

* Has this pupil received remedial teaching from a qualified remedial teacher? Yes/No
  If so, for how long? .... months

* Has this pupil been transferred to the special class? If so, please indicate when transfer took place. ....

* Is this pupil frequently absent from school? Yes/No
  Has this pupil been absent for a significant length of time? Yes/No

  If so, what are/were the reasons for the absence? Yes/No
  If illness is/was a factor, please note the nature of the illness.

  ....

  ....

  ....

VRAELYS : JSAIS NAVORSINGSPROJEK

Kodenommer van leerling .... Geboortedatum ..../..../76
Seun/Dogter

IDENTIFISERENDE DATA - ten tyde van toetsing, November 1983.

Skool ....
SASSE/DSE ....
Vader se beroep ....
Moeder se beroep ....

IDENTIFISERENDE DATA - huidige, November 1985.

Skool : Naam .... Addres .... Tel ....
SASSE/DSE ....
Vader se beroep ....
Moeder se beroep ....

LW Indien hierdie leerlinge u skool verlaat het, verskaf asseblief die inligting wat wel beskikbaar is, voltooi die onderstaande afdeling, en stuur die vorm so gou moontlik aan my terug.

Datum van leerling se vertrek van skool ....
Skool waardeur verslagkaarte aangevra is ....
Addres ....

LEERLING SE SKOLASTIESE REKORD: Omring asseblief die toepaslike simbool.

1983 : i.e. Sub A - 4de kwartaal

Lees	A+	A	A-	B+	B	B-	C+	C	C-	D
Klanke	A+	A	A-	B+	B	B-	C+	C	C-	D
Wiskunde	A+	A	A-	B+	B	B-	C+	C	C-	D
Mondeling	A+	A	A-	B+	B	B-	C+	C	C-	D

Slaag/Druip

1984 : i.e. Sub B - 4de Kwartaal (of, waar van toepassing, Sub A herhaal)

Lees	A+	A	A-	B+	B	B-	C+	C	C-	D
Klanke	A+	A	A-	B+	B	B-	C+	C	C-	D
Wiskunde	A+	A	A-	B+	B	B-	C+	C	C-	D
Mondeling	A+	A	A-	B+	B	B-	C+	C	C-	D
Skriftelike Werk	A+	A	A-	B+	B	B-	C+	C	C-	D

Slaag/Druip

1985 : Std 1 - 4de kwartaal (of, standerd wat van toepassing is. Sub .....)

Lees	A+	A	A-	B+	B	B-	C+	C	C-	D
Klanke	A+	A	A-	B+	B	B-	C+	C	C-	D
Spel	A+	A	A-	B+	B	B-	C+	C	C-	D
Wiskunde	A+	A	A-	B+	B	B-	C+	C	C-	D
Mondeling	A+	A	A-	B+	B	B-	C+	C	C-	D
Skriftelike Werk	A+	A	A-	B+	B	B-	C+	C	C-	D

Slaag/Druip

Antwoord asseblief die volgende vrae, deur die relevante response te omring.

- Het hierdie leerling 'n standerd herhaal? Ja/Nee
  Indien wel, watter standerd en in watter Jaar? Sub , in 198 .

- Is hierdie leerling, sedert die toetsing in November 1983, na 'n Skoolsielkundige verwys? Ja/Nee

  Indien wel, wat was die rede vir di verwysing en watter intervensies is onderneem?

  ....

  ....

  ....

- Het hierdie leerling remedirende onderig van 'n gekwalifiseerde remedirende onderwys ontvang? Ja/Nee
  Indien wel, vir hoe lank? .... maande

- Is hierdie leerling na 'n spesiale klas oorgeplaas? Ja/Nee
  Indien wel, wanneer het oorplasing plaasgeving? ....

- Is hierdie leerling <u>gereld</u> afwesig van die skool? Ja/Nee
  Was hierdie leerling <u>vir 'n lang tydperk</u> afwesig gewees? Ja/Nee

  Indien wel, waarom is/was die leerling afwesig gewees? Ja/Nee
  Indien swak gesondheid 'n faktor is/was beskryf die aard van die siekte.

  ....

  ....

  ....

APPENDIX B.

SUPPLEMENTARY TABLES.

TABLE A

CORRELATIONS BETWEEN JSAIS SCALES AND SUB A SUBJECTS AND AVERAGE

JSAIS SCALES	SUB A SUBJECTS				
	READING	PHONICS	MATHEMATICS	ORAL LANGUAGE	AVERAGE
GLOBAL	,516*** (92)	,609*** (92)	,635*** (93)	,557*** (91)	,665*** (93)
VERBAL	,518*** (92)	,594*** (92)	,526*** (93)	,590*** (91)	,635*** (93)
PERFORMANCE	,341*** (91)	,382*** (91)	,534*** (92)	,346*** (90)	,466*** (92)
NUMERICAL	,424*** (92)	,505*** (92)	,565*** (93)	,455*** (91)	,550*** (93)

Note: N for each correlation is given in parentheses. The total number of Sub A subjects is 93. Where N < 93, this is due to missing data.

*** $p \leq ,001$

TABLE B

CORRELATIONS BETWEEN JSAIS SCALES AND SUB B SUBJECTS AND AVERAGE

JSAIS SCALES	SUB B SUBJECTS					
				ORAL	WRITTEN	
	READING	PHONICS	MATHEMATICS	LANGUAGE	LANGUAGE	AVERAGE
GLOBAL	,467***	,378***	,505***	,498***	,415***	,521***
	(92)	(90)	(92)	(88)	(84)	(92)
VERBAL	,492***	,434***	,411***	,534***	,438***	,527***
	(92)	(90)	(92)	(88)	(84)	(92)
PERFORMANCE	,216*	,122	,340***	,329**	,229*	,286**
	(91)	(89)	(91)	(87)	(84)	(91)
NUMERICAL	,463***	,383***	,514***	,350***	,380***	,485***
	(92)	(90)	(92)	(88)	(84)	(92)

Note: N is given in parentheses. The total number of Sub B subjects is 92. Where N < 92, this is due to missing data.

TABLE C

CORRELATIONS BETWEEN JSAIS SCALES AND STD I SUBJECTS AND AVERAGE

JSAIS SCALES	STD I SUBJECTS					
	READING	SPELLING	MATHEMATICS	ORAL LANGUAGE	WORK	WRITTEN AVERAGE
GLOBAL	,440*** (90)	,473*** (90)	,580*** (89)	,482*** (90)	,491*** (89)	,558*** (90)
VERBAL	,497*** (90)	,486*** (90)	,575*** (89)	,466*** (90)	,528*** (89)	,578*** (90)
PERFORMANCE	,167 (89)	,236* (89)	,311** (88)	,247* (89)	,219* (88)	,266* (89)
NUMERICAL	,447*** (90)	,464*** (90)	,594*** (89)	,516*** (90)	,522*** (89)	,576*** (90)

Note: N is given in parentheses. The total number of Std One subjects is 90. Where N < 90, this due to missing data.

* p ⩽ ,05

** p ⩽ ,01

*** p ⩽ <001

TABLE D

CORRELATIONS BETWEEN JSAIS SUBTESTS AND SUB A SUBJECTS AND AVERAGE

JSAIS SUBTESTS	SUB A SUBJECTS				
	READING	PHONICS	MATHEMATICS	ORAL LANGUAGE	AVERAGE
FORM BOARD	,201 (92)	,258* (92)	,436*** (93)	,215* (91)	,322* (93)
VOCABULARY	,358*** (92)	,441*** (92)	,427*** (93)	,404*** (91)	,459*** (93)
NUMBER & QUANTITY CONCEPTS	,338*** (92)	,482*** (92)	,519*** (93)	,433*** (91)	,507*** (93)
MEMORY FOR DIGITS	,285** (92)	,336*** (92)	,371*** (93)	,282** (91)	,348*** (93)
PICTURE RIDDLES	,505*** (92)	,526*** (92)	,437*** (93)	,548*** (91)	,582*** (93)
WORD ASSOCIATION	,362*** (92)	,432*** (92)	,367*** (93)	,430*** (91)	,452*** (93)
ABSURDITIES A	,369*** (92)	,353*** (92)	,357*** (93)	,290** (91)	,403*** (93)
ABSURDITIES B	,159 (92)	,200 (92)	,303** (93)	,227* (91)	,262* (93)

Note: N is given in parentheses. The total number of Sub A subjects is 93. Where N < 93, this is due to missing data.

* $p \leqslant ,05$
** $p \leqslant ,01$
*** $p < ,001$

TABLE E

CORRELATIONS BETWEEN JSAIS SUBTESTS AND SUB B SUBJECTS AND AVERAGE

JSAIS SUBTESTS	SUB B SUBJECTS					
	READING	PHONICS	MATHEMATICS	LANGUAGE	ORAL LANGUAGE	WRITTEN AVERAGE
FORM BOARD	,166 (92)	,101 (90)	,299** (92)	,236* (88)	,147 (84)	,222* (92)
VOCABULARY	,321** (92)	,264* (90)	,323** (92)	,349*** (88)	,281** (84)	,348*** (92)
NUMBER & QUANTITY CONCEPTS	,332*** (92)	,266* (90)	,436*** (92)	,306** (88)	,264* (84)	,374*** (92)
MEMORY FOR DIGITS	,378*** (92)	,322** (90)	,381*** (92)	,239* (88)	,308** (84)	,377*** (92)
PICTURE RIDDLES	,444*** (92)	,408*** (90)	,403*** (92)	,501*** (88)	,416*** (84)	,496*** (92)
WORD ASSOCIATION	,349*** (92)	,310** (90)	,209* (92)	,367*** (88)	,301** (84)	,351*** (92)
ABSURDITIES A	,363*** (92)	,302** (90)	,307** (92)	,412*** (88)	,369*** (84)	,396*** (92)
ABSURDITIES B	-,000 (92)	-,062 (90)	,132 (92)	,091 (88)	,005 (84)	,048 (92)

Note: N is given in parentheses. The total number of Sub B subjects is 92. Where N < 92, this is due to missing data.

* $p \leq ,05$
** $p \leq ,01$
*** $p \leq ,001$

TABLE F

CORRELATIONS BETWEEN JSAIS SUBTESTS AND STD I SUBJECTS AND AVERAGE

JSAIS SUBTESTS	STD I SUBJECTS					
	READING	SPELLING	MATHEMATICS	LANGUAGE	ORAL WORK	WRITTEN AVERAGE
FORM BOARD	,077 (90)	,205 (90)	,122 (89)	,255* (90)	,187 (89)	,193 (90)
VOCABULARY	,341*** (90)	,334*** (90)	,446*** (89)	,312** (90)	,364*** (89)	,405*** (90)
NUMBER & QUANTITY CONCEPTS	,293** (90)	,322** (90)	,565*** (89)	,460*** (90)	,392*** (89)	,443*** (90)
MEMORY FOR DIGITS	,412*** (90)	,384*** (90)	,466*** (89)	,426*** (90)	,454*** (89)	,487*** (90)
PICTURE RIDDLES	,388*** (90)	,384*** (90)	,426*** (89)	,378*** (90)	,450*** (89)	,460*** (90)
WORD ASSOCIATION	,386*** (90)	,378*** (90)	,403*** (89)	,344*** (90)	,373*** (89)	,429*** (90)
ABSURDITIES A	,363*** (90)	,305** (90)	,272** (89)	,197 (90)	,283** (89)	,327** (90)
ABSURDITIES B	-,005 (90)	,071 (90)	,238* (89)	,081 (90)	,068 (89)	,099 (90)

Note: N is given in parentheses. The total number of Std One subjects is 90. Where N < 90, this is due to missing data.

* $p \leqslant ,05$
** $p \leqslant ,01$
*** $p \leqslant ,001$