THE DEVELOPMENT OF

A WAIS-III SHORT FORM

FOR USE IN SOUTH AFRICA

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CHAPTER ONE: INTRODUCTION

The Wechsler Adult Intelligence Scale - 3rd Edition (WAIS-III) is the newest of the internationally recognised Wechsler family of intelligence tests. It has been improved in terms of its psychometric properties, neuropsychological assessment abilities and its content. This test is in the process of being standardised by the Human Sciences Research Council (HSRC) in South Africa. As the adapted South African version will be available shortly for use in the multicultural circumstances of South Africa, the application of the various aspects of this test needs to be investigated.

This test is very comprehensive and thorough, however its one disadvantage is that it takes on average three hours to administer in its entirety. Thus there is a need to find ways in which to abbreviate the test for particular purposes when time is limited, for example in research, brief clinical assessments or neuropsychological screenings. The concept of abbreviating tests, including the earlier Wechsler intelligence test can be traced back to 1917, when it was asked if all the items on the Binet-Simon scale were required to give an accurate assessment of IQ (Levy, 1968).

Since then there have been many short form suggestions made, with many different considerations in mind. These can be divided into two main approaches or methods. Firstly, the number of subtests of the scale can be reduced. Thus with the WAIS-III which consists of 14 subtests in total, an option is to use, for example only four of the subtests to get an estimate of a person's IQ. Secondly, the number of items in each subtest can be reduced. Thus only half the items or even only a third of the items on a subtest can be administered to get an estimate of the persons'

performance on each subtest and in this way estimate their overall IQ. Both methods have been used on the WAIS and WAIS-R, although the reduction of the subtests is favoured. Both should now be validated and considered for use with the WAIS-III in South Africa.

Wechsler tests and their constituent subtests have been found to be differentially effected by race, education, language and socio-economic status (Kaufman, McLean & Reynolds, 1988; Nell 1999). These differences have also been found to impact on the short forms which are suggested, as certain subtests are considered to be more biased towards particular groups than others. Vocabulary and Block Design in particular bias testees who are not as westernised or acculturated towards a largely American and European culture (Kaufman, McLean & Reynolds, 1988). These differences, although often ascribed to race, language or socio-economic status can best be understood more broadly in terms of degree of acculturation (i.e. westernisation) (Shuttleworth-Jordan, 1996) and test-wiseness (Nell, 1999). In South Africa in particular, with its extreme cultural diversity these factors need to be carefully considered when developing short forms.

In the present study the development of a short form appropriate to South Africa's diverse cultural circumstances will be approached, through a sample which has been stratified according to gender, first language (English vs. African), quality of schooling received (Private/Model C vs. DET) and level of education achieved (Matric vs. Graduate). Both a subtest reduction method and an item reduction method will be considered to arrive at a short form. The subtest reduction method will be considered further in an attempt to clarify which subtests would be more or less appropriate to include in a short form considering group differences. Finally the thesis will develop suggestions as to which short forms would be best for use in South Africa.

CHAPTER TWO: LITERATURE REVIEW

Intelligence testing has been steeped in controversy since the first intelligence scale was published in 1904 by Alfred Binet. Since then many tests have been used to justify group prejudice and discrimination, for example in the immigration policies of the United States of America, where people from certain countries were declared more or less desirable immigrants due to differential test performance (Kamin, 1974; Nell, 1999). So too in South Africa, where differences on test performance along racial lines were used to support the apartheid government policies, particularly in terms of education and employment (Claassen, 1997; Nell, 1994). Tests have been used widely to assess people applying for jobs and this is particularly pertinent in terms of the new South African labour legislation which attempts to legislate against the use of tests which are culturally biased (Nell, 1999). The controversy continues in terms of trying to identify the causes of differential test performance by various groups, whether these differences are genetic or environmental, or whether they are the result of test construction (Kamin, 1974; Nell, 1999; Schepers, 1997; Shuttleworth-Jordan, 1996). Despite these considerations and debates, intelligence tests have been used widely and found useful for the determination of individuals' capacities and abilities around the world and in South Africa (Huysamen, 1980).

2.1 Historical Roots of Intelligence Testing

Historically, Sir Francis *Galton* is generally credited with the start of the mental test movement. In 1892 he established the Anthropometric Laboratory in London and proceeded to test people's mental ability. He tested their mass, height, eyesight and hearing, amongst others. His reasoning was based on John Lockes' idea that all knowledge enters via the senses and thus a measurement of sensory functions should give an indication of the person's mental capacity (Huysamen, 1983).

In 1888 an American James McKeen *Cattell* visited Galton and on his return to America promoted the test movement which had begun in Europe. In 1890 he describes a test he used on university students, which was similar to Galton's but now included more psychological functions like memory and reaction time (Huysamen, 1983). This seems to be the start of mental testing as we know it today.

In 1895 two Frenchmen, Binet and Henri criticised these tests as being too concerned with sensory functions and proposed tests for memory, attention and comprehension. Binet got the opportunity to develop these when he was commissioned by the French government to investigate the training of mental retardates. Binet and Simon developed the *Binet-Simon Scale*, published in 1904 (Huysamen, 1983). The test consisted of a series of tasks of increasing difficulty, representing the typical achievements of children at particular ages. The tasks varied widely, but relied heavily on understanding language and the ability to reason with verbal or non-verbal materials (Carroll, 1982). With this test he hoped to identify students needing special schooling. Interestingly his opinion of intelligence was that it could be trained and an absence or lack of it cured (Kamin, 1974).

In South Africa a modified Binet-Simon scale was used by Martin, as early as 1915, to test 4-18 year old Zulu children. At the same time Rich tested 6-22 year old Zulu children and young adults (Huysamen, 1983). From this time onwards several scales were developed, standardised and used in South Africa, based to a larger or smaller extent on American and European developments. Therefore it is useful to trace the development of these American and European tests first, as the WAIS-III, which is the concern of the present study, is based on these American and European developments.

2.1.1 American and European IQ Test Developments

In America Louis Terman at Stanford University was instrumental in revising the Binet-Simon scale and in 1916 published the *Stanford-Binet Intelligence Scale*. This scale was revised in 1937 and again in 1960 by Terman and Merrill (Huysamen, 1983). During World War I there was a need to test a large number of recruits and while intelligence tests until then had been individual, now group pencil and paper tests were rapidly developed. The most important being the *Army Alpha* and *Army Beta* tests, for literates, and illiterates and non-English speaking recruits respectively. During this time personality questionnaires were also more widely developed and so the whole area of testing of human capacities and potentials received a boost during this time (Huysamen, 1983).

David Wechsler was chief psychologist at the Bellevue Psychiatric Hospital in New York and was dissatisfied with the Stanford-Binet tests in their revised forms and so set about developing and standardising another scale. In 1939 he published the *Wechsler-Bellevue Adult Intelligence Scale*. The items were not new, but derived from previous tests. In comparison to the Stanford-Binet the items were grouped according to type and not according to age levels (Huysamen, 1983). The main innovation of this test was the way in which IQ was calculated. The Stanford-Binet tests had determined the mental age of the participants and then compared these with chronological age, so deriving an IQ score. The Wechsler-Bellevue tests adopted the deviation IQ promoted by Thurstone, where the subtest raw scores are converted to scale scores, with a population mean of 10 and a standard deviation (SD) of 3, while the global IQ score has a mean of 100 and a SD of 15 (Nell, 1994). This is the method that has continued to be used in all the later Wechsler tests.

Here it is interesting to note that Wechsler defined intelligence as "... the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment" (Wechsler, 1939, p.63). He adds that by measuring these abilities it is possible to arrive at an estimate of intelligence and in this way evaluate it. He does however warn that intelligence is not the mere sum of these abilities, as the way in which abilities can be combined is also important. Factors like drive, motivation, incentive and goal awareness also influence a person's abilities and thus intelligence (Wechsler, 1939). Thus while many now use the tests that are based on Wechsler's work to indicate an innate ability or inherent capacity, this was not the perception of the developer of these test.

In 1938 Raven published the *Progressive Matrices*, which has become an alternative to the more verbal tests and is considered to be more culturally fair (Huysamen, 1983). This test is one which has been used frequently in South Africa, particularly in hospital settings, as it does not rely on language skills and is thus thought not to be verbally biased (Bass, 2000). Matrix Reasoning, one of the new subtests of the WAIS-III, is based on this test and thus the WAIS-III has attempted to incorporate Raven's influence into the newest Wechsler test.

As World War I was a precipitant, so again World War II led to more psychological tests being developed in various parts of the world, the most well known and reputed being the *Army General Classification Test*, developed for the US Army (Huysamen, 1983). The test developments during the war again slowly filtered into the more general testing arena.

In 1955 a revised version of the Wechsler-Bellevue was published as the *Wechsler Adult* Intelligence *Scale (WAIS)*. The revisions were fundamental and extensive, with the majority of the items on the Information, Arithmetic and Picture Completion scales being revised, as well

as the general subtest instructions changed to reduce test anxiety. The administration and scoring of the Digit Span subtest were changed to having both items of each length administered and now scored 0, 1 or 2, instead of only 0 or 1. Block Design now used blocks with only red and white colours and no blue and yellow, using a maximum of 9 blocks only and increasing the difficulty of the items (Nell, 1994).

In 1981 the *Wechsler Adult Intelligence Scale-Revised (WAIS-R)* was published, retaining 80% of the WAIS items. The sequence of administration was changed from one where all the Verbal subtests were followed by all the Performance subtest, to a situation where Verbal and Performance subtests were administered alternatively (Nell, 1994).

In 1997 the *Wechsler Adult Intelligence Scale - Third Edition (WAIS-III)* was published, again with important revisions from the WAIS-R in terms of method and content, as well as factor analytic respects. This test was co-normed in the USA and UK with the WMS-III (Wechsler Memory Scale-III). Many of the innovations of the WAIS-III were the result of large scale consultation and thus many neuropsychological principles are now included into the mainstream of psychological testing. An incidental recall task is now included on the Digit Symbol subtest, adding a memory component. Reversal items have been added at the beginning of Picture Completion, Vocabulary, Similarities, Block Design, Arithmetic, Matrix Reasoning, Information and Comprehension subtests. This includes guided learning and extended practice for testees who do not grasp the concepts required for the test immediately, or fall at the lower end of the intelligence spectrum. This effectively lowers the floor of the tests (Wechsler, 1997), but also gives people without knowledge of formal testing an opportunity to be taught how the testing works (Nell, 1999).

Besides the traditional Verbal and Performance IQ scales, a four factor model is now part of the WAIS-III. Each factor yields an index score, with a mean of 100 and a SD of 15. These indexes are Verbal Comprehension, Perceptual Organisation, Working Memory and Processing Speed. The diagnostic ability of these factors has been improved by the introduction of 3 new subtests; namely Matrix Reasoning, Letter-Number Sequencing and Symbol Search. As indicated above, the Matrix Reasoning subtest is analogous to the Raven's Progressive Matrices and is constructed to represent pattern completion, classification, analogy and serial reasoning, as four types of non-verbal reasoning. The Letter-Number Sequencing subtest focuses on the use of working memory. Symbol Search as a subtest was first used in the WISC-III and tests concentration and information processing speed (Wechsler, 1997).

The WAIS-III is the newest of the internationally recognised general intelligence tests and with its modifications, new subtests and factor indexes promises to add considerably to the field of neuropsychological testing. It is also beginning to be used in many countries around the world, where several standardisations are underway. So too in South Africa, where the Human Sciences Research Council (HSRC) has entered into a licensing agreement with the Psychological Corporation to norm the WAIS-III for use with South African adults (Claassen, 1998). This standardisation is currently underway and will be discussed in more detail below, following a closer examination of the South African developments in terms of intelligence testing.

2.1.2 South African IQ Test Developments

The *Binet-Simon* test was applied to Zulu children as early as 1916, however in 1925 Dr Eybers of Grey University College in Bloemfontein published an adapted *Binet-Terman* scale for South African use (Huysamen, 1983). However these and most of the other tests developed after this in South Africa were only developed for white English and Afrikaans speaking individuals.

Most of the test development in South Africa focused on assessing children, with few test developments for adults. Thus in this section many child tests will be reviewed, as they formed the basis for the South African IQ test development. These tests were often used to establish the mental age of adults and are important in terms of adult intelligence testing nonetheless. Additionally there was more of a focus on the development of group tests, as opposed to individual scales. Thus the group tests will briefly be reviewed here, particularly as many of these were also used individually.

During the 1920's many university academics in South Africa were working on developing a group test for schools, leading to the publication of the *South African Group Test of Intelligence* in 1930. By 1950 the South African Group Test of Intelligence was found to be too easy, now with a mean of about 110 and with too large an emphasis on language ability. Thus in 1956 the *New South African Group Test* was published with 3 parallel forms, for English and Afrikaans speaking pupils. In 1968 the *Group Test for Indian Pupils* was published and in 1974 a *Group Test for Coloured Pupils*. Between 1987 and 1991 the *General Scholastic Aptitude Test* was published for three age groups ranging in total from 9 to 18 years. Again these tests were only standardised for English and Afrikaans speaking pupils, although separate norms were now being developed for environmentally disadvantaged students (Huysamen, 1983).

In terms of adult group testing the National Institute for Personnel Research (NIPR) did much pioneering research into developing tests for the selection and classification of operatives in the clothing industry, from 1945 onwards. These were all group tests, due to the large number of testees who needed to be assessed. They later expanded into the testing of mine workers, where they encountered problems with language and cultural diversity. The NIPR was incorporated into the HSRC in 1984 (Huysamen, 1983).

In terms of individual child tests, after Dr. Eybers published an adapted Binet-Terman in 1925, Dr. Fick of the Union Department of Internal Affairs published the Official Mental Health Test in 1927. The extension of this test, the *Individual Test of General Intelligence* was published in 1939, again only for children. This test became known as the "*Fick Scale*" and was based on the 1916 Stanford-Binet (Huysamen, 1983, Claassen, 1997). In 1957 development began on the New South African Individual Scale, which was finally published in 1964 and was aimed at individuals aged 5-17 years. In 1980 it was renamed the *Senior South African Individual Scale (SSAIS)* for 11-17 year old and the *Junior South African Individual Scale (JSAIS)* for 5-11 year olds and revised versions, the SSAIS-R and JSAIS-R were published in 1991. The initial versions consisted of 5 verbal and 4 non-verbal subtests, while the revised versions had an extra verbal and an extra non-verbal subtest. Again the norms were only for English and Afrikaans speaking individuals, however norms were now developed for the environmentally non-disadvantaged within these groups. Between 1988 and 1990 these tests were adapted for use with Xhosa, Zulu, Northern Sotho and Tswana speaking children. Despite these new tests the old Fick Scale (1939, Individual Test of General Intelligence) was still popular and was thus revised and updated in 1994, due to popular demand (Huysamen, 1983).

In 1947 work began on developing an individual standardised South African intelligence test for adults, based on the Wechsler-Bellevue test which had been published in 1939. The test was called the *South African Wechsler Adult Intelligence Scale (SA-WAIS)*, giving rise to the erroneous idea that it was based on the later WAIS, only published in 1955. Problems with this test's development were enormous as the actual Wechsler-Bellevue test material was not available in South Africa and therefore subtests were constructed locally based on verbal descriptions and diagrams which were not to scale. Thus this test, although based on the

Wechsler-Bellevue, diverges from it considerably (Nell, 1994). Again the test only had norms available for English and Afrikaans speaking white South Africans (Huysamen, 1983). Thus it is important to remember that the SA-WAIS is not based on the WAIS and hence does not incorporate many of the modifications and adaptations that were implemented in this test, as described above. This consideration is often ignored when interpretations are made on the basis of the SA-WAIS, where the clinical and diagnostic interpretations used are actually derived from research using the WAIS or WAIS-R. This makes SA-WAIS interpretations of VIQ and PIQ discrepancies, amongst others, very problematic, as the characteristics of the scales on which the assumptions are based are quite different from the SA-WAIS (Pieters & Louw, 1987).

Most experts in the field of psychological testing have agreed for some time that the use of the SA-WAIS is dated and only relevant to a small population group (Claassen, 1998; Foxcroft, 1997; Huysamen, 1983; Pieters and Louw, 1987; Shuttleworth-Jordan, 1995, 1996). The SA-WAIS is also technically limited and outdated in terms of content (Pieters & Louw, 1987). The test is also considered to overestimate intelligence, especially in the above average IQ range, which is not surprising in that IQ's have been found to increase by about 0.3 IQ points per year (Flynn, 1998). Also being the only individual test for adults standardised on a South African population, does not offer much choice to clinicians in this country.

There has been some pioneering research into the adaptation of the WAIS-R for South Africa, but numerous obstacles were encountered mostly related to technical problems with the scale. The floor of many of the subtests was not considered low enough and did not give testees without test experience the opportunity to familiarise themselves with the test requirements (Avenant, 1988). These technical problems have been addressed in the WAIS-III, particularly by lower subtest floors, including reversal items and giving the opportunity for the teaching of the test principles.

Thus with the publication of the WAIS-III in America, the door was opened to use this new and updated test through a large scale standardisation in South Africa. This standardisation would bring South Africa in line with developments made over the last 60 years in terms of neuropsychological assessment and test development. It will also allow South African research using the South African WAIS-III to be more readily comparable with research in the rest of the world.

2.1.3 WAIS-III Standardisation in South African

In March 1997 a national symposium was held to discuss the need for an adult intelligence scale in South Africa. As a first step towards this goal the HSRC registered a project to standardise the WAIS-III for English-speaking South Africans in December 1997 (Claassen, 1998). A large advisory committee was set up consisting of academics, psychologists and other interested parties, to discuss various issues around a standardisation (A.B. Edwards, personal communication, March 2000). This committee was also advised by experts who had been involved in the American standardisation process (Claassen, 1998).

It was decided that the WAIS-III would be standardised for English First Language speakers, as this is the fastest expanding language group in the country. At the same time the use of the WAIS-III with English Second Language speakers would be investigated. The option of translating the WAIS-III into the other 10 official languages of South Africa was dismissed for various reasons, the most important being the logistical enormity of such a task, as well as the variety of dialects within some of the languages and the technical and interpretative problems which such translations would entail. Instead, as English is considered the main lingua franca and the most spoken language in South Africa, it was decided to investigate how second language users, with varying levels of English language proficiency would perform on a English version of

the WAIS-III (A.B. Edwards, personal communication, March 2000). Thus there would be an initial standardisation on 900 individuals who are English First Language speakers and these will become the norm sample. Another experimental group of 700 individuals, with varying degrees of English language proficiency would also be assessed on the WAIS-III, giving an indication of how results from the standardisation may need to be adapted for these groups (Claassen, 1998).

The *main standardisation group* was drawn from all South Africans who are English-speaking, representing about 13% of the population. "English speaking" was defined as speaking English in the home most of the time. The sample was stratified according to age, educational level and gender. The testees were between 16 and 69 years of age. It was aimed that the sample would be evenly divided between the four racial groups, namely white, coloured, black and Indian. However after a year of testing this criteria was changed, due a lack of black English First Language speakers. The final racial composition of the sample is not clear at the present point in time (N.C.W. Claassen, personal communication, April 2000). The total norm group consists of 900 people (Claassen, 1998).

The *experimental group* includes persons between 20 and 34 years of age, and was divided into three groups. The first group consists of 300 people who have an African language as first language, but speak English at work or school most of the time. The second group consists of 200 people who have Afrikaans as a first language, but speak English at work or school most of the time. The third group are 200 people with Afrikaans as a first language, who also speak Afrikaans at work or at school most of the time. The experimental group was stratified along the same lines as the norm sample, so that the 300 people in the norm sample who are in the same age category as this experimental group formed a comparison group for this study. The experimental groups had the WAIS-III administered in English, however they also completed a test of English

language proficiency, which the norm group in the same age group had also completed. In this way a total of 1 600 people (including the main standardisation and experimental groups) were tested on the WAIS-III, yielding information on how English speaking South Africans perform, as well as what the effect of different levels of English language proficiency are on WAIS-III test performance (Claassen, 1998).

For the HSRC standardisation the WAIS-III was administered in its American form, to allow for the comparison of the South African standardisation results with the American norms. However, it was considered that some items on the verbal subtests may need to be replaced, as they were regionally or culturally inappropriate to South Africa. Thus potential replacement items were administered as additional items at the end of the existing subtests. Ten additional items were administered on the Vocabulary subtest, twelve on the Information subtest and seven on the Comprehension subtest. The wording of some questions was also altered, particularly on Arithmetic, for example changing Dollars to Rands and Miles to Kilometres (Claassen, 1998). This has also been done on the British version of the WAIS-III (Wechsler, 1997) and even for an Irish modification of the Information subtest of the WAIS-R (James & Dalton, 1993).

The testing for the standardisation has ended, but the results of the standardisation will only be available later this year (N.C.W. Claassen, personal communication, April 2000), yielding norms for English speaking individuals, as well as indicating the effect of differential language proficiency. Some of the additional items administered during the standardisation may be used to replace items in the final South African version. This will make the test more appropriate to South African use, at the same time the aim is to keep the test as similar to the American test as possible (Claassen, 1998). Eventually this should yield an intelligence test that is modern and up to date with research and developments world wide, while still being applicable to South Africa.

2.2 The Question of Time: Short Forms

Tests take time to administer and score, often taking hours of a clinician's time. The amount of time taken by testing is often more than the benefit of the results justifies, and thus clinicians often look for shorter and more expedient ways of gaining the same information. Particularly with intelligence testing several hours do not seem justified when an overall estimate of intelligence is all that is needed or the profile yielded is flat and further information gained limited. In these cases especially, a clinician would like to have the choice to administer a shorter IQ test. Besides the economic considerations of saving time, other reasons for short forms exist, although these are generally not stated in the literature, but taken for granted. Clinically, if a full neuropsychological battery is to be administered to assess for a particular deficit, then a full IQ test may not be required and merely an estimate of intelligence needed. This may also be an attempt to arrive at a pre-morbid IQ level, rather than a present IQ, where only so-called hold tests are then desired. Similarly for research purposes with large sample sizes, a shorter method of attaining an IQ estimate is needed. When working with people who are ill or cognitively impaired, their concentration span and stamina may not allow for the administration of a full IQ test, thus necessitating a shorter test. Also, when assessing people whom the full test is culturally biased against, a short form which eliminates particularly biased subtests would give a better indication of their potential than would the entire IQ test. This type of short form would be particularly relevant to assessment in South Africa with its multi-cultural diversity. Thus many reasons exist for developing short forms and these will in turn influence the choice of a particular short form.

In 1917 Doll (in Levy, 1968) appears to have been the first to ask whether all the items of the Binet-Simon test were needed for a proper assessment. This gave rise to a variety of approaches to the abbreviation of tests and thus a multitude of short form suggestions (Abidin & Byrne, 1967; Britton & Savage, 1966; Brooker & Cyr, 1986; Canavan, Dunn & McMillan, 1986; Cella, Jacobsen & Hymowitz, 1985; Crawford, Allen & Jack, 1992; Coetzee & Madge, 1981; Doppelt, 1956; Jones, 1962; Kaufman, Ishikuma & Kaufman-Packer, 1991; McNemar, 1950; Reynolds, Willson & Clark, 1983; Silverstein, 1982; Satz & Mogel, 1962; Walsh, 1991; Ward, 1990; Ward & Ryan, 1996, 1997; Warrington, James & Maciejewski, 1986).

In this review of short form development the focus will be on those developed for the Wechsler family in general and the WAIS-III in particular and also those developed for the SA-WAIS in South Africa. Only the adult tests will be considered as these have common psychometric and statistical properties. Within the Wechsler short forms the focus here will be on (i) considerations which go into the development of short forms (Cyr & Brooker, 1984; Kaufman, 1972; Levy, 1968; Satz & Mogel, 1962; Silverstein, 1985; Tellegen & Briggs, 1976), (ii) those short forms which have been validated extensively and are widely advocated (Kaufman, Ishikuma & Kaufman-Packer, 1991; Silverstein, 1982; Ward, 1990), and (iii) those short forms that have brought new issues into consideration in the development of short forms (Kaufman, Ishikuma & Kaufman-Packer, 1991; Reynolds, Willson & Clark, 1983; Satz & Mogel, 1962; Ward & Ryan, 1996).

Summarising the dilemma of what to consider when developing short forms Doppelt (1956) said that: "A compromise must be made between economy of time and effort and accuracy of prediction" (p.63). Some researchers focus on the accuracy of prediction, some on the time saving, and still other on the applicability to specific population groups. In this way various

approaches to the development of short forms have been used. Levy (1968) distinguished five main methods:

1. Scale Sampling (most valid subset): In this case the clinician chooses that combination of subtests which has the highest correlation with the Full Scale IQ.
2. Scale Sampling (most valid stratified subset): Here the subset is stratified so as to have both Verbal and Performance elements present.
3. Factor Sampling: Here subtests are sampled in such a way as to represent the factors found to exist on the test.
4. Scale Sampling (idiosyncratic subsets): Subsets can also be chosen for other reasons, such as the particular handicaps of the testee, the testers personal preference, administration time etc.
5. Item Sampling: In this approach items from each subtest are sampled leading to a quasi "split half" test.

The way in which the development of short forms has been progressing, the general division appears to be between those methods which reduce the number of subtests (methods 1, 2, 3 and 4 according to the above distinction) and those that reduce the number of items on each subtest (method 5). The different considerations for subtest selection as distinguished by methods 1-4 above, are important to keep in mind as they highlight what criteria were used to select particular subtests, but they can more usefully be looked at under one heading, as these methods are now mostly combined in some form. Thus the various short forms developed will be distinguished as falling under the group of (i) subtest reduction methods, or (ii) item reduction methods. Before considering these two methods more closely, the specific short forms to be considered in this literature review are presented in Table 2.2.1 below. A table of the abbreviations used, in this and subsequent tables, for the WAIS-III subtests, IQ scales and factor indexes is presented in Table 2.2.2, also on p.18 and in Appendix A, p.120.

Table 2.2.1: Short Forms to be Considered in this Literature Review

Test	Developers	Subtests Included
WAIS-R	Silverstein (1982)	V +BD
		V +A +PA +BD
	Reynolds, Willson & Clark (1983)	I +A +PC +BD
	Ward (1990)	I +DSP +A +S +PC +BD +DSY
	Kaufman, Ishikuma & Kaufman-Packer (1991)	I +PC
		I +PC +DSP
		S +A +DSY +PC
SA-WAIS	Coetzee & Madge (1981)	S +BD
		S +BD +PC
		S +A +BD +PC
WAIS-III	WASI (Psychological Corporation, 2000)	V +MR
		V +S +MR +BD
WAIS	Satz & Mogel (1962)	All Subtests Abbreviated

Table 2.2.2: Abbreviations Used for WAIS-III Subtests, IQ Scales and Factor Indexes

PC	Picture Completion
V	Vocabulary
DSY	Digit Symbol
S	Similarities
BD	Block Design
A	Arithmetic
MR	Matrix Reasoning
DSP	Digit Span
I	Information
PA	Picture Arrangement
C	Comprehension
SS	Symbol Search
LN	Letter-Number Sequencing
OA	Object Assembly
VIQ	Verbal Intelligence Quotient
PIQ	Performance Intelligence Quotient
FSIQ	Full Scale Intelligence Quotient
VCI	Verbal Comprehension Index
POI	Perceptual Organisation Index
WMI	Working Memory Index
PSI	Processing Speed Index

2.2.1 Subtest Reduction Methods

The main criteria for the selection of which subtests will make up a particular short form is the *validity* of the resultant short form (Nagle & Bell, 1995). Validity is a central concept in test construction and an essential quality of a test. There are several types of validity, the most important here being content validity which is concerned with whether a test is actually measuring what it has set out to measure and construct validity which looks at whether all components of this construct are measured in the correct proportions (Gold, 1984; Jensen, 1980). The validity of the full IQ test is complex to establish as it will need to consider whether the test is actually measuring intelligence in its multifaceted complexity. On the other hand, the validity of the short form is more straight forward, as it is only measuring the overall concept of intelligence. Thus a short form whose *estimated* Full Scale IQ approximates the *actual* Full Scale IQ, as established by the entire test, can be considered to have very high validity. The validity is based on the part-whole correlation between the subtest-combination and the Full Scale IQ, corrected for attenuation (Jensen, 1980).

Tellegen and Briggs (1976) have suggested a modified formula to correct for the non-independence of test administration of the part(s) and whole. This is necessary as the whole test is usually administered and then the various subtest combinations derived, rather than the subtest combination administered independently and the results compared to an administration of the whole. This modified formula is still generally used for the assessment of the validity of short forms at present (Cyr & Brooker, 1984; Demsky, Gass & Golden, 1997; McCusker, 1994; Paolo, Ryan, Ward & Hilmer, 1996; Silverstein, 1982; Ward & Ryan, 1996, 1997).

The formula suggested by Tellegen and Briggs (1976) is as follows:

$$r'_{pw} \frac{\sum \sum r_{j\ell}}{2\sqrt{\tfrac{1}{2}n + \sum r_{jk}} \quad \sqrt{\tfrac{1}{2}t + \sum r_{\ell m}}}$$

where r'_{pw} = modified coefficient of correlation between the composite part and the composite whole; $r_{j\ell}$ = correlation between any subtest j included in the part and any subtest ℓ included in the whole, where any included correlation between a subtest and itself is represented by its reliability coefficient; r_{jk} = correlation between any subtest j and k belonging to the part (where subscript k is numerically larger than subscript j); $r_{\ell m}$ = correlation between any subtests ℓ and m belonging to the whole (where subscript m is numerically larger than subscript ℓ); n = number of subtests in the part, and t = number of subtests in the whole.

Short form development has also been criticised for generally focusing on the validity of the selection only and not taking into account the *reliability*. Reliability is a composite of the accuracy, consistency and stability of a test across various situations (Anastasi, 1968; Gold, 1984). Cyr and Brooker (1984) suggest that reliability also be taken into account and they did this using the formula suggested by Tellegen and Briggs (1967). Their reliability formula is as follows:

$$r_{cc} = \frac{\sum r_{jj} + 2\sum r_{jk}}{n + 2\sum r_{jk}}$$

where r_{cc} = reliability coefficient of the subtest combination of composite C; r_{jj} = reliability coefficient of any component subtest j; r_{jk} = correlation between any component subtests j and k (where subscript k is numerically larger than subscript j) and n = number of component subtests (Tellegen & Briggs, 1967).

The reliability of the Wechsler tests has generally been found to be very high (Jensen, 1980), particularly on the Full Scale IQ, Verbal IQ and Performance IQ scores (0.98, 0.97 and 0.94 respectively for the WAIS-III American standardisation). The reliability of the subtests varies, between 0.72 and 0.93 for the WAIS-III subtests (Wechsler, 1997), and thus the short form's reliability needs to be an additional consideration in the subtest selection (Cyr & Brooker, 1984; Tellegen & Briggs, 1967). Using the formulae for validity and reliability Cyr and Brooker (1984) arrived at an average of the two and were able to use this composite for their selection of short forms.

Besides these technical and statistical suggestions and considerations Kaufman (1972) suggested guidelines for the actual development of short forms, which would make short forms valid, as well as clinically useful. He argued that short forms should contain two Verbal and two Performance subtests which are quick to administer and to score, which correlate highly with the Verbal and Performance scales respectively, at the same time measure a variety of mental abilities and form a clinically interesting combination. These recommendations and suggestions have been taken into account in some short form developments, of which there have been many. As noted above, all the possible short forms suggested in the literature will not be reviewed here, instead a few of the more widely respected and validated ones will be considered, as well as some whose development led to the introduction of new ideas and criteria to the development of short forms. *Silverstein* (1982) suggested the use of the *Vocabulary* and *Block Design* subtests for a *two-subtest short form (dyad)* of the WAIS-R. This dyad was found to have the highest correlation with Full Scale IQ compared to any other dyad and also to have high reliability. On combining validity and reliability it has the highest combined coefficient for all dyads on the WAIS-R (Cyr & Brooker, 1984). It is suggested that this short form is adequate for most purposes. This dyad combination is also one commonly used for the Spanish version of the WAIS (Escala de Inteligencia

Wechsler) and found to be valid for a Spanish population (Demsky, Gass & Golden, 1997). For a *four subtest short form (tetrad)* Silverstein (1982) suggested the use of the *Vocabulary, Arithmetic, Picture Arrangement and Block Design* subtests. Although this selection is not the best in terms of validity, it is only marginally below others and has a high reliability (Ward & Ryan, 1996). It was also a combination already suggested by Doppelt (1956) for the WAIS, as well as by Kaufman (1976, in Silverstein, 1982) for the WISC-R. The reason it had been chosen in these previous cases is due to the fact that the combination of the verbal and performance tests correlates very highly with the total Verbal and Performance scores (Silverstein, 1982). Additional reasons for this combination's choice appears to be it's clinical, practical and empirical qualities (Boone, 1990; Nagle & Bell, 1995). Silverstein (1982) goes on to provide tables which allow a tester to look up Full Scale IQ equivalents for either the dyad or tetrad short forms. This was done so that the sum of scaled scores for the dyad or tetrad can be transformed into a scaled score, with a mean of 100 and a standard deviation of 15. However Silverstein's short forms have been criticised for their inclusion of biasing subtests, as will be discussed later.

In contrast *Reynolds, Willson and Clark* (1983) suggested a short form consisting of *Information, Arithmetic, Picture Completion and Block Design.* Thus instead of Silverstein's Vocabulary, they used Information and instead of Picture Arrangement, they used Picture Completion. This short form only takes 20-30 minutes to administer, entailing a large time saving. It gained much support for its overall correlation with Full Scale IQ (Boone, 1990; Crawford, Mychalkiw, Johnson & Moore, 1996), but it was found to overestimate IQ and thus misclassify many patients, particularly those with brain damage and head injuries. This group would be one for which short forms are particularly useful due to short attention spans and flagging concentration. Thus this research suggests cautious use of this particular short form for classification and decision making (Boone, 1990; Robiner, Dossa & O'Dowd, 1997). This

short form however eliminated tests from the Silverstein version, which are generally considered to be biased towards certain groups, and thus was felt to be less biased and more culturally fair.

Kaufman, Ishikuma and Kaufman-Packer (1991) suggested 'very short' short forms of the WAIS-R. Their dyad, triad and tetrad were chosen primarily for the administration and scoring time of each subtest. The factor structure of the WAIS-R was also considered (McCusker, 1994; Ward, Selby & Clark, 1987). For the development of the two and three subtest version they also took into consideration whether the subtest was given at the beginning or the end of the full test battery as motivation and attention would impact on the estimated IQ on this length of short form. This was based on research that indicated that subtests towards the end of the complete test would overestimate IQ if given in a 'very short' short form, due to the different levels of motivation and concentration in the different situations. Thus they preferred using subtests in a short form which are given near the beginning of the entire test. This effect does not seem to be so prominent when the short form consists of four or more subtests and thus does not need to be given as much consideration for tetrads (Nagle & Bell, 1995).

The actual *dyad* suggested by Kaufman Ishikuma and Kaufman-Packer (1991) consisted of *Information and Picture Completion*. Thus having a verbal and a performance subtest, both of which are short to administer and near the beginning of the scale. The *triad* added *Digit Span* to the dyad of *Information and Picture Completion*. This was added to reflect the factor structure of the WAIS-R. Now there was a subtest each representing the factors of Verbal Comprehension, Perceptual Organisation and Freedom from Distractibility. The *tetrad* chosen was done in such a way as to contain a dyad which correlates highly with Verbal IQ and one which correlates highly with Performance IQ. Thus it consisted of *Picture Completion, Digit Symbol, Similarities and Arithmetic*. These short forms have been used in numerous validation studies which seem that

they are as good as or better than most other short forms (Boone, 1992; Nagle & Bell, 1995; McCusker, 1994; Ward & Ryan, 1996, 1997). Their ease of use and short administration time appear to have made them favourites with clinicians.

Ward (1990) suggested a seven subtest short form. This may not sound like much of a time saving, but has been found to only take between 37 and 45 minutes to administer, thus halving administration time (Axelrod & Paolo, 1998; Ward & Ryan, 1996). The short form consists of *Information, Digit Span, Arithmetic, Similarities, Picture Completion, Block Design, and Digit Symbol.* From these very accurate estimates of Full Scale IQ, VIQ and PIQ can be made. Numerous validation studies have been done with this short form and it has been found to be applicable to most populations, including psychiatric patients, elderly samples and those with brain damage (Axelrod & Paolo, 1998; Benedict, Schretlen & Bobholz, 1992; Iverson, Myers & Adams, 1997; Ward, 1990; Ward & Ryan, 1996). This short form also appears to have strong internal consistency and very good test-retest reliability. At the same time this short form also has the warning that it cannot compare with the full length test, when individual scores are important and the testing is needed to make decisions about someone's future, as misclassifications are too numerous to ignore (Axelrod & Paolo, 1998). Thus it appears, that while this short form has very good validity and reliability it still cannot be seen as a replacement for the full test and thus it is not surprising that clinicians would rather choose a shorter short form than this one, if both only yield limited estimates of Full Scale IQ.

Another consideration with short forms which is not often mentioned is that while the overall correlation between the IQ and the estimated IQ are very high, the maximum error (or bandwidth) on some can be quite substantial, as high as 30 points and thus lead to misclassifications (McCusker, 1994; Ward & Ryan, 1997). The maximum error is the largest discrepancy found

between an estimated score from a short form and the actual score from the full length test. This type of discrepancy can be substantial and should also be a consideration in short form selection when the individual's score is important. Some research even goes as far as saying that the full test should always be administered when important decisions will be based on the scores or an individual classified accordingly (Boone, 1991; McCusker, 1994; Ward & Ryan, 1997). Silverstein (1985) however warns that a difference of one point can lead to a different classification category, whereas a difference of 19 points can lead to no difference of classification category. Thus these considerations should be based on point differences and not on differences in classification category.

Another consideration with short form selection is that generally the research indicates that those short forms that contain more subtests are more valid and reliable than those that contain less subtests. Thus it should be considered to rather choose a few more subtests, which have a shorter administration time, rather than fewer subtests, which have a longer administration time. Thus the actual time which a short form takes to complete should also be considered, rather than just comparing all those which have four subtests in them with each other. A more accurate comparison would be between all those that take about 20 minutes to administer, some may then consist of three subtests, others of six. Comparing short forms in this way Kaufman, Ishikuma and Kaufman-Packer's (1991) short forms performed amongst the best in their groups (Ward & Ryan, 1996; Ward. Selby & Clark, 1987).

Taking all these criteria into account when attempting to choose a particular short form is impossible, as the criteria are just too numerous and would lead to contradictory results. In most cases it has been found that all short forms containing four or five subtests have acceptable levels of reliability and validity and adding more subtests does not substantially reduce the amount of

error of the short form (Coetzee & Madge, 1982). Thus when choosing which short form to use in a particular situation one should probably be guided most by the purpose of an assessment and the reason for the assessment (J. Zhu, personal communication, April 2000)

2.2.1.1 Subtest Reduction Short Forms for the WAIS-III

The WAIS-III with its optional subtests usually takes three hours to complete, but can take up to seven hours, with intelligent and meticulous people. Thus while this test is comprehensive and thorough it can also be laborious and time consuming. As with the WAIS and WAIS-R there is a need to examine ways of abbreviating the test, so as to have a tool which allows for a briefer screening, while still trying to retain as much of the information as the whole test can yield, as was discussed previously. Some of the short forms developed for the WAIS have also been applicable to the WAIS-R. However, looking at a comparison of scores where individuals had completed both the WAIS and WAIS-R, significant differences were found on Block Design and Similarities (Culcross & Lakshmanan, 1998). Thus indicating that there are significant differences between the subtests of the two versions. Each test that is developed has its own statistical properties and thus the development of short forms is dependent on the particular test. Thus while it is interesting and important to look at the development of the short forms for the WAIS and WAIS-R, these should only be considered as ideas and pointers for the potential development of a short form for the WAIS-III, particularly seeing that it has three new sub-tests to consider and potentially use in short forms. The WAIS-III manual states that most previously suggested short forms should be validated on the WAIS-III before being used on its subtests (Wechsler, 1997). The development of a short form does not appear to have been part of the standardisation process in America, although an abbreviated version has been published by the Psychological Corporation.

For the WAIS-III the Psychological Corporation (Psychological Corporation, 2000) has actually published an official short form called the *Wechsler Abbreviated Scale of Intelligence (WASI)* for people between 6 and 89 years of age. It consists of a two subtest version and a four subtest version. The *two subtest version* can be administered in about 15 minutes and consists of a *Vocabulary and Matrix Reasoning* subtest. This provides an estimate of Full Scale IQ only. The *four subtest* version can be administered in about 30 minutes and yields an estimate of Full Scale IQ, as well as Performance IQ and Verbal IQ. The subtests used are *Matrix Reasoning, Block Design, Vocabulary and Similarities.* The inclusion of these subtests is to give a range of abilities measured, with Matrix Reasoning testing non-verbal fluid abilities, Block Design assessing visuo-motor skill and co-ordination, and Vocabulary and Similarities assessing crystallised abilities (Psychological Corporation, 2000). These are also the subtests which correlated most highly with Full Scale IQ for the American standardisation, showing strong associations to general cognitive abilities and reflecting the split of the subtests into Verbal and Performance, as well as fluid and crystallised abilities (J. Zhu, WASI Project Director, personal communication, April 2000).

The innovation of this short form is that the items are parallel to those of the Wechsler Intelligence Scale for Children - 3rd Edition (WISC-III) and the Wechsler Adult Intelligence Scale - 3rd Edition (WAIS-III), but are different and new. Thus the subtests have the same type of items, but the actual content is different. The subtests of this short form can be seen as a type of parallel form of the subtests of the WAIS-III and WISC-III. The short form has also been standardised nationally in America, adding to its validity. The short form is also linked to the WISC-III and the WAIS-III, thus testing both adults and children and necessitating the extension of the range of the items. Thus the Block Design subtest consists of 13 2-dimensional patterns, which are modelled or printed. The Matrix Reasoning subtest is modelled on that in the WAIS-III

(WISC-III does not have a Matrix Reasoning subtest). The Similarity and Vocabulary subtest include low end picture items, in this way extending the floor of these test (Psychological Corporation, 2000).

This new short form idea appears to be new and innovative, but as yet the extent of its usage is not clear. Other studies on short form of the WAIS-III are emerging slowly as people have had time to administer the test. One approach is that researchers will validate previously suggested short forms for the WAIS-III. Thus Pilgrim, Meyers, Bayless and Whetstone (1999) validated the Ward (1990) seven subtest short form for the WAIS-III and found that the obtained correlations for Full Scale IQ, Verbal IQ and Performance IQ were high and suggested that this short form can continue to be used with the WAIS-III. This approach allows for some comparison of results between WAIS-R and WAIS-III short forms, but ignores the different statistical properties of the WAIS-III, as well as the introduction of the new subtests and the potential additional information with which these can enhance the information provided by a short form.

2.2.1.2 Short Forms in South Africa

Coetzee and Madge (1981) appear to have conducted the only South African study into short forms. They used a psychiatric sample of English and Afrikaans speaking males and females, aged 18-55. They looked at which combination of subtests from the SA-WAIS would be good short form suggestions. As the Vocabulary subtest is generally omitted from the administration of the SA-WAIS, they did not include this subtest in their research either. They used regression analyses to arrive at various suggestions for the different age, gender and language groups. They then calculated the validity of the short forms derived in this way, according to a formula suggested by McNemar (1950). For a *dyad* they suggested *Similarities and Block Design*. For a *triad* they suggested that *Picture Completion* be added, while for a *tetrad*, they added *Arithmetic*. For a six

subtest short form they felt that any combination of three verbal and three performance subtests would yield good results. They also warned that using a dyad for IQ estimation will contain large error margins and should be avoided except in special circumstances. They suggest that using four or five subtests will optimise the balance between time saving and error margin. Adding more subtests beyond this will not add significantly to the accuracy of the prediction or decrease the error of estimate substantially (Coetzee & Madge, 1981). It appears that these short form suggestions have not been further validated or researched in South Africa. The sample used by Coetzee and Madge (1981) was very limited, and no information is available as to the level of education these participants had achieved, thus the results should be viewed very cautiously when considering a broader South African population.

While no further research has been conducted into short forms in South Africa, use has widely been made of various short forms based on WAIS and WAIS-R research, personal preference or specific needs. Thus with the introduction of the WAIS-III into South Africa and the standardisation of this instrument for the local population and circumstances, we can make reference to short forms which consider developments world-wide, at the same time taking due cognisance of the specific need and conditions in the South African context.

2.2.2 Subtest Reduction Short Forms, Race, Language and Education

Performance on the Wechsler tests is known to be different for various subgroups, particularly according to culture, but also according to occupation, language and education level (Insua, 1983; Manly et al. 1998; Matarazzo & Herman, 1984; Ogden & McFarlane-Nathan, 1997; Paolo, Ryan, Ward & Hilmer, 1996; Zindi, 1994). Thus with the development of the short forms these factors should also be looked at, as these significant relationships also extend to performance on the specific subtests. Thus the combination of subtests in a particular short form should be considered in the light of these differences.

On the WAIS and WAIS-R it has been found that whites do better than blacks on the tests overall (Kaufman, McLean & Reynolds, 1988). They also outperform blacks on the Verbal and Performance scales, as well as on the individual subtests. Vocabulary specifically has been associated most with differences according to race, followed by Block Design (Paolo, Ryan, Ward & Hilmer, 1996). After these Arithmetic, Comprehension and Information also show significant differences according to race. The subtests which appear to be least discriminating between races are Digit Span, Picture Arrangement and Digit Symbol (Kaufman, McLean & Reynolds, 1988).

While these differences appear to support a notion of racial difference and racial inferiority, these results have convincingly been linked to cultural and language differences (Manly et al., 1998; Ogden & McFarlane-Nathan, 1997). Thus those tests which require verbal skills and rely on culturally biased general knowledge are the ones to bias non-European non-westernised individuals most. In a study comparing Maori men with the USA norms, on some WAIS-R subtests, the Maori men performed about 1 SD below the norm for Vocabulary (Ogden & McFarlane-Nathan, 1997). Manly et al. (1998) also found that with black Americans those who were most acculturated to westernised white American culture did not perform differently from the norms. On the other hand those who were less acculturated performed at a much lower level on Information and Vocabulary. Block Design was also linked to acculturation in her study. Interestingly in Ogden & McFarlane-Nathan's (1997) study the Maori men performed at about 1 SD above the norm for Block Design. Thus Block Design appears to vary considerably in either direction across various cultures. With both studies Digit Span and other tests linked to attention span and mental tracking were not found to vary, between Maori and USA norms (Ogden & McFarlane-Nathan, 1997) or between more or less acculturated black Americans. These findings were in support of earlier findings which found Argentineans performed significantly lower on Vocabulary, Arithmetic, Similarities and Digit Symbol, but not on Block Design (Insua, 1983).

Completion in their dyad, with Digit Span in their triad and a tetrad of Picture Completion, Digit Symbol, Similarities and Arithmetic. Thus they avoid using Vocabulary, Comprehension and Block Design, which are considered more biased. Ward (1990) uses Information, Digit Span, Arithmetic, Similarities, Picture Completion, Block Design and Digit Symbol for his seven subtest short form. Although including Block Design, Ward avoids Vocabulary and Comprehension, and through using so many subtests the degree of discrimination caused by Block Design is lessened as the overall results are closer to the actual Full Scale IQ, than with a shorter short form. Thus short forms which use Vocabulary and Block Design should be avoided in multi-racial settings (Kaufman, Reynolds & McLean, 1988; Paolo, Ryan, Ward & Hilmer, 1996). Thus Silverstein's (1991) dyad of Vocabulary and Block Design and his tetrad of Vocabulary, Block Design, Arithmetic and Picture Completion are considered to discriminate. Reynolds, Wilson and Clark's (1983) tetrad of Information, Arithmetic, Picture Completion and Block Design also discriminate according to race. Although differences were found on these short forms they were smaller than expected and thus not entirely condemning of the short forms as such (Paolo, Ryan, Ward & Hilmer, 1996).

Finally, from the data which was collected for the present study on the WAIS-III in a South African population, but used in separate analyses (see methodology) the following important findings emerge. When looking at this data in terms of first language (comparing the performance educationally privileged African First Language speakers with educationally privileged English First Language speakers both completing the WAIS-III in English) it was found that the subtests Picture Completion, Vocabulary, Block Design, Symbol Search and Object Assembly show significant differences, with the English First Language group obtaining better scores throughout.

Considering this same data from the point of view of quality of education (comparing African First Language speakers who had a good quality of schooling i.e. Private/Model C, to those who had a lower quality of schooling, i.e. DET) the following emerges. The group who had Private or Model C schooling perform significantly better on all the WAIS-III subtests, except on Block Design which shows no significant differences. When further dividing this African First Language group into subgroups who have a degree and those that do not, these differences are refined. When comparing groups who only have a matric (12 years of education), but have either had Private/Model C or DET schooling, it emerges that all the subtests except Block Design, Object Assembly, Information and Letter-Number Sequencing are significantly different, with the Private/Model C group performing better. Looking at the group who have a degree and again comparing a group having had Private/Model C schooling with those who have had DET schooling, far fewer subtests are significant. Vocabulary, Information, Picture Arrangement, Comprehension and Symbol Search are now the only subtests on which the Private/Model C group perform significantly better on (Kemp, 2000).

These results suggest that using the WAIS-III is very problematic for English Second Language users, who have had a low quality of schooling (DET) and only have a matric level of education. However with English Second Language users who have had a privileged schooling (Private/Model C) or who have attained a degree the test as a whole is less problematic. Despite this certain subtests should be approached with extreme caution when considering their inclusion in a subtest reduction short form due to the bias they will have against certain groups. The subtests to be viewed with caution are: Vocabulary, Picture Completion, Block Design, Symbol Search, Object Assembly, Information and Comprehension.

2.2.3 Item Reduction Method Short Forms

Paul Satz and Steve Mogel (1962) suggested a different method for the abbreviation of the Wechsler scales (the WAIS in this case). They argue that the subtest reduction method is limited to research usage or as a quick screening tool, due to the method's emphasis on the single IQ indicator. They state that the breadth of performance which the full test gives is lost in this method. They refer to the research of Wolfson and Bachelis (1960, in Satz & Mogel, 1962), who had attempted to abbreviate all the verbal subtests, but did not do the same for the performance subtests. They had also not looked at the correlation of each subtest to the abbreviated subtest. Thus Satz and Mogel attempted to do this for all the subtests and in this way achieve a short form. Thus for Information, Vocabulary and Picture Completion they only scored every third item. For Comprehension, Arithmetic, Similarities, Block Design, Picture Arrangement and Object Assembly they scored only the odd items. Digit Span and Digit Symbol were scored in their entirety. These abbreviated subtests correlated with their respective subtest totals at a level between .84 and .97. The thus estimated IQ's correlated with the Performance IQ at .97, the Verbal IQ at .99 and the Full Scale IQ at .99 (Satz & Mogel, 1962). Thus an abbreviation was accomplished which appeared to retain the breadth of the full IQ test (Adams, Smigielski & Jenkins, 1984; Cella, 1984; Satz & Mogel, 1962), and reduced the administration time by about half (Goebel & Satz, 1975). Silverstein (1968) modified the Satz-Mogel abbreviation to one where all the odd items were administered except for Digit Span and Digit Symbol. This alternative approach received some support for the WAIS and WAIS-R (Edinger, Shipley & Watkins, 1986; Tipton & Stroud, 1973), but does not seem to have replaced the original Satz-Mogel abbreviation, which uses less items in total.

In an attempt to validate their abbreviation Mogel and Satz (1963) used a test-retest method. Many short forms are worked out and validated from the rescored protocols of a complete test administration and it is assumed that the testee would perform the same, whether the items are embedded in the whole test or are given alone. Mogel and Satz (1963) used patients who had previously been administered the full WAIS and now only administered the item reduced short form, with a control group who had the full WAIS administered on two occasions. They found very comparable results, thus further indicating that this abbreviation is valid. Estes (1963) also validated the Satz-Mogel short form on a population with superior IQ's.

Various other studies have been done to validate the item reduction method, normally known as the Satz-Mogel, all the studies found high correlations with the Full Scale IQ, Verbal IQ and Performance IQ (Adams, Kobos & Preston, 1977; Edinger, Shipley & Watkins, 1986; Goebel and Satz, 1975; Holmes, Armstrong, Johnson & Ries, 1966; Quattlebaum & White, 1969; Watkins & Kinzie, 1970). They also found almost no difference between the short form and the Full Scale IQ according to racial-ethnic groups or age groups (Adams, Kobos & Preston, 1977; Resnick & Entin, 1971). This is due to the possibly biasing subtests being represented in the same proportion as in the entire test. Thus this type of short form will contain the same amount and kind of bias as the entire test. Looking at various IQ ranges they found that for the upper range of 110 to 129 the abbreviation does not offer an adequate estimate. In contradiction Marsh (1973) found that the correlation was higher for those patients with IQ's of 110 plus.

However the Satz-Mogel abbreviation has also come under rather severe criticism from several studies, despite the overall correlation being high. Several studies indicate that the variance between the subtests was increased and exaggerated. Also the pattern of subtest scatter was

changed, thus making the interpretation of this scatter problematic (Edinger, Shipley & Watkins, 1986; Holmes, Armstrong, Johnson & Ries, 1966; Marsh, 1973; Watkins & Kinzie, 1970). All the studies point out that the overall correlation is good, but the scatter is increased and thus the profiles are reduced in their validity. Thus the very reason for this type of abbreviation is questioned (Watkins & Kinzie, 1970) and it is suggested that the interpretation of the scatter is not valid. The discrepancies seem to be largest on the Information, Comprehension, Picture Completion and Picture Arrangement subtests (Marsh, 1973).

The problem with an altered subtest scatter pattern is not a concern when using a subtest reduction method, as those subtests which are applied would have the same results as on the entire test and thus the scatter between these subtests would be the same whether they were part of the short form or part of the entire test. The item reduction method of abbreviation also does not appear to be that popular with clinicians, as it may reduce the actual administration time, but does not really reduce the number of subtests or reduce the scoring time in a significant way.

An item reduction short form has, to the author's knowledge never been used or advocated in a South African setting and thus no research exists in this regard. In terms of an item reduction short form for the WAIS-III Ryan, Lopez and Werth (1999) have attempted to validate a Satz-Mogel type short form of the WAIS-III and have found that the overall estimation of Full Scale IQ is very high. At the same time t-tests revealed significant differences for some of the abbreviated subtests, thus making the interpretation of scatter, and subtest strengths and weaknesses problematic. They suggest that this type of short form can be used, but only for an estimate of Full Scale IQ and not for further interpretation.

2.2.4 Subtest vs. Item Reduction Short forms

When comparing the subtest reduction technique and the item reduction technique of deriving short forms, both methods generally deliver significant and large correlations for Full Scale IQ. However the item reduction technique, while showing high correlation for the respective subtests, does show significant differences when t-test analyses are done (Boone, 1991; Edinger, Shipley & Watkins, 1986). This indicates more clearly that the original pattern of inter-subtest scatter is not reproduced (Cella, Jacobsen & Hymowitz, 1985). This difference cannot be ignored as there is already a high degree of subtest unreliability for the WAIS-III subtests (Wechsler, 1997). Thus it is strongly recommended that when relative strengths and weaknesses are important and the subtest scatter is to be looked at, the full test should be administered (Boone, 1991; Dining & Kraft, 1983).

Thus the main reason for the item reduction technique does not hold, as the only information that is reliably achieved is the Full Scale IQ. In this case the subtest reduction technique appears to hold many advantages. Even when using the relatively long seven subtest short form of Ward (1990) the saving of time is more considerable than with the item-reduction technique. The administration time is shorter and the scoring time is also substantially reduced. The ease of administration and scoring should also be considered, as well as the potential to make clerical and mechanical errors; for example in scoring, adding or converting raw to scaled scores. The potential errors of this nature are much less with the subtest reduction method. The effort and time a clinician needs to concentrate on which items to skip and the additional calculations on the Satz-Mogel type short form also make this a less attractive option (Boone, 1991). A final consideration is that when a subtest reduction short form has been administered, the rest of the

subtests can still be administered with relative ease, if more than an estimate is required. This would be a more problematic prospect with a Satz-Mogel short form (Boone, 1991).

In general it appears that the subtest reduction type of short form dominates the arena of short forms, while the item reduction type is less commonly advocated.

2.3 The Present Study

The focus of the present research is the development of a WAIS-III short form for use in South Africa. Short form development is not part of the HSRC standardisation and thus this research aims to make suggestions in this area. A subtest reduction short form will be derived via validity and reliability calculations, considerations of subtest bias and the validation of short forms suggested for previous Wechsler tests. An item reduction short form will also be considered. The stratification of the sample in this study, according to quality of schooling, level of education and first language will be used to assess which short forms can be used for various subgroups without prejudice.

CHAPTER THREE: METHODOLOGY

3.1 Participants

This study forms part of a larger research project conducted by four Clinical Psychology Masters Students at Rhodes University, under the supervision of Prof. A.B. Edwards, Clinical Neuropsychologist. The participants were selected to accommodate the following analyses:

1) *Language*: The differential effects of first language on the overall performance of the WAIS-III and on the various subtests (Hartman, 2000).
2) *Gender*: The differential effects of gender on the overall performance of the WAIS-III and on the various subtests (Muirhead, 2000).
3) *SES, Education Level and Schooling Type*: The differential effects of socio-economic status, levels of education and types of schooling on the overall performance on the WAIS-III and the various subtests (Kemp, 2000).
4) *Short Form*: The development of a short form for the WAIS-III appropriate to the South African context, particularly in terms of first language, type of schooling and level of education.

This thesis is concerned with the fourth option which comprises the development of a WAIS-III short form. The methodological details relevant to this particular research will be focused on, while those relevant to the other analyses will only be mentioned briefly.

The participants were selected in such a way as to make all four of the above analyses possible. While the participant numbers in each cell are small, these individual cells were not used for any of the analyses, as the cells were collapsed depending on the analysis being conducted. Thus the

analyses for this thesis compared the participants on the basis of First Language (40 vs. 28 participants), Level of Education (34 vs. 34 participants) and Type of Schooling (48 vs. 20 participants). In this way the participants being compared in each analysis were large enough for the statistical procedures used and larger than this table would suggest. Table 3.1.1, below presents the participant numbers, according to the various subgroups.

Table 3.1.1: Participant Numbers According to Category (N = 68)

	Matric		Three Year Degree Plus	
	Female	Male	Female	Male
African First Language – DET School Education	5	5	5	5
African First Language – Private/Model C School Education	5	5	5	5
English First Language – Private/Model C School Education	7	7	7	7

The participants comprised 68 volunteers, who were selected according to four dimensions:

1) *First language* - 40 participants were African first language speakers (30 Xhosa, 10 Other African Language) and 28 participants were English first language speakers. Potential participants were asked what they considered to be their first or home language (i.e. what they spoke at home most of the time) and placed in either category accordingly.

2) *Type of Schooling* - the above groups were further subdivided so that half the African language subgroup had received at least four years of their high schooling at a private or former Model C, Department of Education school and the other half received Department of Education and Training (DET) schooling. The English first language speakers had all gone to private or former Model C schools. Here again, potential participants were asked from which school they had matriculated and then also for how long they had been at that type of school. They were placed into the 'Private/Model C' category if they had matriculated from and been to a Private or Model C school for 4 years. This group were considered to have received a

better quality of schooling (Kallaway, 1984). Similarly participants were placed in the 'DET' category if they had matriculated from and been to a DET school for at least 4 years of their high school, and they were considered to have had a less privileged and of lesser quality type of education (Kallaway, 1984).

3) *Level of Education* - the groups were stratified so that half the participants had completed matric, but had not obtained a university degree or equivalent (average years of education = 12.47, SD = 0.56). The other half had completed at least a three year university degree (average years of education = 16.53, SD = 1.35). The years of education were allocated according to the level of education achieved and not according to actual years of study. Thus a Matric was recorded as 12 years, a degree as 15 years, an honours degree as 16 years and a masters degree as 18 years.
4) *Gender* - the sample was divided equally between male and female participants.

The participants were all between 19 and 30 years of age (Average age = 24.06, SD = 2.95). The age range was restricted to just over a decade, in this way restricting the effects of ageing. Thus the participants would be adults and thus no longer subject to the natural growth of childhood, at the same time they would not yet be subject to the natural decline of later adulthood (Anastasi, 1968). This age range was also chosen so as to be similar to that of the experimental group of the HSRC standardisation, thus allowing our results to be comparable to the results of their study.

The participants were all working or studying in the medium of English and thus a certain level of fluency and competency in English was assumed, allowing for the administration of the WAIS-III in English. Here the self report of the potential participants was relied upon. Their basic competency was confirmed during the initial contact, when their willingness to participate in the study was established.

In order to control for other variables which could negatively influence the participants' performance on the tests, potential participants were excluded who had sustained a head injury, had a history of learning disability, neurological disorder or psychiatric disorder. No completed protocols were excluded on this basis and of the potential participants approached none were excluded on this basis.

Table 3.1.2, below gives a summary of the participants' demographic data.

Table 3.1.2: Participant's Age, Years of Education and Full Scale IQ (N=68)

	Number	Mean	Minimum	Maximum	SD
Age	68	24.06	19.00	30.00	2.95
Years of Education	68	14.50	12.00	20.00	2.29
FSIQ	68	103.53	63.00	135.00	18.47

From the above it can be seen that the mean age of the sample is 24.06 years, the mean years of education 14.5 years and the mean Full Scale IQ is 103.53. This data is shown according to First Language, Level of Education and Type of Schooling in Tables 3.1.3 and 3.1.4, below. The data is not further divided according to gender, as this particular study will not be investigating gender differences in its analysis. Gender has not been considered in any of the research on previous short forms. While gender differences have been found on the WAIS-III subtests, these have decreased over time with greater educational equivalence across genders, indicating that these may soon no longer be an issue to consider (Muirhead, 2000).

Table 3.1.3: Participant's Mean Age in Years (N=68)

	Matric		Graduate	
	Mean	SD	Mean	SD
DET, African 1st Language	25.60	3.86	27.40	3.86
Private/Model C, African 1st Language	21.40	1.58	24.00	2.79
Private/Model C, English 1st Language	23.64	2.41	22.93	1.33

Table 3.1.4: Participant's Years Of Education (N=68)

	Matric		Graduate	
	Mean	SD	Mean	SD
DET, African 1st Language	12.20	0.42	16.50	1.58
Private/Model C, African 1st Language	12.60	0.70	16.30	1.16
Private/Model C, English 1st Language	12.57	0.51	16.71	1.38

There are some differences to be seen according to age across the categories, with the African First Language, DET group being slightly older than the other groups. However due to the age range being restricted to just over one decade, these differences are not considered to have contributed to the results in any way. In terms of years of education, the Graduate group are all very similar and the Matric groups are all very similar as well.

3.2 Test Materials

The following material was used during the testing: Initial Contact Sheet (Appendix B), Answer (Appendix C) and Response Booklets (Appendix D), Instruction Sheets (Appendix E), WAIS-III test materials and a Scoring Sheet (Appendix F). The Answer and Response Booklets contained a section of demographic questions, an informed consent, a section for WAIS-III test answers, a language proficiency test and a socio-economic questionnaire. For clarity the test material will be considered in more detail in terms of these subgroups, rather than in the way they were grouped together in the booklets.

3.2.1 Initial Contact Sheet (Appendix B)

This page of information was completed when contact was made with potential participants to ensure that they met all the requirements of the research. Thus their age, gender, type of education, level of education and home language were enquired about. This sheet also contained the exclusionary questions pertaining to potential participants having sustained a head injury, having a history of a learning, neurological or psychiatric disorder. At the end of this questionnaire a time and a place for the testing was recorded.

3.2.2 Informed Consent (Appendix D)

The participants were asked to sign the informed consent form which gave some background to intelligence testing in South Africa, outlined the nature of the research being conducted and assured the participants of the confidentiality of the information provided and the test results.

3.2.3 Demographic Questionnaire (Appendix C)

The demographic questionnaire provided information on the participants' age, gender, home language, type of schooling received, level of education, matric symbol, whether they attained a matric exemption and what they have been doing since leaving school. This information again verified that the participants met the necessary category requirements and formed the introduction to the testing.

3.2.4 Socio-Economic Questionnaire (Appendix C)

The socio-economic questionnaire was designed to assess the socio-economic status of the participants and their families. It also enquired about the nature of facilities available to the participants in their homes at various stages of their life. The information gathered from this will not form part of the analysis of this thesis and thus the questionnaire will not be discussed in more detail.

3.2.5 Language Proficiency Test (Appendix D)

The language proficiency test measured the level of the participants' competency in the English language, through a series of multiple choice questions. This test was also used by the HSRC in their standardisation to assess English language competency. The information gathered from this test will not form part of the analysis of this thesis and thus will not be discussed in more detail.

3.2.6 WAIS-III (including Answer and Response Booklets, Instructions and test material)

The WAIS-III was administered to each participant, including the optional subtests and additions to subtests as outlined in the WAIS-III manual. (Digit Symbol Incidental Recall and Copy, Symbol Search, Letter-Number Sequencing and Object Assembly). This comprehensive administration was carried out to allow for the use of these protocols for other later analyses and comparison to the American norms. For the wording of the questions on the Arithmetic subtest, the HSRC's version was used, as these had been altered so as to have Rands and Cents, instead of Dollars and Cents. These wording changes are not considered to interfere substantially with a potential comparison to the American standardisation and other international research.

Additional items were also administered on the Vocabulary, Information and Comprehension subtests. These additional items were devised for the South African standardisation by the HSRC, as possible replacements for items that are not applicable to a South African context. Ten additional words were added to the Vocabulary subtest, twelve questions to Information and seven to Comprehension. These additions were used, allowing the protocols to be scored according to the American norms, at the same time yielding the additional information that would allow them to be rescored according to the South African standardisation. To accommodate these changes the Answer (Appendix C) and Response (Appendix D) Booklets were slightly altered for the purposes of this research. The Instructions (Appendix E) were also typed out for ease of use, including the additional item instructions and the changed South African wording where appropriate. For the performance subtests the WAIS-III test materials were used.

3.2.7 Scoring Sheet (Appendix F)

The scoring sheet allowed for the noting of the raw scores of each subtest and the conversion of these into scaled scores. It also allowed for the calculation of the various IQ and Index scores.

There is also a space for the recording of additional information not used in the calculation of the IQ and Index scores, for example the Digit Symbol incidental learning and copy task score. This sheet provides an overview of each participant's performance on the test as a whole.

3.3 Procedure

The research team consisted of four Clinical Psychology masters students, who were all trained and experienced in the administration of psychometric tests. The preliminary questionnaire and socio-economic questionnaire were drawn up by the research team in consultation with their supervisor and administered in a standardised way by all the researchers. The standardised instructions from the WAIS-III test manual were used throughout the administration of this test.

The testing of the participants took place between 10 September 1999 and 21 February 2000. The participants were mainly from the Eastern Cape, with two participants from the Western Cape and one from Gauteng. Contact was made with potential participants through personal contacts of the researchers, various tertiary educational institutions, schools and places of employment. Potential participants were generally contacted telephonically by one of the researchers to establish if they did indeed fulfil all the category requirements and none of the exclusion criteria applied. They were then given some background information on the research and their willingness to participate in the research was established. The sample was thus a convenience sample, which is not considered to be a problem in this type research, as potential confounding variables were controlled for (Gold, 1984: Jensen, 1980).

During the initial telephonic contact the Initial Contact Sheet was completed (Appendix B) and a time and place arranged for the testing to take place. This was usually a quiet room in the researcher's home or an office at the Rhodes Psychology Clinic. The time of the testing varied according to the availability of the participants and researchers, but most frequently occurred

in the late afternoon and evening after work hours. While this time was not considered ideal due to fatigue and concentration levels, this variable effected most participants from all groups and thus is not considered to be a confounding factor on the results.

The participants had the nature of the testing explained to them, were given an opportunity to ask questions before the testing began and during the testing if required. They were also required to sign an informed consent form, outlining the nature of the research and the confidentially of the results. Three hours were set aside for each participant, although if it became clear that the testing would take substantially longer than this, options for the completion at another time were discussed with the participant. It was attempted to put the participants at ease as much as possible, as anxiety can negatively effect test performance (Lezak, 1995). During the testing a break was usually taken about half way through the protocol, usually after the Matrix Reasoning subtest. The participants were given general feedback on the testing if they so desired.

3.4 Data Processing

The protocols were marked after meetings of the research team to discuss potential problems and to ensure consensus in the marking of certain items. The additional items suggested by the HSRC for the Vocabulary, Information and Comprehension subtests, which are possible South African replacements, were not marked or used to replace other items in the scoring of the protocols. The final marking criteria and which items were to be replaced on the final South African test were not available from the HSRC at this point in time and thus the protocols were marked and scored according to the American standardisation criteria only.

The raw scores for each subtest were entered into the scoring sheet and then converted to a scaled score again according to the American norms. These scale scores were then used to calculate the raw score totals for the Verbal IQ, Performance IQ, Full Scale IQ, Verbal

Comprehension Index, Perceptual Organisation Index, Working Memory Index and the Processing Speed Index, which were then again converted into the scaled IQ or index scores, according to the tables provided in the WAIS-III manual and again based on the American standardisation. The workings for these conversions was done on the scoring sheet (Appendix F).

The data were then captured onto a comprehensive spreadsheet. In order to avoid scorer errors and increase scorer reliability, the computer programme was used to calculate the totals and subtotals used to arrive at the overall IQ and index scores. In this way the data entry was cross-checked and errors corrected as they were found. The demographic data and the results of the socio-economic questionnaire and language proficiency test were also captured onto this spreadsheet. The data on the spreadsheet were then used by each of the four researchers for their specific research areas.

3.5 Statistical Procedure

The data were analysed in several ways with the aim of developing a short form appropriate to South Africa. The analyses were done (i) on the entire sample (N=68), and in most cases on the sample broken down according to the following variables:

(ii) Type of Schooling: Private/Model C (N=48) versus DET (N=20)
(iii) First Language: English (N=28) versus African (N=40)
(iv) Level of Education: Graduate (N=34) versus Matric (N=34)

1. *Correlations* were performed between the WAIS-III subtests, the IQ scales and factor indexes, for the entire sample and for each of the subgroups as described above. These interrcorrelations indicate the statistical similarity between this sample's performance on the test to that of the American standardisation sample. It also indicates how subtests correlated with a particular scale or index and thus which subtests can be considered the best indicators of a particular scale or index.

2. The *normality* of the subtests' scores were calculated with the Kolmogorov-Smirnov test procedure, to ensure that these had performed as would be expected in this sample. The *reliabilities* of the subtests were also calculated to ascertain the similarity of these reliabilities to the American standardisation and for use in the reliability and validity calculations for potential subtest reduction short forms. The reliabilities were calculated from a single administration using a split-half method (except for Digit Symbol and Symbol Search, as these are speeded tests). The subtest items were divided by an odd-even split to form two half-tests. The reliability of the entire subtest was then calculated by correlating the total scores of the two half-tests, corrected by the Spearman-Brown formula. As Digit Symbol and Symbol Search are speeded, split-half coefficients are not the correct estimate of reliability. Reliability for these subtests should normally be calculated by a test-retest method, which was not done in this study. The use of the American standardisation sample reliability scores will be considered for these, if the reliabilities are found to be comparable on the other subtests. The subtests' normality and reliability was only calculated for the entire sample.

3. *Dyads* were considered as these would give a very brief estimate of IQ and then a possible tetrad could be built on these. The dyad options to be considered were made up of all those subtests which formally contribute to the Full Scale IQ, thus Letter-Number Sequencing, Symbol Search and Object Assembly were excluded as options for the short forms as their results are not normally used when calculating Full Scale IQ. All possible dyads consisting of one verbal and one performance subtest were considered. The reliability and validity for each of these options was calculated according to the formulae suggested by Tellegen and Briggs (1976), as outlined in Section 2.2.1 (p.20) and an average of both used to rank order the options. The calculations were first completed on the entire sample and then for the sample divided according to quality of schooling, first language and level of education achieved.

4. *Tetrads* were developed using the best ranked dyad as the basis. Tetrads were decided on as these would reflect the verbal - performance split of the WAIS-III, and because four or five subtest short forms have been found to maximise the balance between time saving and level of error (Coetzee & Madge, 1981). To the best dyad found in step 3 a further verbal and a further performance subtest were added. All the possible tetrad combinations achieved in this way had their reliability and validity calculated, again using the formulae suggested by Tellegen and Briggs (1976) and rank ordered according to the average of these.

5. *Previous short forms* suggested for the WAIS-R and SA-WAIS and discussed in the literature review were considered as possible short form options for the WAIS-III. Although the focus here is on dyad and tetrad short form options, the other options which were highlighted in the literature were also used here for the sake of completeness. The short forms' reliability and validity were calculated and an average of the two arrived at. The suggested short forms were also modified to see how the replacement of one of the performance subtests with Matrix Reasoning would effect the reliability and validity. This was done as Matrix Reasoning was the new subtest which contributed to the Full Scale IQ and which the literature had indicated as being culture fair.

6. In this section each *subtest's contribution to Full Scale IQ* was examined more closely. A paired t-test for dependent samples was performed between the subtest means and an adapted mean of the Full Scale IQ. This adapted mean of the Full Scale IQ was arrived at by using the sum of the subtest scaled scores which make up the Full Scale IQ and dividing this by 11, in this way making the Full Scale IQ mean comparable to the subtest's mean. Considering that each subtest *should* have a mean=10 and a SD=3, this comparison shows where this sample differs from the American standardisation used to score the protocols, as well as showing

which individual subtests when used in a short form may under- or overestimate the Full Scale IQ. These t-tests were performed on the entire sample and each of the subgroups.

7. Finally, an *item reduction type short form* was considered as an option for the WAIS-III. For the subtests Picture Completion, Vocabulary, Matrix Reasoning and Information three options were considered. First all their odd items, then all their even items and lastly every third item was used and the resultant subtest score multiplied by two or three and then converted to scaled scores from the usual conversion tables in the manual. For the subtests Similarities, Block Design, Arithmetic, Picture Arrangement, Comprehension and Object Assembly only their odd and even item combinations were used, as the subtests were considered too short to only consider every third item. Digit Symbol, Digit Span, Symbol Search and Letter-Number Sequencing were not abbreviated, as they are not suitable to such an abbreviation. From the subtests' scaled scores the IQ scales and factor indexes were also calculated, either using all the odd, or all the even subtest options. For the third item options, the odd item scores were used on those subtests which did not have an every third item option. The resultant subtest scaled scores, IQ scale scores and factor indexes were then correlated with the actual scores as obtained on the entire test, to see how closely these abbreviation approximates the original score. Then t-tests were performed on the abbreviated scores and those of the entire test to ascertain if the difference scores between these are significant. This analysis was done on the entire sample only.

CHAPTER FOUR: RESULTS

The results are presented to show how the short form suggestions were derived and to indicate the preliminary analysis of the data before investigating the short form suggestions. Thus the results are presented in the following order: (1) the intercorrelations of the subtests, IQ scales and factor indexes, (2) calculated reliabilities and normality of the subtests, (3) validities and reliabilities of dyads options, (4) validity and reliability of tetrad options, (5) t-tests to establish the subtests' contribution to Full Scale IQ and their potential bias, (6) the validity and reliability of previously suggested short forms as applied to the WAIS-III and (7) an item reduction short form. The results for each of the above steps are presented (i) for the entire sample (N=68) and for steps 1, 3, 4, 5 and 6 above, these are broken down according to the following variables:

(ii) quality of schooling: Private (N=48) versus DET (N=20);

(iii) first language: English (N=28) versus African (N=40);

(iv) level of education: Graduate (N=34) versus Matric (N=34).

The abbreviations used in the results section are for the WAIS-III subtests, IQ scales and Factor indexes and appear in Table 2.2.2 on p. 18 or in Appendix A, p.120.

4.1 Intercorrelations of WAIS-III Subtests, IQ Scales, Factor Indexes

The results of the intercorrelations for the entire sample are presented in Table 4.1.1. p.54. These results are broken down into the various groups and presented as follows:

Private schooling :	Table 4.1.2	p. 55
DET schooling:	Table 4.1.3	p. 56
English first language:	Table 4.1.4	p. 57
African first language:	Table 4.1.5	p. 58
Graduate:	Table 4.1.6	p. 59
Matric:	Table 4.1.7	p. 60

Each table shows the correlations of each subtest with each of the other subtests and with the IQ scales and factor indexes. The intercorrelations of the subtests are shown in the upper left hand part of the table. The intercorrelations of the IQ scales and factor indexes are shown in the lower right hand part of each table. The intercorrelation of the subtests with the scales and factor indexes to which they contribute appear in the upper right hand portion of the table. The mean score and standard deviation (SD), for each subtest, scale and factor index is also shown at the very bottom of each table.

For the entire sample the subtests correlate with the Full Scale IQ at levels between 0.70 and 0.89, this being comparable with the American standardisation sample, where the subtests correlate at levels between 0.61 and 0.84 with the Full Scale IQ. The subtests contributing to Verbal IQ correlate with it at levels between 0.69 and 0.93, while for the American standardisation this was between 0.65 and 0.89. For the subtests contributing to Performance IQ the range is between 0.79 and 0.81, while the American standardisation varies between 0.76 and 0.79. For the Verbal Comprehension Index the range is between 0.90 and 0.94, for Perceptual Organisation it is 0.79 and 0.88, for Working Memory it is between 0.83 and 0.90 and for Processing Speed it is between 0.91 and 0.92. For the American standardisation sample the ranges are from 0.90 to 0.93, from 0.81 to 0.85, from 0.83 to 0.85 and from 0.91 to 0.91 respectively, making the results of this study very comparable to those of the American standardisation sample (Wechsler, 1997, p. 98, Technical Manual).

The pattern of intercorrelations between the subtests and their respective IQ scales and factor indexes is similar for each of the subgroups, although some of the correlation coefficients are noticeably lower, due to the smaller sample sizes. However all the intercorrelations between the subtests and their respective scales and factor indexes are significant at $p<0.01$.

TABLE 4.1.1: Intercorrelations and Mean Score of WAIS-III Subtest Scaled Scores, IQ Scales and Factor Indexes: Entire Sample (N=68)

	PC	V	DSY	S	BD	A	MR	DSP	I	PA	C	SS	LN	OA	VIQ	PIQ	FSIQ	VCI	POI	WMI	PSI
PC																.79	.71		.83		
V	.59														.93		.89	.94			
DSY	.56	.61														.81	.78				.91
S	.55	.77	.54												.80		.77	.90			
BD	.66	.56	.54	.50												.81	.73		.88		
A	.42	.60	.57	.46	.56										.76		.77			.84	
MR	.42	.53	.64	.43	.57	.67										.80	.74		.79		
DSP	.33	.56	.62	.29	.49	.66	.65								.69		.70			.90	
I	.54	.81	.55	.72	.55	.59	.46	.49							.88		.84	.91			
PA	.55	.71	.55	.58	.51	.55	.59	.49	.67							.80	.80				
C	.49	.79	.51	.73	.40	.46	.39	.43	.75	.62					.84		.77				
SS	.59	.62	.68	.44	.64	.59	.61	.58	.52	.56	.47										.92
LN	.35	.57	.53	.46	.46	.50	.51	.65	.51	.48	.49	.61								.83	
OA	.65	.62	.59	.58	.79	.52	.58	.44	.56	.63	.46	.68	.48								
VIQ	.58	.93	.69	.80	.61	.76	.63	.69	.88	.73	.84	.66	.65	.64		.80	.96	.95	.72	.81	.73
PIQ	.79	.74	.81	.64	.81	.69	.80	.63	.68	.80	.59	.77	.58	.81			.93	.75	.96	.74	.85
FSIQ	.71	.89	.78	.77	.73	.77	.74	.70	.84	.80	.77	.75	.66	.75					.86	.83	.82
VCI	.60	.94	.61	.90	.58	.60	.51	.48	.91	.71	.82	.58	.57	.63					.66	.63	.64
POI	.83	.65	.69	.58	.88	.66	.79	.58	.61	.65	.49	.73	.53	.80						.69	.77
WMI	.42	.67	.67	.46	.59	.84	.71	.90	.61	.58	.53	.69	.83	.56							.74
PSI	.63	.67	.91	.53	.64	.63	.67	.65	.58	.60	.52	.92	.62	.69							
MEAN	10.6	10.5	10.4	10.8	9.5	10.6	11.4	10.5	10.5	9.2	11.2	9.2	11.3	8.0	104.4	101.7	103.5	103.4	103.0	104.5	99.1
SD	3.5	4.2	3.0	3.4	3.1	3.2	3.6	3.38	3.30	3.57	3.34	3.05	3.10	3.12	17.9	17.9	18.5	18.8	17.4	16.9	15.2

TABLE 4.1.2: Intercorrelations and Mean Score of WAIS-III Subtest Scaled Scores, IQ Scales and Factor Indexes: Private Schooling Subgroup (N=48)

	PC	V	DSY	S	BD	A	MR	DSP	I	PA	C	SS	LN	OA	VIQ	PIQ	FSIQ	VCI	POI	WMI	PSI
PC																.68	.49		.74		
V	.35														.89		.81	.91			
DSY	.32	.31														.63	.58				.86
S	.23	.64	.19												.66		.58	.83			
BD	.56	.30	.25	.20												.73	.56		.84		
A	.17	.49	.45	.26	.40										.72		.74			.83	
MR	.12	.25	.40	.13	.33	.57										.66	.57		.65		
DSP	.11	.34	.45	-.03	.32	.61	.52								.57		.60			.87	
I	.27	.72	.31	.53	.31	.52	.20	.35							.83		.75	.86			
PA	.28	.50	.22	.31	.28	.40	.36	.28	.47							.64	.64				
C	.18	.72	.20	.59	.04	.30	.04	.21	.58	.36					.75		.61				
SS	.44	.43	.52	.15	.48	.41	.32	.41	.33	.26	.21					.61					.89
LN	.23	.51	.38	.36	.36	.41	.34	.51	.50	.31	.40	.57								.76	
OA	.50	.44	.42	.39	.70	.34	.35	.26	.34	.46	.18	.53	.38								
VIQ	.29	.89	.44	.66	.36	.72	.40	.57	.83	.52	.75	.46	.62	.44		.59	.93	.91	.46	.77	.51
PIQ	.68	.51	.63	.32	.73	.59	.66	.49	.46	.64	.24	.61	.50	.73			.85	.49	.93	.64	.70
FSIQ	.49	.81	.58	.58	.56	.74	.57	.60	.75	.64	.61	.58	.65	.62				.83	.72	.80	.66
VCI	.33	.91	.31	.83	.31	.48	.23	.25	.86	.50	.72	.36	.54	.44					.37	.50	.38
POI	.74	.39	.43	.25	.84	.53	.65	.42	.34	.41	.11	.56	.42	.69						.56	.57
WMI	.20	.53	.52	.22	.44	.83	.59	.87	.54	.39	.35	.57	.76	.39							
PSI	.44	.42	.86	.19	.42	.49	.41	.49	.37	.27	.23	.89	.55	.55							
MEAN	11.8	12.1	11.6	11.9	10.4	11.5	12.6	11.5	11.5	10.8	12.3	10.3	12.1	8.9	111.2	109.6	111.4	110.2	109.6	109.9	105.2
SD	2.9	3.6	2.3	2.9	2.8	3.1	3.1	3.2	2.9	2.8	2.8	2.6	2.7	3.0	14.8	13.1	13.8	15.5	13.9	15.1	12.2

TABLE 4.1.3: Intercorrelations and Mean Score of WAIS-III Subtest Scaled Scores, IQ Scales and Factor Indexes: DET Schooling Subgroup (N=20)

	PC	V	DSY	S	BD	A	MR	DSP	I	PA	C	SS	LN	OA	VIQ	PIQ	FSIQ	VCI	POI	WMI	PSI
PC																.72	.70		.77		
V	.55														.92		.90	.93			
DSY	.41	.65														.76	.72				.88
S	.72	.81	.66												.90		.88	.94			
BD	.56	.72	.63	.71												.89	.86		.91		
A	.50	.42	.36	.49	.64										.59		.63			.69	
MR	.36	.53	.61	.44	.72	.60										.82	.73		.82		
DSP	.13	.65	.62	.42	.51	.45	.65								.66		.64			.90	
I	.61	.82	.45	.83	.69	.35	.45	.35							.89		.85	.94			
PA	.31	.69	.21	.53	.41	.24	.41	.32	.71							.57	.65				
C	.56	.70	.46	.75	.60	.32	.43	.42	.84	.66					.85						
SS	.35	.50	.53	.40	.67	.64	.78	.60	.41	.46	.39										.87
LN	.06	.36	.42	.27	.31	.39	.48	.79	.19	.29	.31	.39								.91	
OA	.67	.62	.42	.65	.88	.64	.75	.42	.73	.47	.61	.67	.30								
VIQ	.64	.92	.67	.90	.80	.59	.62	.66	.89	.67	.85	.59	.45	.75		.89	.98	.96	.82	.66	.72
PIQ	.72	.81	.76	.82	.89	.63	.82	.57	.76	.57	.71	.72	.39	.85			.97	.85	.97	.61	.86
FSIQ	.70	.90	.72	.88	.86	.63	.73	.64	.85	.65	.80	.67	.45	.82				.94	.92	.66	.80
VCI	.67	.93	.63	.94	.75	.44	.49	.51	.94	.69	.82	.46	.29	.70					.77	.47	.63
POI	.77	.72	.66	.75	.91	.69	.82	.51	.70	.45	.63	.72	.34	.91						.58	.80
WMI	.23	.55	.54	.44	.54	.69	.67	.90	.34	.34	.40	.62	.91	.51							.66
PSI	.45	.67	.88	.62	.76	.57	.79	.68	.50	.38	.47	.87	.46	.63							
MEAN	7.7	6.9	7.6	8.2	7.4	8.4	8.5	8.3	8.0	5.4	8.6	6.7	9.4	5.6	88.0	82.7	84.7	87.1	87.1	91.6	84.4
SD	3.0	3.2	2.5	3.1	2.9	2.1	3.1	2.6	2.9	2.1	3.1	2.5	3.3	2.0	13.6	13.0	14.1	15.9	14.7	13.7	11.4

TABLE 4.1.4: Intercorrelations and Mean Score of WAIS-III Subtest Scaled Scores, IQ Scales and Factor Indexes: English First Language Subgroup (N=28)

	PC	V	DSY	S	BD	A	MR	DSP	I	PA	C	SS	LN	OA	VIQ	PIQ	FSIQ	VCI	POI	WMI	PSI
PC																.77	.74		.83		
V	.63														.94		.90	.95			
DSY	.54	.62														.83	.78				.91
S	.69	.82	.59												.87		.83	.93			
BD	.55	.57	.58	.58												.77	.74		.83		
A	.48	.55	.57	.43	.55										.69		.73			.81	
MR	.55	.52	.70	.43	.61	.70										.86	.75		.87		
DSP	.32	.62	.67	.47	.57	.69	.63								.73		.74			.93	
I	.59	.82	.49	.77	.56	.43	.41	.45							.86		.81	.92			
PA	.50	.70	.49	.56	.46	.56	.57	.52	.66							.77	.78				
C	.56	.82	.49	.79	.46	.37	.38	.45	.74	.62					.85		.78				
SS	.48	.60	.60	.44	.62	.54	.60	.58	.47	.57	.51										.87
LN	.25	.50	.48	.48	.38	.35	.42	.66	.35	.44	.46	.47								.79	
OA	.63	.67	.57	.67	.74	.59	.58	.50	.67	.61	.55	.58	.41								
VIQ	.67	.94	.69	.87	.66	.69	.61	.73	.86	.73	.85	.63	.57	.74		.83	.97	.95	.75	.78	.74
PIQ	.77	.75	.83	.70	.77	.72	.86	.67	.68	.77	.62	.70	.49	.77			.95	.76	.95	.74	.85
FSIQ	.74	.90	.78	.83	.74	.73	.75	.74	.81	.78	.78	.69	.56	.78				.91	.88	.80	.83
VCI	.68	.95	.61	.93	.61	.50	.48	.55	.92	.69	.84	.54	.49	.71					.69	.60	.64
POI	.83	.67	.72	.66	.83	.69	.87	.60	.60	.60	.54	.65	.41	.75						.67	.77
WMI	.41	.66	.68	.54	.59	.81	.70	.93	.48	.60	.50	.63	.79	.59							.73
PSI	.57	.68	.91	.58	.67	.62	.72	.69	.54	.59	.55	.87	.52	.65							
MEAN	12.6	13.0	12.9	12.3	11.4	11.8	12.9	11.9	12.1	11.0	12.2	10.9	12.4	9.8	113.8	113.3	114.8	113.7	114.1	111.8	108.0
SD	3.0	3.4	1.9	2.9	2.7	3.0	2.9	3.3	2.6	2.4	2.6	2.6	2.8	2.8	14.8	11.9	13.2	14.6	13.1	15.9	11.9

TABLE 4.1.5: Intercorrelations and Mean Score of WAIS-III Subtest Scaled Scores, IQ Scales and Factor Indexes: African First Language Subgroup (N=40)

	PC	V	DSY	S	BD	A	MR	DSP	I	PA	C	SS	LN	OA	VIQ	PIQ	FSIQ	VCI	POI	WMI	PSI
PC																.63	.36		.66		
V	.17														.85		.78	.90			
DSY	.25	.25														.51	.52				.88
S	.06	.57	.11												.57		.50	.80			
BD	.54	.15	.01	.08												.69	.45		.86		
A	.08	.53	.38	.33	.38										.82		.79			.84	
MR	-.16	.27	.22	.18	.27	.50										.56	.58		.54		
DSP	.03	.27	.38	-.25	.15	.53	.58								.51		.53			.83	
I	.11	.67	.33	.45	.21	.72	.30	.35							.86		.77	.82			
PA	.29	.51	.25	.34	.19	.33	.40	.22	.43							.68	.66				
C	.19	.76	.35	.53	.06	.50	.21	.25	.71	.50					.83		.74				
SS	.45	.36	.66	.14	.40	.50	.43	.42	.31	.21	.23										.94
LN	.25	.54	.48	.26	.38	.62	.54	.56	.66	.35	.45	.71								.86	
OA	.41	.22	.31	.21	.68	.24	.37	.13	.07	.41	.13	.57	.39								
VIQ	.13	.85	.43	.57	.22	.82	.47	.51	.86	.53	.83	.46	.70	.23		.54	.93	.90	.39	.79	.48
PIQ	.63	.42	.51	.23	.69	.54	.56	.41	.42	.68	.39	.70	.63	.73			.81	.42	.92	.62	.67
FSIQ	.36	.78	.52	.50	.45	.79	.58	.53	.77	.66	.74	.63	.77	.48				.81	.67	.82	.63
VCI	.13	.90	.27	.80	.17	.61	.29	.14	.82	.52	.78	.32	.57	.21					.27	.50	.32
POI	.66	.27	.26	.14	.86	.49	.54	.36	.29	.42	.20	.64	.56	.71						.55	.52
WMI	.13	.51	.49	.11	.36	.84	.64	.83	.67	.34	.47	.64	.86	.29							.63
PSI	.40	.33	.88	.14	.25	.48	.37	.44	.34	.24	.30	.94	.67	.50							
MEAN	9.2	8.8	9.4	9.8	8.2	9.7	10.4	9.6	9.4	7.9	10.5	8.1	10.6	6.7	97.8	93.5	95.7	96.2	95.3	99.3	92.8
SD	3.1	3.8	3.2	3.4	2.7	3.1	3.7	3.1	3.3	3.7	3.6	2.8	3.1	2.6	17.1	17.0	17.6	18.1	15.9	15.7	14.2

TABLE 4.1.6: Intercorrelations and Mean Score of WAIS-III Subtest Scaled Scores, IQ Scales and Factor Indexes: Graduate Education Level Subgroup (N=34)

	PC	V	DSY	S	BD	A	MR	DSP	I	PA	C	SS	LN	OA	VIQ	PIQ	FSIQ	VCI	POI	WMI	PSI
PC																.69	.64		.77		
V	.55														.85		.82	.89			
DSY	.40	.52														.73	.72				.89
S	.45	.63	.39												.72		.67	.87			
BD	.61	.52	.40	.43												.76	.69		.87		
A	.42	.44	.51	.33	.57										.73		.76			.81	
MR	.24	.49	.56	.40	.49	.65										.77	.74		.74		
DSP	.12	.36	.57	.16	.35	.57	.60								.60		.59			.83	
I	.56	.66	.48	.65	.53	.61	.51	.39							.85		.82	.86			
PA	.31	.58	.35	.36	.33	.49	.51	.27	.59							.72	.69				
C	.41	.67	.42	.51	.21	.29	.31	.17	.58	.44					.71		.62				
SS	.45	.58	.60	.29	.44	.61	.56	.48	.46	.43	.40										.89
LN	.24	.40	.26	.42	.25	.28	.35	.36	.44	.25	.33	.39								.68	
OA	.61	.66	.47	.52	.70	.54	.53	.36	.52	.60	.47	.63	.35								
VIQ	.54	.85	.65	.72	.57	.73	.66	.60	.85	.61	.71	.63	.51	.68		.82	.96	.92	.74	.78	.72
PIQ	.69	.73	.73	.55	.76	.72	.77	.52	.72	.72	.48	.68	.39	.80			.95	.75	.93	.69	.78
FSIQ	.64	.82	.72	.67	.69	.76	.74	.59	.82	.69	.62	.69	.48	.78				.87	.87	.78	.78
VCI	.58	.89	.53	.87	.55	.51	.52	.33	.86	.59	.66	.50	.49	.65					.69	.56	.57
POI	.77	.65	.58	.53	.87	.69	.74	.46	.67	.48	.37	.61	.37	.77						.65	.66
WMI	.34	.50	.58	.37	.51	.81	.69	.83	.62	.42	.33	.64	.68	.53							.69
PSI	.48	.60	.89	.37	.47	.63	.62	.58	.53	.43	.46	.89	.37	.61							
MEAN	11.3	12.9	11.0	12.3	10.2	11.8	12.0	11.5	12.5	10.2	13.0	10.2	12.3	804	114.6	106.1	111.9	114.4	106.7	110.9	103.2
SD	3.2	3.3	2.6	2.8	2.8	2.9	3.4	2.8	2.5	3.6	2.5	2.7	2.5	2.7	13.7	15.4	15.1	14.3	15.3	13.1	13.4

TABLE 4.1.7: Intercorrelations and Mean Score of WAIS-III Subtest Scaled Scores, IQ Scales and Factor Indexes: Matric Education Level Subgroup (N=34)

	PC	V	DSY	S	BD	A	MR	DSP	I	PA	C	SS	LN	OA	VIQ	PIQ	FSIQ	VCI	POI	WMI	PSI
PC																.86	.76		.85		
V	.62														.93		.90	.94			
DSY	.65	.71														.84	.84				.93
S	.59	.76	.60												.76		.74	.89			
BD	.67	.57	.59	.49												.83	.76		.88		
A	.35	.57	.57	.36	.49										.71		.70			.82	
MR	.54	.59	.68	.42	.61	.68										.82	.78		.83		
DSP	.40	.60	.62	.20	.52	.67	.68								.71		.72			.93	
I	.51	.75	.59	.61	.54	.38	.43	.42							.80		.77	.87			
PA	.74	.84	.68	.68	.61	.50	.65	.60	.71							.86	.89				
C	.51	.74	.53	.75	.43	.35	.41	.43	.67	.71					.82		.75				
SS	.66	.56	.72	.40	.75	.47	.63	.58	.43	.62	.36										.92
LN	.35	.57	.65	.35	.52	.54	.60	.76	.40	.58	.43	.68								.88	
OA	.67	.68	.64	.62	.84	.51	.60	.47	.67	.66	.46	.70	.53								
VIQ	.62	.93	.76	.76	.64	.71	.68	.71	.80	.85	.82	.60	.67	.72		.84	.96	.93	.75	.79	.73
PIQ	.86	.78	.84	.64	.83	.63	.82	.66	.67	.86	.60	.80	.64	.82			.95	.78	.97	.73	.88
FSIQ	.76	.90	.84	.74	.76	.70	.78	.72	.77	.89	.75	.73	.69	.79				.89	.89	.80	.84
VCI	.64	.94	.71	.89	.59	.49	.54	.45	.87	.83	.80	.52	.49	.73					.68	.54	.66
POI	.85	.68	.73	.57	.88	.61	.83	.61	.58	.77	.51	.79	.57	.82						.68	.82
WMI	.42	.66	.69	.35	.59	.82	.74	.93	.46	.64	.47	.66	.88	.57							.73
PSI	.70	.68	.93	.54	.72	.56	.69	.64	.56	.69	.47	.92	.72	.74							
MEAN	9.9	8.1	9.9	9.3	8.9	9.4	10.9	9.6	8.5	8.2	9.5	8.3	10.3	7.6	94.1	97.2	95.1	92.4	99.3	98.1	94.9
SD	3.6	3.6	3.3	3.3	3.3	3.0	3.7	3.6	2.8	3.3	3.2	3.1	3.3	3.5	15.7	19.3	17.9	16.1	18.9	17.9	16.0

4. eliabilit and or alit of WAIS-III Subtests

The reliability of the WAIS-III subtests was calculated to ascertain the similarity of these to those of the American standardisation and to use in the validity and reliability calculations for the potential short forms. The reliabilities were obtained using a split-half method, except for Digit Symbol and Digit Span as these are speeded tests. As the reliability calculated here for the other subtests was very similar to that of the American standardisation and the performance on Digit Symbol and Digit Span had not differed significantly from the American norms or between the groups compared, it was considered that the reliability as calculated by a test-retest method on the American standardisation sample would be an adequate estimate of reliability for this sample and would not negatively influence the further calculations using this information. The calculated reliabilities are presented in Table 4.2.1:

Table 4.2.1: Reliability Coefficient of WAIS-III Subtests (Split-half Reliabilities)

	Reliability Coefficients	Reliability Coefficient of US standardisation
PC	0.82	0.83
V	0.96	0.93
DSY	-	0.84
S	0.86	0.86
BD	0.90	0.86
A	0.88	0.88
MR	0.90	0.90
DSP	0.93	0.90
I	0.92	0.91
PA	0.87	0.74
C	0.82	0.84
SS	-	0.77
LN	0.82	0.82
OA	0.84	0.70

The normality of the subtests' distribution was calculated using the Kolmogorov-Smirnov test procedure. The results are presented in Table 4.2.2 and indicate that all the IQ scales and factor indexes passed the test of normality with $p>0.20$. The subtests passed the test with $p>0.10$ for four subtests and $p>0.20$ for the other subtests.

Table 4.2.2: Kolmogorov-Smirnov Normality Test for WAIS-III subtests

	Kolmogorov-Smirnov statistic - d	p-value
PC	0.1044	>0.20
V	0.1326	>0.10
DSY	0.1228	>0.20
S	0.1120	>0.20
BD	0.0988	>0.20
A	0.0908	>0.20
MR	0.0795	>0.20
DSP	0.0908	>0.20
I	0.0808	>0.20
PA	0.1356	>0.10
C	0.1366	>0.10
SS	0.1223	>0.20
LN	0.1324	>0.10
OA	0.1041	>0.20
VIQ	0.0768	>0.20
PIQ	0.1106	>0.20
FSIQ	0.0928	>0.20
VCI	0.0766	>0.20
POI	0.0897	>0.20
WMI	0.0830	>0.20
PSI	0.1022	>0.20

4.3 D ads - Two Subtest Short For s

All possible dyads consisting of one verbal and one performance subtest were considered. The reliability and validity for each dyad was calculated. An average of both was calculated and the dyads rank ordered accordingly. For the entire sample all the dyad options are presented, for the sample divided into the subgroups, only the top ten dyad options are presented:

Entire sample:	Table 4.3.1	p. 64
Private schooling :	Table 4.3.2	p. 65
DET schooling:	Table 4.3.3	p. 65
English first language:	Table 4.3.4	p. 66
African first language;	Table 4.3.5	p. 66
Graduate:	Table 4.3.6	p. 67
Matric:	Table 4.3.7	p. 67

Table 4.3.1 shows that the combination of Vocabulary and Matrix Reasoning appears as the best dyad for the entire sample with a reliability of 0.95, a validity of 0.81 and a combined score of 0.88. Tables 4.3.2 - 4.3.7 show that very similar reliability and validity coefficients are obtained for the dyad Vocabulary and Matrix Reasoning in all the subgroups, where this dyad appears as the best combination. The reliabilities range from 0.94 to 0.96, the validities range from 0.67 to 0.82 and the combination scores range from 0.81 to 0.89. For the DET and the Matric groups (Tables 4.3.3 and 4.3.7) Vocabulary and Block Design appears as the best dyad, with reliability of 0.96 and 0.96 respectively and validity of 0.81 and 0.82 respectively. However, the dyad combination Vocabulary and Matrix Reasoning ranks second and third respectively, with reliability (0.95 and 0.96 respectively) and validity (0.81 and 0.82 respectively) coefficients very comparable to those of the first ranked dyad. All the coefficients calculated are significant, mainly due to the subtests' own contribution to the Full Scale IQ and thus this cannot be used as a basis for distinguishing which is better. However the high reliabilities and validities achieved by both these dyad options, allows choice as to the preferred dyad. However the Vocabulary and Matrix

Reasoning combination appears in ranked first place more often and is later also found to be the better choice in terms of bias, thus this was the dyad used as the basis for the tetrad calculations.

Table 4.3.1: Dyad Reliability, Validity and Combination for a WAIS-III Short Form: Entire Sample (N=68)

	RELIABILITY r_{cc}	VALIDITY r_{pw}	COMBINATION $r_{pw} + r_{cc}$
V+MR	0.9539	0.8094	0.8816
V+BD	0.9549	0.7989	0.8769
V+DSY	0.9386	0.8023	0.8704
V+PA	0.9505	0.7873	0.8689
I+MR	0.9383	0.7986	0.8685
I+BD	0.9417	0.7743	0.8580
I+DSY	0.9230	0.7923	0.8577
I+PA	0.9372	0.7718	0.8545
V+PC	0.9313	0.7751	0.8532
S+MR	0.9157	0.7704	0.8430
DSP+PA	0.9340	0.7509	0.8424
A+PA	0.9175	0.7651	0.8413
C+MR	0.8997	0.7800	0.8398
I+PC	0.9161	0.7601	0.8381
C+BD	0.9001	0.7761	0.8381
S+PA	0.9140	0.7593	0.8367
S+BD	0.9195	0.7505	0.8350
DSP+BD	0.9436	0.7247	0.8341
A+BD	0.9274	0.7355	0.8315
S+DSY	0.9028	0.7588	0.8308
A+DSY	0.9096	0.7504	0.8300
DSP+PC	0.9076	0.7488	0.8282
C+DSY	0.8885	0.7641	0.8263
C+PA	0.9052	0.7458	0.8255
A+PC	0.8933	0.7522	0.8228
A+MR	0.9323	0.7125	0.8224
DSP+DSY	0.9305	0.7112	0.8209
DSP+MR	0.9492	0.6893	0.8193
S+PC	0.8971	0.7215	0.8093
C+PC	0.8808	0.7329	0.8068

Table 4.3.2: Dyad Reliability, Validity and Combination for a WAIS-III Short Form: Private Schooling Subgroup (N=48)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw} + r_{cc}$
V+MR	0.9436	0.7094	0.8265
V+BD	0.9460	0.6036	0.7748
V+PA	0.9433	0.5888	0.7661
V+DSY	0.9244	0.6051	0.7647
I+MR	0.9251	0.5969	0.7610
I+BD	0.9311	0.5769	0.7540
I+PA	0.9286	0.5708	0.7497
I+DSY	0.9095	0.5785	0.7440
A+PA	0.9088	0.5764	0.7426
V+PC	0.9191	0.5631	0.7411

Table 4.3.3: Dyad Reliability, Validity and Combination for a WAIS-III Short Form: DET Schooling Subgroup (N=20)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw} + r_{cc}$
V+BD	0.9590	0.8084	0.8837
V+MR	0.9540	0.8090	0.8815
I+BD	0.9467	0.7882	0.8674
I+MR	0.9376	0.7931	0.8654
S+BD	0.9292	0.7953	0.8623
S+MR	0.9163	0.8059	0.8611
I+DSY	0.9178	0.7816	0.8497
V+DSY	0.9401	0.7580	0.8490
C+BD	0.9129	0.7843	0.8486
V+PC	0.9297	0.7610	0.8454

Table 4.3.4: Dyad Reliability, Validity and Combination for a WAIS-III Short Form: English First Language Subgroup (N=28)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw} + r_{cc}$
V+MR	0.9447	0.6710	0.8078
I+PA	0.9267	0.5794	0.7531
A+PA	0.9040	0.5980	0.7510
V+PA	0.9438	0.5580	0.7509
I+MR	0.9306	0.5646	0.7476
V+BD	0.9388	0.5449	0.7418
V+DSY	0.9209	0.5513	0.7361
I+BD	0.9253	0.5375	0.7314
I+DSY	0.9107	0.5403	0.7255
C+MR	0.8846	0.5657	0.7251

Table 4.3.5: Dyad Reliability, Validity and Combination for a WAIS-III Short Form: African First Language Subgroup (N=40)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw} + r_{cc}$
V+MR	0.9536	0.8228	0.8882
V+BD	0.9552	0.8132	0.8842
V+DSY	0.9387	0.8123	0.8755
I+MR	0.9360	0.8121	0.8741
V+PA	0.9501	0.7881	0.8691
S+MR	0.9156	0.8141	0.8648
V+PC	0.9330	0.7905	0.8618
I+DSY	0.9203	0.7994	0.8598
I+BD	0.9422	0.7708	0.8565
DSP+PC	0.9075	0.7944	0.8509

Table 4.3.6: Dyad Reliability, Validity and Combination for a WAIS-III Short Form: Graduate Education Level Subgroup (N=34)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw} + r_{cc}$
V+MR	0.9527	0.7665	0.8596
I+MR	0.9404	0.7180	0.8292
V+BD	0.9537	0.6909	0.8223
I+BD	0.9410	0.6956	0.8183
I+DSY	0.9198	0.7122	0.8160
V+DSY	0.9348	0.6965	0.8157
V+PA	0.9462	0.6638	0.8050
I+PA	0.9342	0.6677	0.8009
V+PC	0.9297	0.6576	0.7936
I+PC	0.9174	0.6625	0.7900

Table 4.3.7: Dyad Reliability, Validity and Combination for a WAIS-III Short Form: Matric Education Level Subgroup (N=34)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw} + r_{cc}$
V+BD	0.9551	0.8201	0.8876
V+PA	0.9538	0.8202	0.8870
V+MR	0.9557	0.8175	0.8866
V+DSY	0.9420	0.8218	0.8819
V+PC	0.9329	0.8043	0.8686
I+MR	0.9370	0.7975	0.8673
I+PA	0.9389	0.7847	0.8618
DSP+PA	0.9383	0.7852	0.8618
I+DSY	0.9254	0.7843	0.8548
A+PA	0.9152	0.7942	0.8547

4.4 Tetrads - Four Subtest Short For s

Tetrads were developed using the basis of Vocabulary and Matrix Reasoning and then adding to this one other verbal and one other performance subtest. All such possible tetrads had their reliability and validity calculated. An average of these was used to rank order the tetrads and the calculations were done for the entire sample as well as for the divided samples, the results are presented as follows:

Entire sample:	Table 4.4.1	p. 69
Private schooling :	Table 4.4.2	p. 70
DET schooling:	Table 4.4.3	p. 70
English first language:	Table 4.4.4	p. 71
African first language:	Table 4.4.5	p. 71
Graduate:	Table 4.4.6	p. 72
Matric:	Table 4.4.7	p. 72

Tables 4.4.1 to 4.4.7 show that the combination of Vocabulary, Matrix Reasoning, Information and Block Design appears as the best tetrad option for the entire sample (reliability is 0.9707 and validity is 0.8386) and for the Private, DET, English and Graduate groups (reliability from 0.9729 to 0.9584 and validity from 0.7421 to 0.8470). For the African language and Matric groups this option is in third and fifth places respectively (reliability 0.9708 and 0.9708, validity 0.8401 and 0.8384 respectively). The best option for the African first language group is the combination of Vocabulary, Matrix Reasoning, Information and Digit Symbol, with a reliability of 0.9659 and a validity of 0.8470. For the Matric group the best tetrad option consists of Vocabulary, Matrix Reasoning, Information and Picture Arrangement, with reliability of 0.9707 and validity of 0.8453.

Considering the results in Table 4.4.1 for the entire sample, it becomes clear that the reliability coefficients range from 0.9712 to 0.9565 and the validity coefficients range between 0.8046 and 0.8400. These reliabilities and validities can all be considered acceptable. For the subgroups the validities particularly, vary a bit more, but mainly due to the smaller sample numbers in these calculations. The validities and reliabilities of the subgroups, should therefore be seen more as guidelines as to how the tetrads would rank rather then the final reliabilities and validities, as these would be substantially higher if a larger sample were used. The general outcome of the reliability and validity calculation is that the potential four subtest short forms do not differ considerably from each other on the basis of reliability or validity, with no option being statistically much better than the other options.

Table 4.4.1: Tetrad Reliability, Validity and Combination for a WAIS-III Short Form: Entire Sample (N=68)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw}+r_{cc}$
V+MR+I+BD	0.9707	0.8386	0.9046
V+MR+I+DSY	0.9662	0.8389	0.9025
V+MR+I+PC	0.9627	0.8400	0.9014
V+MR+I+PA	0.9697	0.8308	0.9003
V+MR+C+BD	0.9600	0.8376	0.8988
V+MR+S+BD	0.9644	0.8288	0.8966
V+MR+DSP+PC	0.9619	0.8272	0.8946
V+MR+S+PA	0.9633	0.8244	0.8939
V+MR+A+PC	0.9575	0.8296	0.8936
V+MR+S+DSY	0.9602	0.8261	0.8931
V+MR+A+PA	0.9650	0.8209	0.8929
V+MR+C+DSY	0.9564	0.8288	0.8926
V+MR+A+BD	0.9666	0.8187	0.8926
V+MR+DSP+BD	0.9712	0.8141	0.8926
V+MR+DSP+PA	0.9695	0.8150	0.8923
V+MR+C+PC	0.9523	0.8304	0.8914
V+MR+S+PC	0.9565	0.8255	0.8910
V+MR+C+PA	0.9602	0.8212	0.8907
V+MR+A+DSY	0.9623	0.8183	0.8903
V+MR+DSP+DSY	0.9674	0.8046	0.8860

Table 4.4.2: Tetrad Reliability, Validity and Combination for a WAIS-III Short Form: Private Schooling Subgroup (N=48)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw}+r_{cc}$
V+MR+I+BD	0.9610	0.7673	0.8641
V+MR+I+DSY	0.9550	0.6574	0.8062
V+MR+I+PC	0.9490	0.6624	0.8057
V+MR+I+PA	0.9611	0.6486	0.8049
V+MR+C+BD	0.9431	0.6579	0.8005
V+MR+A+BD	0.9579	0.6399	0.7989
V+MR+A+PC	0.9438	0.6537	0.7988
V+MR+A+PA	0.9567	0.6389	0.7978
V+MR+DSP+BD	0.9620	0.6280	0.7950
V+MR+DSP+PA	0.9603	0.6290	0.7947
V+MR+S+BD	0.9504	0.6383	0.7943
V+MR+DSP+PC	0.9477	0.6405	0.7941
V+MR+A+DSY	0.9526	0.6326	0.7926
V+MR+S+DSY	0.9439	0.6346	0.7893
V+MR+S+PA	0.9509	0.6273	0.7891
V+MR+C+DSY	0.9393	0.6390	0.7891
V+MR+C+PA	0.9470	0.6291	0.7881
V+MR+C+PC	0.9320	0.6419	0.7870
V+MR+DSP+DSY	0.9573	0.6133	0.7853
V+MR+S+PC	0.9382	0.6314	0.7848

Table 4.4.3: Tetrad Reliability, Validity and Combination for a WAIS-III Short Form: DET Schooling Subgroup (N=20)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw}+r_{cc}$
V+MR+I+BD	0.9729	0.8380	0.9054
V+MR+S+BD	0.9677	0.8328	0.9003
V+MR+C+BD	0.9632	0.8292	0.8962
V+MR+I+DSY	0.9656	0.8219	0.8938
V+MR+I+PC	0.9625	0.8245	0.8935
V+MR+S+PC	0.9575	0.8232	0.8904
V+MR+S+PA	0.9620	0.8176	0.8898
V+MR+C+PC	0.9516	0.8243	0.8880
V+MR+S+DSY	0.9615	0.8128	0.8872
V+MR+C+DSY	0.9558	0.8160	0.8859
V+MR+DSP+PC	0.9603	0.8097	0.8850
V+MR+I+PA	0.9687	0.7980	0.8834
V+MR+DSP+BD	0.9732	0.7906	0.8819
V+MR+A+BD	0.9674	0.7947	0.8810
V+MR+A+PA	0.9595	0.7960	0.8777
V+MR+C+PA	0.9587	0.7966	0.8776
V+MR+A+PC	0.9552	0.7957	0.8755
V+MR+A+DSY	0.9590	0.7907	0.8749
V+MR+DSP+PA	0.9678	0.7747	0.8713
V+MR+DSP+DSY	0.9679	0.7589	0.8634

Table 4.4.4: Tetrad Reliability, Validity and Combination for a WAIS-III Short Form: English First Language Subgroup (N=28)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw}+r_{cc}$
V+MR+I+BD	0.9584	0.7421	0.8503
V+MR+I+PC	0.9406	0.6483	0.7944
V+MR+I+PA	0.9617	0.6215	0.7916
V+MR+I+DSY	0.9532	0.6270	0.7901
V+MR+A+PA	0.9564	0.6228	0.7896
V+MR+A+PC	0.9344	0.6436	0.7890
V+MR+C+BD	0.9436	0.6254	0.7845
V+MR+A+DSY	0.9489	0.6174	0.7831
V+MR+A+BD	0.9552	0.6049	0.7801
V+MR+C+PA	0.9519	0.6060	0.7789
V+MR+C+PC	0.9277	0.6285	0.7781
V+MR+C+DSY	0.9414	0.6140	0.7777
V+MR+DSP+PA	0.9603	0.5831	0.7717
V+MR+DSP+PC	0.9388	0.5971	0.7680
V+MR+DSP+BD	0.9582	0.5729	0.7655
V+MR+S+DSY	0.9389	0.5899	0.7644
V+MR+S+PA	0.9518	0.5750	0.7634
V+MR+S+BD	0.9455	0.5797	0.7626
V+MR+DSP+DSY	0.9540	0.5684	0.7612
V+MR+S+PC	0.9252	0.5961	0.7607

Table 4.4.5: Tetrad Reliability, Validity and Combination for a WAIS-III Short Form: African First Language Subgroup (N=40)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw}+r_{cc}$
V+MR+I+DSY	0.9659	0.8470	0.9065
V+MR+S+BD	0.9654	0.8476	0.9065
V+MR+I+BD	0.9708	0.8401	0.9054
V+MR+S+PA	0.9633	0.8461	0.9047
V+MR+C+BD	0.9608	0.8462	0.9035
V+MR+DSP+PC	0.9634	0.8422	0.9028
V+MR+I+PA	0.9692	0.8358	0.9025
V+MR+S+DSY	0.9612	0.8430	0.9021
V+MR+I+PC	0.9639	0.8393	0.9016
V+MR+DSP+BD	0.9721	0.8280	0.9001
V+MR+DSP+PA	0.9696	0.8291	0.8994
V+MR+C+DSY	0.9568	0.8391	0.8979
V+MR+S+PC	0.9592	0.8350	0.8971
V+MR+A+BD	0.9667	0.8253	0.8960
V+MR+C+PA	0.9600	0.8310	0.8955
V+MR+C+PC	0.9545	0.8333	0.8939
V+MR+A+PA	0.9647	0.8223	0.8935
V+MR+A+PC	0.9591	0.8265	0.8928
V+MR+DSP+DSY	0.9682	0.8168	0.8925
V+MR+A+DSY	0.9625	0.8199	0.8912

Table 4.4.6: Tetrad Reliability, Validity and Combination for a WAIS-III Short Form: Graduate Education Level Subgroup (N=34)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw}+r_{cc}$
V+MR+I+BD	0.9692	0.8124	0.8908
V+MR+I+DSY	0.9638	0.7622	0.8630
V+MR+I+PC	0.9602	0.7604	0.8603
V+MR+I+PA	0.9672	0.7429	0.8551
V+MR+A+PC	0.9536	0.7535	0.8536
V+MR+A+BD	0.9645	0.7401	0.8523
V+MR+DSP+PC	0.9557	0.7466	0.8511
V+MR+A+DSY	0.9589	0.7431	0.8510
V+MR+C+BD	0.9552	0.7456	0.8504
V+MR+S+BD	0.9615	0.7358	0.8486
V+MR+A+PA	0.9616	0.7331	0.8473
V+MR+S+DSY	0.9558	0.7378	0.8468
V+MR+DSP+BD	0.9679	0.7256	0.8467
V+MR+S+PC	0.9516	0.7369	0.8443
V+MR+S+PA	0.9585	0.7278	0.8432
V+MR+DSP+PA	0.9649	0.7174	0.8411
V+MR+C+DSY	0.9519	0.7278	0.8398
V+MR+C+PC	0.9467	0.7326	0.8396
V+MR+DSP+DSY	0.9641	0.7080	0.8360
V+MR+C+PA	0.9551	0.7144	0.8347

Table 4.4.7: Tetrad Reliability, Validity and Combination for a WAIS-III Short Form: Matric Education Level Subgroup (N=34)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{pw}+r_{cc}$
V+MR+I+PA	0.9707	0.8453	0.9080
V+MR+I+DSY	0.9671	0.8454	0.9062
V+MR+C+BD	0.9607	0.8514	0.9061
V+MR+I+PC	0.9634	0.8479	0.9057
V+MR+I+BD	0.9708	0.8384	0.9046
V+MR+S+BD	0.9648	0.8427	0.9037
V+MR+S+PA	0.9653	0.8413	0.9033
V+MR+C+DSY	0.9578	0.8471	0.9024
V+MR+DSP+PA	0.9716	0.8330	0.9023
V+MR+C+PA	0.9622	0.8423	0.9022
V+MR+S+DSY	0.9618	0.8380	0.8999
V+MR+A+PA	0.9660	0.8337	0.8999
V+MR+C+PC	0.9540	0.8451	0.8996
V+MR+DSP+PC	0.9644	0.8348	0.8996
V+MR+DSP+BD	0.9722	0.8252	0.8987
V+MR+S+PC	0.9583	0.8354	0.8969
V+MR+A+PC	0.9584	0.8329	0.8957
V+MR+DSP+DSY	0.9688	0.8226	0.8957
V+MR+A+BD	0.9667	0.8213	0.8940
V+MR+A+DSY	0.9634	0.8199	0.8916

4.5 Validation of Previous Short For s on the WAIS-III

Short forms suggested for the WAIS-R and SA-WAIS and discussed in the literature review of this thesis are presented here, as applied to this WAIS-III sample. The reliability and validity was calculated for each and the option of replacing one of the suggested performance subtests with Matrix Reasoning was also investigated. This was done as Matrix Reasoning was the new subtest which contributed to the Full Scale IQ and was indicated as a good option for short forms in the previous sections. The calculations in this section were done for the entire sample and the subgroups, and are presented as follows:

Entire sample:	Table 4.5.1	p. 74
Private schooling :	Table 4.5.2	p. 75
DET schooling:	Table 4.5.3	p. 76
English first language:	Table 4.5.4	p. 77
African first language:	Table 4.5.5	p. 78
Graduate:	Table 4.5.6	p. 79
Matric:	Table 4.5.7	p. 80

The results in Tables 4.5.1 to 4.5.2 show that the reliability and validity of these short forms is also very high. For the entire sample the reliability ranges from 0.9744 to 0.9161 and the validity from 0.8474 to 0.7601. For the various subgroups the reliabilities range from 0.9750 to 0.8657 and the validity from 0.8625 to 0.4217, with the lower validities being with the dyad options on the smaller subgroups of our study. The pattern of reliability and validity is generally the same across the groups and the coefficients achieved indicate that the short forms suggested in the literature perform well on the WAIS-III as well. Considering the entire sample (Table 4.5.1) it can be seen that, when substituting Matrix Reasoning for one of the performance subtests the combined reliability and validity score increases, except for Silverstein's tetrad, Kaufman's triad and Ward's seven subtest short form. Indicating these substitutions as better options for the WAIS-III, than the original combinations suggested for the WAIS-R or SA-WAIS. The subgroups show the same pattern.

Table 4.5.1: Reliability, Validity and Combination of Previous Short Form Suggestions on the WAIS-III: Entire Sample (N=68)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{cc} + r_{pw}$
V+BD(Silverstein)	0.9549	0.7989	0.8769
V+MR	0.9539	0.8094	0.8816
I+PC (Kaufman et al.)	0.9161	0.7601	0.8381
I+MR	0.9383	0.7986	0.8685
S+BD (Coetzee & Madge)	0.9195	0.7505	0.8350
S+MR	0.9157	0.7704	0.8430
I+PC+DSP(Kaufman et al.)	0.9433	0.8138	0.8785
I+MR+DSP	0.9604	0.7934	0.8769
S+BD+PC (Coetzee & Madge)	0.9344	0.7537	0.8440
S+BD+MR	0.9428	0.7925	0.8676
S+PC+MR	0.9274	0.7940	0.8607
V+A+PA+BD(Silverstein)	0.9603	0.8732	0.9167
V+A+PA+MR	0.9650	0.8209	0.8929
V+A+BD+MR	0.9666	0.8187	0.8926
S+A +PC+DSY(Kaufman et al.)	0.9409	0.8139	0.8774
S+A+PC+MR	0.9450	0.8366	0.8908
S+A+DSY+MR	0.9505	0.8083	0.8794
I+A+PC+BD(Reynolds et al.)	0.9544	0.8073	0.8808
I+A+BD+MR	0.9624	0.8202	0.8913
I+A+PC+MR	0.9525	0.8250	0.8888
S+BD+PC+A (Coetzee & Madge)	0.9471	0.8005	0.8738
S+BD+MR+A	0.9550	0.8075	0.8812
S+MR+PC+A	0.9450	0.8173	0.8811
I+DSP+A+S+PC+BD+DSY(Ward)	0.9709	0.8474	0.9092
I+DSP+A+S+PC+BD+MR	0.9730	0.8396	0.9063
I+DSP+A+S+PC+DSY+MR	0.9714	0.8405	0.9059
I+DSP+A+S+BD+DSY+MR	0.9744	0.8400	0.9072

Table 4.5.2: Reliability, Validity and Combination of Previous Short Form Suggestions on the WAIS-III: Private Schooling Subgroup (N=48)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{cc} + r_{pw}$
V+BD(Silverstein)	0.9460	0.6987	0.8224
V+MR	0.9436	0.7094	0.8265
I+PC (Kaufman et al)	0.8983	0.5547	0.7265
I+MR	0.9251	0.5969	0.7610
S+BD (Coetzee & Madge)	0.8995	0.5182	0.7089
S+MR	0.8934	0.5292	0.7113
I+PC+DSP(Kaufman et al)	0.9273	0.6185	0.7729
I+MR+DSP	0.9522	0.5944	0.7733
S+BD+PC (Coetzee & Madge)	0.9155	0.5167	0.7161
S+BD+MR	0.9204	0.5756	0.7480
S+PC+MR	0.8938	0.5758	0.7348
V+A+PA+BD(Silverstein)	0.9517	0.6771	0.8144
V+A+PA+MR	0.9567	0.6389	0.7978
V+A+BD+MR	0.9579	0.6399	0.7989
S+A+PC+DSY(Kaufman et al)	0.9165	0.6245	0.7705
S+A+PC+MR	0.9218	0.6519	0.7869
S+A+DSY+MR	0.9343	0.6087	0.7715
I+A+PC+BD(Reynolds et al)	0.9427	0.6202	0.7815
I+A+BD+MR	0.9531	0.6286	0.7909
I+A+PC+MR	0.9371	0.6473	0.7922
S+BD+PC+A (Coetzee & Madge)	0.9288	0.6047	0.7668
S+BD+MR+A	0.9400	0.6146	0.7773
S+MR+PC+A	0.9218	0.6309	0.7764
I+DSP+A+S+PC+BD+DSY(Ward)	0.9585	0.6706	0.8145
I+DSP+A+S+PC+BD+MR	0.9612	0.6694	0.8153
I+DSP+A+S+PC+DSY+MR	0.9594	0.6623	0.8108
I+DSP+A+S+BD+DSY+MR	0.9643	0.6623	0.8133

Table 4.5.3: Reliability, Validity and Combination of Previous Short Form Suggestions on the WAIS-III: DET Schooling Subgroup (N=20)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{cc} + r_{pw}$
V+BD(Silverstein)	0.9590	0.8185	0.8888
V+MR	0.9540	0.8090	0.8815
I+PC (Kaufman et al)	0.9202	0.7187	0.8194
I+MR	0.9376	0.7931	0.8654
S+BD (Coetzee & Madge)	0.9292	0.7953	0.8623
S+MR	0.9163	0.8059	0.8611
I+PC+DSP(Kaufman et al)	0.9378	0.8116	0.8747
I+MR+DSP	0.9583	0.7859	0.8721
S+BD+PC (Coetzee & Madge)	0.9395	0.7722	0.8559
S+BD+MR	0.9489	0.8077	0.8783
S+PC+MR	0.9303	0.7881	0.8592
V+A+PA+BD(Silverstein)	0.9579	0.8439	0.9009
V+A+PA+MR	0.9595	0.7960	0.8777
V+A+BD+MR	0.9674	0.7947	0.8810
S+A+PC+DSY(Kaufman et al)	0.9414	0.7665	0.8540
S+A+PC+MR	0.9466	0.7872	0.8669
S+A+DSY+MR	0.9492	0.7827	0.8659
I+A+PC+BD(Reynolds et al)	0.9548	0.7816	0.8682
I+A+BD+MR	0.9627	0.7564	0.8595
I+A+PC+MR	0.9503	0.7872	0.8688
S+BD+PC+A (Coetzee & Madge)	0.9514	0.7697	0.8605
S+BD+MR+A	0.9582	0.7882	0.8732
S+MR+PC+A	0.9466	0.7751	0.8609
I+DSP+A+S+PC+BD+DSY(Ward)	0.9705	0.8333	0.9019
I+DSP+A+S+PC+BD+MR	0.9722	0.8415	0.9069
I+DSP+A+S+PC+DSY+MR	0.9706	0.8131	0.8919
I+DSP+A+S+BD+DSY+MR	0.9745	0.8229	0.8987

Table 4.5.4: Reliability, Validity and Combination of Previous Short Form Suggestions on the WAIS-III: English First Language Subgroup (N=28)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{cc} + r_{pw}$
V+BD(Silverstein)	0.9388	0.6474	0.7931
V+MR	0.9447	0.6710	0.8078
I+PC (Kaufman et al)	0.8842	0.5213	0.7028
I+MR	0.9306	0.5646	0.7476
S+BD (Coetzee & Madge)	0.8973	0.4625	0.6799
S+MR	0.8877	0.4328	0.6602
I+PC+DSP(Kaufman et al)	0.9189	0.5677	0.7433
I+MR+DSP	0.9550	0.5411	0.7481
S+BD+PC (Coetzee & Madge)	0.9029	0.4217	0.6623
S+BD+MR	0.9149	0.5026	0.7087
S+PC+MR	0.8657	0.5380	0.7019
V+A+PA+BD(Silverstein)	0.9493	0.6448	0.7970
V+A+PA+MR	0.9564	0.6228	0.7896
V+A+BD+MR	0.9552	0.6049	0.7801
S+A+PC+DSY(Kaufman et al)	0.9060	0.5745	0.7403
S+A+PC+MR	0.9084	0.6506	0.7795
S+A+DSY+MR	0.9291	0.5829	0.7560
I+A+PC+BD(Reynolds et al)	0.9402	0.5657	0.7529
I+A+BD+MR	0.9535	0.6046	0.7790
I+A+PC+MR	0.9318	0.6322	0.7820
S+BD+PC+A (Coetzee & Madge)	0.9213	0.5350	0.7282
S+BD+MR+A	0.9372	0.5642	0.7507
S+MR+PC+A	0.9084	0.6079	0.7581
I+DSP+A+S+PC+BD+DSY(Ward)	0.9518	0.6307	0.7912
I+DSP+A+S+PC+BD+MR	0.9553	0.6355	0.7954
I+DSP+A+S+PC+DSY+MR	0.9538	0.6344	0.7941
I+DSP+A+S+BD+DSY+MR	0.9603	0.6306	0.7954

Table 4.5.5: Reliability, Validity and Combination of Previous Short Form Suggestions on the WAIS-III: African First Language Subgroup (N=40)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{cc} + r_{pw}$
V+BD(Silverstein)	0.9552	0.8074	0.8813
V+MR	0.9536	0.8228	0.8882
I+PC (Kaufman et al)	0.9190	0.7546	0.8368
I+MR	0.9360	0.8121	0.8741
S+BD (Coetzee & Madge)	0.9235	0.7739	0.8487
S+MR	0.9156	0.8141	0.8648
I+PC+DSP(Kaufman et al)	0.9436	0.8342	0.8889
I+MR+DSP	0.9589	0.8235	0.8912
S+BD+PC (Coetzee & Madge)	0.9365	0.7830	0.8598
S+BD+MR	0.9449	0.8139	0.8794
S+PC+MR	0.9336	0.8013	0.8675
V+A+PA+BD(Silverstein)	0.9599	0.8753	0.9176
V+A+PA+MR	0.9647	0.8223	0.8935
V+A+BD+MR	0.9667	0.8253	0.8960
S+A+PC+DSY(Kaufman et al)	0.9430	0.8230	0.8830
S+A+PC+MR	0.9484	0.8286	0.8885
S+A+DSY+MR	0.9515	0.8181	0.8848
I+A+PC+BD(Reynolds et al)	0.9532	0.8221	0.8877
I+A+BD+MR	0.9615	0.825	0.8932
I+A+PC+MR	0.9532	0.8225	0.8878
S+BD+PC+A (Coetzee & Madge)	0.9484	0.8177	0.8831
S+BD+MR+A	0.9560	0.8205	0.8882
S+MR+PC+A	0.9484	0.8178	0.8831
I+DSP+A+S+PC+BD+DSY(Ward)	0.9716	0.8583	0.9149
I+DSP+A+S+PC+BD+MR	0.9740	0.8478	0.9109
I+DSP+A+S+PC+DSY+MR	0.9723	0.8473	0.9098
I+DSP+A+S+BD+DSY+MR	0.9750	0.8481	0.9115

Table 4.5.6: Reliability, Validity and Combination of Previous Short Form Suggestions on the WAIS-III: Graduate Education Level Subgroup (N=34)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{cc} + r_{pw}$
V+BD(Silverstein)	0.9537	0.7382	0.8459
V+MR	0.9527	0.7665	0.8596
I+PC (Kaufman et al)	0.9174	0.6625	0.7900
I+MR	0.9404	0.7180	0.8292
S+BD (Coetzee & Madge)	0.9156	0.6390	0.7773
S+MR	0.9138	0.6652	0.7895
I+PC+DSP(Kaufman et al)	0.9373	0.7197	0.8285
I+MR+DSP	0.9591	0.6981	0.8286
S+BD+PC (Coetzee & Madge)	0.9296	0.6474	0.7885
S+BD+MR	0.9392	0.6992	0.8192
S+PC+MR	0.9186	0.7108	0.8147
V+A+PA+BD(Silverstein)	0.9569	0.7657	0.8613
V+A+PA+MR	0.9616	0.7331	0.8473
V+A+BD+MR	0.9645	0.7401	0.8523
S+A+PC+DSY(Kaufman et al)	0.9332	0.7284	0.8308
S+A+PC+MR	0.9395	0.7550	0.8473
S+A+DSY+MR	0.9458	0.7278	0.8368
I+A+PC+BD(Reynolds et al)	0.9544	0.7097	0.8320
I+A+BD+MR	0.9622	0.7326	0.8474
I+A+PC+MR	0.9516	0.7417	0.8466
S+BD+PC+A (Coetzee & Madge)	0.9435	0.7006	0.8221
S+BD+MR+A	0.9522	0.7212	0.8367
S+MR+PC+A	0.9395	0.7362	0.8378
I+DSP+A+S+PC+BD+DSY(Ward)	0.9675	0.7573	0.8624
I+DSP+A+S+PC+BD+MR	0.9699	0.7587	0.8643
I+DSP+A+S+PC+DSY+MR	0.9681	0.7565	0.8623
I+DSP+A+S+BD+DSY+MR	0.9718	0.7546	0.8632

Table 4.5.7: Reliability, Validity and Combination of Previous Short Form Suggestions for the WAIS-III: Matric Education Level Subgroup (N=34)

	RELIABILITY	VALIDITY	COMBINATION
	r_{cc}	r_{pw}	$r_{cc} + r_{pw}$
V+BD(Silverstein)	0.9551	0.8135	0.8843
V+MR	0.9557	0.8175	0.8866
I+PC (Kaufman et al)	0.9149	0.7649	0.8399
I+MR	0.9370	0.7975	0.8673
S+BD (Coetzee & Madge)	0.9187	0.7593	0.8390
S+MR	0.9147	0.7870	0.8509
I+PC+DSP(Kaufman et al)	0.9429	0.8215	0.8822
I+MR+DSP	0.9594	0.8024	0.8809
S+BD+PC (Coetzee & Madge)	0.9349	0.7725	0.8537
S+BD+MR	0.9429	0.8086	0.8757
S+PC+MR	0.9307	0.8037	0.8672
V+A+PA+BD(Silverstein)	0.9602	0.8971	0.9287
V+A+PA+MR	0.9660	0.8337	0.8999
V+A+BD+MR	0.9667	0.8213	0.8940
S+A+PC+DSY(Kaufman et al)	0.9411	0.8224	0.8817
S+A+PC+MR	0.9447	0.8441	0.8944
S+A+DSY+MR	0.9506	0.8126	0.8816
I+A+PC+BD(Reynolds et al)	0.9511	0.8227	0.8869
I+A+BD+MR	0.9605	0.8339	0.8972
I+A+PC+MR	0.9506	0.8327	0.8916
S+BD+PC+A (Coetzee & Madge)	0.9448	0.8156	0.8802
S+BD+MR+A	0.9537	0.8129	0.8833
S+MR+PC+A	0.9447	0.8219	0.8833
I+DSP+A+S+PC+BD+DSY(Ward)	0.9700	0.8625	0.9162
I+DSP+A+S+PC+BD+MR	0.9725	0.8454	0.9090
I+DSP+A+S+PC+DSY+MR	0.9710	0.8519	0.9114
I+DSP+A+S+BD+DSY+MR	0.9737	0.8506	0.9121

4.6 Subtest Scaled Scores Co pared to Full Scale IQ

In section 4.1 all the subtests have been shown to correlate highly with Full Scale IQ ($p<0.01$ with Bonferroni's adjustment). In this section each subtest's contribution to the Full Scale IQ is examined more closely. Paired t-tests for dependent sample indicate which subtests would over- or underestimate Full Scale IQ if included in a short form. Thus the comparison is presented for the entire sample and then for each subgroup as follows:

Entire sample:	Table 4.6.1	p. 82
Private schooling :	Table 4.6.2	p. 83
DET schooling:	Table 4.6.3	p. 83
English first language:	Table 4.6.4	p. 84
African first language:	Table 4.6.5	p. 84
Graduate:	Table 4.6.6	p. 85
Matric:	Table 4.6.7	p. 85

Table 4.6.1 indicates that for the entire sample four subtests have means which are significantly different from that which would be expected from the Full Scale IQ. Block Design and Picture Arrangement would underestimate, and Comprehension and Matrix Reasoning would overestimate the Full Scale IQ's if used in short forms.

Table 4.6.2 shows that for the Private Schooling subgroup the same subtests are significantly different and in the same direction. Thus Block Design and Picture Arrangement would underestimate and Matrix Reasoning and Comprehension would overestimate IQ in short forms for Private Schooling testees. In comparison, when considering the DET group in Table 4.6.3 we find that now Vocabulary and Picture Arrangement would underestimate IQ, with no subtests overestimating. Looking at the English first language subgroup (Table 4.6.4) it can be seen that only Picture Arrangement has a significantly different result and would underestimate Full Scale IQ in a short form. In the African first language group (Table 4.6.5) Comprehension and Matrix

Reasoning are found to overestimate IQ and Block Design and Picture Arrangement underestimate. The graduate group (Table 4.6.6) show that Vocabulary, Information and Comprehension would overestimate IQ and Block Design and Picture Arrangement would underestimate IQ in a short form using these subtests. In comparison the matric group (Table 4.6.7) showed that Vocabulary, Information and Picture Arrangement would underestimate IQ and Matrix Reasoning would overestimate IQ.

In summary of these findings; Picture Arrangement underestimates IQ in all the groups. Vocabulary underestimates in the DET and matric group, while Block Design underestimate in the whole group, but especially in the Private and African groups. Thus Picture Arrangement, Vocabulary and Block Design are problematic subtests for use in short forms in terms of underestimating the Full Scale IQ's of certain subgroups in a South African context. Comprehension overestimates in the whole group, but especially for the Private, African and Graduate groups. Matrix Reasoning overestimates for the whole group, but particularly for the Private and African group. Vocabulary and Information overestimate for the Graduate group. These overestimations should also be considered in terms of their impact on certain short forms.

Table 4.6.1: WAIS-III Subtest Means Compared to Adapted Full Scale IQ (10.48, SD=2.65): Entire Sample (N=68)

	Mean (SD)	t	p
V	10.54 (4.20)	.23	.82
S	10.82 (3.40)	1.31	.20
A	10.56 (3.17)	.30	.76
DSP	10.54 (3.38)	.21	.84
I	10.49 (3.30)	.01	.99
C	11.22 (3.34)	2.89	.01*
PC	10.59 (3.46)	.36	.72
DSY	10.43 (2.99)	-.24	.81
BD	9.51 (3.12)	-3.73	.00**
MR	11.41 (3.59)	3.19	.00**
PA	9.19 (3.57)	-4.99	.00**
FSIQ	103.53 (18.47)		

Significant Difference: * indicates $p<0.05$, ** indicates $p<0.01$

Table 4.6.2: WAIS-III Subtest Means Compared to Adapted Full Scale IQ (11.63, SD=1.88): Private Schooling Subgroup (N=48)

	Mean (SD)	t	p
V	12.08 (3.58)	1.34	.19
S	11.92 (2.90)	.83	.41
A	11.46 (3.11)	-.58	.57
DSP	11.50 (3.21)	-.36	.72
I	11.52 (2.89)	-.41	.68
C	12.31 (2.81)	2.10	.04*
PC	11.79 (2.91)	.43	.67
DSY	11.60 (2.31)	-.11	.92
BD	10.40 (2.77)	-3.73	.00**
MR	12.63 (3.05)	2.72	.01*
PA	10.77 (2.76)	-2.81	.01*
FSIQ	111.40 (13.83)		

Significant Difference: * indicates p<0.025, ** indicates p<0.005, with Bonferroni's adjustment

Table 4.6.3: WAIS-III Subtests Means Compared to adapted Full Scale IQ (7.72, SD=2.16): DET Schooling Subgroup (N=20)

	Mean (SD)	t	p
V	6.85 (3.18)	-2.50	.02*
S	8.20 (3.11)	1.38	.18
A	8.40 (2.14)	1.64	.12
DSP	8.25 (2.63)	1.16	.26
I	8.00 (2.94)	.80	.43
C	8.60 (3.07)	2.16	.04
PC	7.70 (2.98)	-.04	.97
DSY	7.60 (2.52)	-.30	.77
BD	7.40 (2.93)	-.92	.37
MR	8.50 (3.14)	1.63	.12
PA	5.40 (2.14)	-5.76	.00**
FSIQ	84.65 (14.08)		

Significant Difference: * indicates p<0.025, ** indicates p<0.005, with Bonferroni's adjustment

Table 4.6.4: WAIS-III Subtest Means Compared to Adapted Full Scale IQ (12.09, SD=1.71): English First Language Subgroup (N=28)

	Mean (SD)	t	p
V	13.00 (3.43)	2.04	.05
S	12.29 (2.88)	.41	.69
A	11.75 (3.00)	-.94	.36
DSP	11.86 (3.32)	-.45	.66
I	12.07 (2.62)	-.07	.94
C	12.21 (2.63)	.36	.72
PC	12.61 (2.97)	.96	.35
DSY	11.96 (1.91)	-.38	.71
BD	11.39 (2.67)	-1.53	.14
MR	12.89 (2.90)	1.77	.09
PA	11.00 (2.40)	-3.17	.00**
FSIQ	114.79 (13.24)		

Significant Difference: * indicates p<0.025, ** indicates p<0.005, with Bonferroni's adjustment

Table 4.6.5: WAIS-III Subtest Means Compared to Adapted Full Scale IQ (9.35, SD=2.62): African First Language Subgroup (N=40)

	Mean (SD)	t	p
V	8.83 (3.85)	-1.78	.08
S	9.80 (3.39)	1.49	.14
A	9.73 (3.05)	1.10	.28
DSP	9.63 (3.14)	.80	.43
I	9.38 (3.30)	.07	.95
C	10.53 (3.62)	3.28	.00**
PC	9.10 (3.08)	-.54	.59
DSY	9.35 (3.15)	-.01	.99
BD	8.20 (2.73)	-3.79	.00**
MR	10.38 (3.70)	2.65	.01*
PA	7.93 (3.72)	-3.87	.00**
FSIQ	95.65 (17.60)		

Significant Difference: * indicates p<0.025, ** indicates p<0.005, with Bonferroni's adjustment

Table 4.6.6: WAIS-III Subtest Means Compared to Adapted Full Scale IQ (11.69, SD=2.08): Graduate Education Level Subgroup (N=34)

	Mean (SD)	t	p
V	12.94 (3.33)	3.65	.00**
S	12.32 (2.77)	1.80	.08
A	11.76 (2.89)	.23	.82
DSP	11.53 (2.79)	-.40	.69
I	12.47 (2.45)	3.37	.00**
C	12.97 (2.47)	3.76	.00**
PC	11.26 (3.21)	-1.02	.32
DSY	11.00 (2.61)	-2.17	.04
BD	10.18 (2.76)	-4.46	.00**
MR	11.97 (3.41)	.71	.48
PA	10.18 (3.55)	-3.38	.00**
FSIQ	111.91 (15.10)		

Significant Difference: * indicates p<0.025, ** indicates p<0.005, with Bonferroni's adjustment

Table 4.6.7: WAIS-III Subtest Means Compared to Adapted Full Scale IQ (9.28, SD=2.63): Matric Education Level Subgroup (N=34)

	Mean (SD)	t	p
V	8.15 (3.59)	-3.89	.00**
S	9.32 (3.34)	.13	.90
A	9.35 (3.01)	.20	.84
DSP	9.59 (3.66)	.65	.51
I	8.50 (2.83)	-2.38	.02*
C	9.47 (3.19)	2.11	.59
PC	9.91 (3.61)	1.60	.12
DSY	9.85 (3.27)	1.90	.07
BD	8.85 (3.35)	-1.13	.27
MR	10.85 (3.73)	3.92	.00**
PA	8.21 (3.35)	-4.07	.00**
FSIQ	95.15 (17.88)		

Significant Difference: * indicates p<0.025, ** indicates p<0.005, with Bonferroni's adjustment

4.7 Ite eduction Short For

In this section a Satz-Mogel type short form is considered as an option for the WAIS-III. The subtests Picture Completion, Vocabulary, Matrix Reasoning and Information had all their odd items, all their even items and every third item considered as options. For the subtests Similarities, Block Design, Arithmetic, Picture Arrangement, Comprehension and Object Assembly only their odd and even item combinations were considered. Digit Symbol, Digit Span, Symbol Search and Letter-Number Sequencing were not abbreviated, as they are not suitable to such an abbreviation. From the subtests' scaled scores the IQ scales and factor indexes were also calculated, either using all the odd, or all the even subtest options. Table 4.7.1 shows the correlation coefficients and t-test analyses for the various abbreviations and those of the entire test. This analysis was done on the entire sample only.

From Table 4.7.1 it is clear that the correlations between the abbreviated subtest scores and the actual scores are very high, the lowest correlation being 0.81. The verbal and performance IQ's correlate at 0.99 and between 0.84 and 0.94 respectively. The Full Scale IQ correlates at 0.98 or 0.99, depending on the items used. Thus indicating that this short form's estimation of Full Scale IQ correlates very highly with that of the actual test. However, when looking at the t-test analysis we find significant differences between many of the abbreviation options and their respective complete subtests, namely on Picture Completion odd and even options, Vocabulary every third, Block Design odd (here it is interesting to note that these are all the embedded designs), all Matrix Reasoning options, Information even and third, Picture Arrangement odd, Comprehension even and Object Assembly odd and even. In terms of the IQ scales and factor indexes, all Full Scale IQ options shows significant differences, as well as Verbal IQ third, Performance IQ even and odd, and all the Perceptual Organisation options. Most important here is that the Full Scale IQ, calculated in either of the three ways, differs significantly from that of the entire scale.

Table 4.7.1: Correlations and t-test Analysis on Satz-Mogel Type Short Form for the WAIS-III

	Correlation	Comparison of difference	
	r	t	p
PC odd	0.89	-3.35	0.0014**
PC even	0.87	3.99	0.0002**
PC third	0.81	-0.33	0.7438
V odd	0.97	1.08	0.2819
V even	0.97	-0.98	0.3284
V third	0.96	-4.84	0.0000**
DSY	1.00	0.00	1.0000
S odd	0.90	0.79	0.4325
S even	0.91	0.00	1.0000
BD odd	0.95	2.04	0.0458*
BD even	0.95	-0.48	0.6311
A odd	0.93	1.27	0.2069
A even	0.93	-1.54	0.1293
MR odd	0.93	4.88	0.0000**
MR even	0.94	-3.86	0.0003**
MR third	0.92	-5.40	0.0000**
DS	1.00	0.00	1.0000
I odd	0.96	-0.64	0.5260
I even	0.96	2.07	0.0428*
I third	0.95	-3.36	0.0013**
PA odd	0.91	2.10	0.0391*
PA even	0.92	-1.82	0.0731
C odd	0.83	-1.29	0.2027
C even	0.93	2.34	0.0273*
SS	1.00	0.00	1.0000
LN	1.00	0.00	1.0000
OA odd	0.88	3.29	0.0016**
OA even	0.89	-3.85	0.0003**
VIQ odd	0.99	0.39	0.6981
VIQ even	0.99	1.27	0.2068
VIQ third	0.99	-3.68	0.0005**
PIQ odd	0.94	3.37	0.0013**
PIQ even	0.84	-2.75	0.0078**
PIQ third	0.94	-1.62	0.1089
FSIQ odd	0.98	2.78	0.0071**
FSIQ even	0.99	-2.33	0.0228*
FSIQ third	0.98	-3.09	0.0029**
VCI odd	0.98	0.83	0.4094
VCI even	0.97	0.76	0.4528
VCI third	0.88	-0.97	0.3344
POI odd	0.88	3.02	0.0036**
POI even	0.93	-4.25	0.0001**
POI third	0.89	-2.38	0.0204*
WMI odd	0.99	1.38	0.1736
WMI even	0.99	-1.20	0.2331
PSI	1.00	0.00	1.0000

Significant Difference: * indicates $p<0.05$, ** indicates $p<0.01$

CHAPTER FIVE: DISCUSSION

The objective of this discussion is to provide a framework for the practical application of the results of this thesis. Thus a main aim is to provide some clear and specific guidelines for clinicians who want to use a short form of the WAIS-III for their specific purposes. In this area the focus will again be on the South African situation and its particular conditions. However it is important to note that the sample for this research was restricted to a relatively educated group and age group between 19 and 30, thus limiting the applicability of the results. The sample included people with at least a matric level education, who thus fall mainly into the average to above average IQ range and who were fairly fluent in English, although for a large group this was their second language. Thus while the results of this study can be generalised to testees who match the characteristics of this sample, caution should be exercised when applying these findings to testees who are different from this sample.

As the subtests' intercorrelations, reliabilities and normality's were found to be acceptable (Sections 4.1-4.2, pp.52-62), it was possible to consider calculations for short forms using these data. Thus the discussion will first consider the option of a subtest reduction short form. After this, an item reduction type short form for the WAIS-III will be considered. This will be followed by an evaluation of this research and recommendations for future research in this area.

5.1 Subtest Reduction Short Forms

For this type of short form only a limited number of the subtests are administered and from these the Full Scale IQ is then calculated. There are several ways through which one can establish which subtests to use in this type of short form. In this study three approaches have been used and through a combination of these it is aimed that a short form can be suggested which will satisfy

the criteria of being a good estimate of Full Scale IQ, at the same time not be biased against any particular group and form a good clinical tool. Thus the first section will consider the dyad and tetrad suggestions which have emerged as the best options using calculations of validity and reliability. Secondly, the potential subtests to be used in these short forms are reviewed to establish if any of them would unfairly bias any of the subgroups contained in this study. These subtests would then be eliminated from the short forms suggested. Thirdly, short forms which have been suggested for the WAIS-R and the SA-WAIS will be considered as options for the WAIS-III. Finally the outcome of all three of these considerations will be combined to establish the best short forms for use in South Africa.

5.1.1 Reliability and Validity - Suggestions for Short Forms

Considering the calculations for reliability and validity, the dyad which appears as the best option for the entire sample is the combination of *Vocabulary and Matrix Reasoning* (Table 4.3.1, p.64). This dyad is also the best option for the subgroups Private Schooling, English First Language, African First Language and Graduate Education Level (Tables 4.3.2-4.3.7, pp.65-67). For the DET and Matric groups (Tables 4.3.2-4.3.7, pp.65-67) the option which appears in first place is that of Vocabulary and Block Design, with the option of Vocabulary and Matrix Reasoning in second and third place respectively. Even when the Vocabulary and Matrix Reasoning dyad is not in first place, this dyad's reliability and validity coefficients are still very high. The differences in the combination score for these dyad options are only 0.0022 for the DET group and 0.001 for the Matric groups, thus making the differences negligible on statistical grounds. On this basis it was decided to use only one dyad option for the further calculations, as separate options for various subgroups is not warranted on statistical grounds. The option of Vocabulary and Matrix Reasoning is also the preferred option on grounds of bias as will be discussed in the following section.

Thus for a dyad the recommendation on grounds of reliability and validity is the combination of Vocabulary and Matrix Reasoning. This combination has a validity of 0.81 and a reliability of 0.95 for the entire sample and would probably have even higher validity in a larger sample. Previously the option of Vocabulary and Block Design has been suggested as a dyad for the WAIS-R on the grounds of validity and reliability calculations (Silverstein, 1982). Thus it is not surprising that this option appears amongst the best options. However Matrix Reasoning was not part of the WAIS-R, but is a new subtest in the WAIS-III and it appears to be a good addition to the test and a good option for short forms. The dyad of Vocabulary and Matrix Reasoning is also that which is used for the WASI (Psychological Corporation, 2000) and thus use of this dyad would make research comparable to that conducted with the WASI in other parts of the world.

Using this dyad as a starting point for a tetrad, brought other subtests into the fore. Looking at the entire sample the combination of *Vocabulary, Matrix Reasoning, Information and Block Design* appears as the best tetrad option (Table 4.4.1, p.69). For the entire sample this option has a reliability of 0.97 and a validity of 0.84, both make this an acceptable option statistically. This option also appears as the best option for the Private and DET Schooling subgroups, as well as the English First Language and Graduate Education Level subgroups (Tables 4.4.2-4.4.6, pp.70-72). For the African First Language subgroup the best combination was Vocabulary, Matrix Reasoning, Information and Digit Symbol (Table 4.4.5, p.71), whereas the best combination of the Matric Education Level group is Vocabulary, Matrix Reasoning, Information and Picture Arrangement (Table 4.4.7, p.72). However with the African First Language subgroup the combination Vocabulary, Matrix Reasoning, Information and Block Design appears as the third best option and for the Matric group it appears as the fifth best option.

When looking at the validities and reliabilities of the other tetrad combinations for the entire sample (Table 4.4.1, p.69), these are found to be only marginally below that of the best combination. Therefore, where that best tetrad has a combined validity and reliability score of 0.9046, the lowest ranking tetrad, with the Vocabulary and Matrix Reasoning dyad as starting point, has a score of 0.8860. The reliabilities vary from 0.9707 to 0.9564 and the validities vary from 0.8400 to 0.8183. The variability of the reliability and validity coefficients is not large and thus deciding on a tetrad on the basis of these coefficients alone is a bit arbitrary, as the statistical strength of one particular short form is not so overwhelming that it far outweighs the others. Therefore other considerations should be brought into the decision at this point to make a better choice of short forms for South Africa.

5.1.2 Considerations of Bias

An important consideration for a short form in South Africa is the potential bias which it may have against certain groups. The Wechsler tests as such have been found to be prejudicial towards certain groups, mainly against those whose culture is very different from that of America where the test has been developed and normed (Manly et al. 1998; Ogden & McFarlane-Nathan, 1997). The differences are not consistent across all the subtests, but some subtests are more and others less biased towards certain groups (Kaufman, McLean & Reynolds, 1988). Thus when developing a short form for the Wechsler tests attempts should be made to minimise the bias of the short form, by avoiding the more culturally biased subtests. However, it should be kept in mind that the whole test is biased in terms of culture and thus removing this bias entirely from a short form is an impossible task. Thus, what this section attempts to do, is to consider which subtests would most bias certain subgroups and thus by not using these in a short form, reduce the bias of the short form as much as is possible. T-tests were conducted to see on which subtests

this sample performed statistically differently from what may be expected according to the Full Scale IQ (Section 4.6, pp.81-82), thus allowing conclusions to be drawn as to which subtests if used in a short form would under- or overestimate IQ.

What will be considered is which subtests showed significant differences for the entire sample and across all the subgroups, and those subtests which showed significant differences only for some subgroups, or significant differences in different directions across the subgroups. It will be suggested that those subtests which consistently underestimate the Full Scale IQ for all the participants in this study, would probably be subtests which contain elements foreign to South Africans in general and would thus not be good estimates of IQ for South African testees.

Subtests which are found to differ significantly due to the fact that they underestimate IQ for some groups and not for others, may be considered for use only with those groups for which they do not show significant differences. It is thought that those subgroups for whom they do not underestimate are then possibly more like the American standardisation sample and may thus be more comparable to them. These subtests in a short form would then have limited applicability in South Africa. Those subtests which show different directions of significance, i.e. they underestimate for some subgroups and overestimate for others, would need to be considered with even more caution and may tend not to be good short form choices at all, considering the possible accentuation of differences.

On the other hand, subtests which may be found to consistently overestimate IQ may be considered as options. This is not to say that an overestimation is desirable, but it is thought that this overestimation, may indicate subtests which are less culturally biased for a South African sample. Thus, it is proposed that the overestimation of the subtests may actually reflect the

underestimation of the entire test, more than indicating subtests which actually overestimate. At the same time it should be considered that a testee cannot perform better than his or her potential, but can perform worse than this potential on tasks which are biasing (Lezak, 1995). Thus subtests which appear to overestimate in terms of the entire test may be giving a better indication of the testees potential than the entire test is. Those subtests which are then found to overestimate consistently across all subgroups of this sample may be considered for inclusion in short forms.

Considering each subtest in turn, it emerged that *Picture Arrangement* is significantly different from the Full Scale IQ for the entire sample and for each subgroup (Tables 4.6.1-4.6.7, pp.82-85). This subtest has a lower mean than the adapted Full Scale IQ and consequently will always *underestimate* the Full Scale IQ when used in a short form. Considering this and that this subtest includes a particular type of humour which most participants in this study found difficult to understand and situations which are somewhat foreign to the South African context, makes this subtest a poor choice for a short form. From the results of this study Picture Arrangement was also found to be very prejudicial in terms of educational achievement (Kemp, 2000). These results differ from findings for this subtest in the WAIS-R on an American sample (as discussed in the literature review), where Picture Arrangement was found to be less biasing in terms of educational achievement and according to race (Kaufman, McLean & Reynolds, 1988). However this subtest on the WAIS-III has changed substantially from the WAIS-R, with six new items and the remaining five having new artwork and other subtle changes (Wechsler, 1997). Thus the comparison of this WAIS-III subtest used in a South African context, to the WAIS-R Picture Arrangement subtest in an American setting is problematic. Despite these differences, this subtest is considered an exceptionally poor choice for inclusion in any short form in South Africa.

Significant differences are also found on *Block Design* for the entire sample (Table 4.6.1, p.82). Here it *underestimates* Full Scale IQ, as well as with the Private Schooling, African First Language and the Graduates Education Level subgroups (Tables 4.6.2-4.6.7, pp.83-85). Even with the other groups this subtest will always underestimate the Full Scale IQ slightly, although not to a significant extent. Block Design for the WAIS-R has consistently been considered as one of the more prejudicial and variable tests in the literature, particularly in terms of groups divided according to race (Paolo, Ryan, Ward & Hilmer, 1996). This bias appears consistently across studies, despite this subtest tapping more fluid types of intelligence (Kaufman & Lichtenberger, 1999). The items on this subtest have not changed although the four reversal items were added and one more difficult item (Wechsler, 1997). Thus the bias inherent in this test will probably not have changed either. In the another parts of this study, Block Design was found to prejudice the African First Language speakers (Hartmann, 2000). Thus it is suggested that this subtest be avoided for short forms in South Africa. Thus the dyad combination of Vocabulary and Matrix Reasoning is considered to be a better choice than the dyad of Vocabulary and Block Design, even though it appeared as a marginally better option for the DET Schooling and Matric Education Level subgroups according to their reliability and validity (see earlier discussion).

Matrix Reasoning is another subtest on which the entire sample scores significantly different from the Full Scale IQ (Table 4.6.1, p.82). This difference also appears for the Private Schooling, African First Language and Matric Education Level groups (Tables 4.6.2-4.6.7, pp.83-85) . This difference however indicates that this subtest would *overestimate* the Full Scale IQ and not underestimate it. Seeing that this is the new subtest to be included as one of the subtests contributing to Full Scale IQ on the WAIS-III, there has been no previous research about how this subtest performs in terms of differential group performance. The Raven's Matrices which are similar to this subtest are generally thought to be less prejudicial towards people who are less

westernised (Bass, 2000). This is due to the non-verbal content of the test and due to it tapping fluid intelligence rather than more culturally determined crystallised intelligence (Kaufman & Lichtenberger, 1999). The sample's performance on this subtest then seems to indicate that although the WAIS-III as a whole may prejudice a South African sample and specifically the less privileged subgroups, this subtest does not contribute to this prejudice. Thus it may be argued that while Matrix Reasoning appears to overestimate IQ, it is in fact a case of this subtest giving a more accurate estimate of IQ and the entire test underestimating IQ due to its cultural bias. On this basis Matrix Reasoning, although showing significant difference, may actually be a very good subtest to include in a short form in the South African context. The great emphasis on fluid intelligence in this subtest also makes it inherently a more culture fair subtest than the subtests tapping more crystallised intelligence. Matrix Reasoning is thus considered to be a good subtest to include in a short form for South African use. This again supports the earlier choice of the dyad of Vocabulary and Matrix Reasoning over that of Vocabulary and Block Design.

The only verbal subtest which shows significant levels of difference for the entire sample is the *Comprehension* subtest (Table 4.6.1, p.82). This subtest *overestimates* rather than underestimates the Full Scale IQ. It also significantly overestimates for the Private Schooling, African First Language and Graduate Education Level subgroups (Tables 4.6.2-4.6.7, pp.83-85). In the literature this subtest for the WAIS-R has been found to be slightly prejudicial in terms of race (Kaufman, McLean & Reynolds, 1988) and in this study it has been found to be effected by the level of education, prejudicing those with a lower level of education, compared to higher levels of education (Kemp, 2000). Although this subtest appears to overestimate like the Matrix Reasoning subtest, the Comprehension subtest has been linked to bias in terms of educational level and race and therefore should be avoided for short forms in South Africa.

The other subtests do not show any significant differences from the Full Scale IQ for the entire sample, but some differences are found when looking specifically at the subgroups. *Vocabulary* shows significant differences for the DET Schooling, Graduate and Matric Education Level subgroups (Tables 4.6.2-4.6.7, pp.83-85). In the Graduate Education Level group it *overestimates* IQ, however for the DET Schooling and Matric Education Level group it *underestimates* IQ. This subtest does not show any significant differences according to first language in this sample, however this is probably due to half the African First Language group being very well educated and having had a privileged, largely English education. Thus while this subtest does not appear as significantly biased for the entire sample, this is probably due to the differences between the groups smoothing the scores and thus giving an overall non-biased appearance to this subtest. In the literature this subtest has been found to be highly problematic in the WAIS-R, where significant differences are reported according to race and education (Paolo, Ryan, Ward & Hilmer, 1996; Ogden & McFarlane-Nathan, 1997). The Vocabulary subtest for the WAIS-III has been revised to drop ten of the most biased items from the WAIS-R version, but eight new items have been added (Wechsler, 1997). The continued bias of this test is suggested by the broader results of the present research (Kemp, 2000). Therefore this subtest should probably be avoided in short forms in a South African context, particularly when the testee is from background dissimilar to that of the American standardisation group, i.e. not acculturated to white western culture. This subtest would probably underestimate the IQ for these testees, while possibly overestimating for those of a more advantaged background, making the results from this test highly problematic.

The only other subtest which has a significant difference for any of the subgroups is *Information* and these opposing differences are for the Graduate and Matric Education Level subgroups

(Tables 4.6.2-4.6.7, pp.83-85). This subtest would *overestimate* for the Graduate group and *underestimate* for the Matric group. Considering this difference for a moment it does not seem surprising as this subtest is based on knowledge which is generally acquired through learning and the Graduate subgroup has been exposed to substantially more years of learning. This subtest has also been found in the literature to be biased in terms of race and education (Kaufman, McLean & Reynolds, 1988), and while some of the items have been changed from the WAIS-R (Wechsler, 1997), there are still several items which are very specifically based on American life and experience and are highly prejudicial towards testees outside of this culture. Some of this bias is likely to be eliminated from the South African version, however this subtest should still be approached with caution for use in a short form in South Africa.

In conclusion, the subtests *Similarities*, *Arithmetic*, *Digit Span* and *Picture Completion* do not show any differences from the Full Scale IQ for the entire sample or for any of the subgroups and thus these subtests could be considered as the best to include in short forms when assessing people similar to those of this sample. *Matrix Reasoning* can also be used in short forms, although it appears to overestimate the Full Scale IQ, but does this consistently across the entire sample and is considered to be culturally fair. On the other hand the subtests *Vocabulary*, *Information*, *Comprehension*, *Block Design* and *Picture Arrangement* should probably be avoided completely for short forms in South Africa.

5.1.3 Reconsidering the Reliability and Validity Suggestions

The dyad of Vocabulary and Matrix Reasoning and the tetrad of Vocabulary, Matrix Reasoning, Information and Block Design were suggested as short forms in Section 5.1.1 (p.88) due to their high reliability and validity coefficients. However, the above discussion about the bias of certain subtests necessitates the reconsideration of these short forms. The use of the dyad Vocabulary

and Matrix Reasoning for the entire sample is placed in a questionable light, due to Vocabulary's underestimation of certain subgroups' IQ. The tetrad option of Vocabulary, Matrix Reasoning, Information and Block Design would also be very problematic for use with the entire sample, due to its inclusion of three subtests, namely Vocabulary, Information and Block Design which potentially prejudice certain subgroups. Thus it appears that the suggestions arrived at by considering only validity and reliability are highly problematic and are not appropriate for all South African testees. While the aim of this discussion is to arrive at short forms which would be appropriate for use with a general South African population, the short forms arrived at through reliability and validity calculations may still have a limited, but important use.

The dyad of *Vocabulary and Matrix Reasoning* is the same as that which has been suggested for the WASI (Psychological Corporation, 2000). Although the WASI does not use the exact WAIS-III subtests, it is based on the WAIS-III and the results of the WASI should be comparable to those of a short form using the actual WAIS-III subtests. Thus using the dyad of Vocabulary and Matrix Reasoning would allow the results of studies to be comparable to other studies around the world conducted using the WASI. In this way this dyad could be important for research purposes, where comparisons with other research is desired. However it must be realised that this dyad should only be used on South African testees who are English First Language speakers or if they are African First Language speakers they have had a good quality schooling and at least a matric. Thus this dyad should be restricted in South Africa to testees, who can generally be considered to be relatively privileged. This dyad has reliability (0.95) and validity (0.81). It also reflects the split of verbal and performance subtests, as well as the split of more crystallised and fluid intelligence.

For a tetrad to complement this dyad, that used by the WASI would be considered best, still allowing research with it to be comparable. This tetrad adds *Similarities and Block Design* to the dyad of *Vocabulary and Matrix Reasoning*. The validity of this tetrad would be 0.84 and the reliability would be 0.97. This tetrad further enhances the split between verbal and performance subtests. This combination is also preferable to that which has the highest reliability and validity combination score, namely Vocabulary, Matrix Reasoning, Information and Block Design, due to Similarities tapping a different type of ability than Vocabulary and Information do.

Another suggestion which could be considered for this relatively advantaged group is a combination of subtests which would reflect the four factors of the WAIS-III, thus including one test representing each index. Using the dyad of Vocabulary and Matrix Reasoning as a basis, reflecting Verbal Comprehension and Perceptual Organisation respectively. Then one could consider adding either Arithmetic or Digit Span for the Working Memory Index and Digit Symbol for the Processing Speed Index. This short form would then give a good estimate of a person's overall IQ, as well as serving as a brief neuropsychological screening tool if this is required. This combination of subtests would then contain Digit Symbol and Arithmetic or Digit Span, which are all subtests found to be highly sensitive to brain damage (Lezak, 1995). Thus the inclusion of these subtests would allow the tester to be alerted to any potential deficits which a testee may have. The tetrad of *Vocabulary, Matrix Reasoning, Arithmetic and Digit Symbol* has a validity of 0.82 and a reliability of 0.96, while the tetrad *Vocabulary, Matrix Reasoning, Digit Span and Digit Symbol* has a validity of 0.81 and a reliability of 0.97.

Table 5.1.3: WAIS-III Short Form Suggestions for Relatively Advantaged Testees in South Africa

Dyad	V+MR
Tetrad	V+MR+S+BD
	V+MR+A+DSY
	V+MR+DSP+DSY

This however does not lead to suggestions for short forms to be used with groups who are dissimilar to those for whom the test was designed, i.e. the African First Language speakers and other groups who are less acculturated to western culture. For suggestions in this regard it is necessary to consider what options have been suggested previously particularly for these situations, and then to consider their performance on the WAIS-III in this South African sample.

5.1.4 Previous Short Form Suggestions

There have been many suggestions in the literature, as outlined in the literature review of this thesis, but here again only those which have been reviewed more extensively in this thesis will be considered. Within these the focus will be on the dyads and tetrads, as these will best reflect the structure of the WAIS-III and optimise the balance between error levels and time saving (Coetzee & Madge, 1981). The dyads will be considered first and then the tetrads, ending with a brief overview of the other short forms suggested in the literature. With the suggestions from the literature, the use of Matrix Reasoning as a replacement for one of the performance subtests will also be considered, as this is the new subtest of the WAIS-III and is a good option in terms of reliability and validity calculations, as well as in terms of its culture fairness (Section 5.1.2, p.92).

Considering the dyad suggested by *Silverstein (1982)*, which consists of *Vocabulary and Block Design*, it is found that this combination was a good option using the validity and reliability coefficients (Table 4.5.1, p.74). However, when considering replacing Block Design with Matrix Reasoning, this was found to be an even better option, as it had been shown in the reliability

and validity analysis. This change also decreases the bias of this dyad, by removing the one subtest Block Design, which is considered biased. The inclusion of Vocabulary in this dyad, however is still problematic due to its level of bias, thus not making this a good dyad for a broader South African population.

The options advocated by *Coetzee and Madge (1981)* for the SA-WAIS should be considered with caution for the WAIS-III as this test is so vastly different in its structure and thus comparisons are difficult at best. Their suggested dyad of *Similarities and Block Design* has a reliability and validity comparable to that of the other dyads considered thus far (Table 4.5.1, p.74). These coefficients improve when Block Design is replaced with Matrix Reasoning, at the same time removing Block Design removes the subtest which is considered biased. This dyad combination of Similarities and Matrix Reasoning is also one which did well in the statistical analysis (Table 4.3.1, p.64), in fact being the best option when the biased subtests of Vocabulary and Information were removed as options. This dyad of *Similarities and Matrix Reasoning* is thus a very good option to consider for South Africa.

Looking at the combinations suggested by *Kaufman, Ishikuma and Kaufman-Packer (1991)* it is found that the dyad combination of *Information and Picture Completion* does relatively well on the reliability and validity analysis and when Picture Completion in this option is replaced with the new performance subtest of Matrix Reasoning, a very good combination score is obtained (Table 4.5.1, p.74). This dyad combination of Information and Matrix Reasoning is in fact the one with the highest combination score when Vocabulary is eliminated as an option (Table 4.3.1, p.64). However, the use of Information in this dyad would prejudice people with lower levels of education or lesser quality of schooling, thus making this dyad problematic in a larger application of this short form.

Therefore the only dyad suggestion which really is an acceptable, relatively culture fair option for South African application is the option of Similarities and Matrix Reasoning. This is the dyad which is suggested for use in South Africa, with testees who are fluent in English and have at least a matric level of education.

Table 5.1.4.1: WAIS-III Dyad Suggestion for South Africans (Matric + English Fluency)

Dyad:	S+MR

Considering next the tetrad options suggested in the literature, it is found that the combination of *Vocabulary, Arithmetic, Picture Arrangement and Block Design* was suggested by *Silverstein (1982).* This tetrad has very good reliability and validity scores in this present study (Table 4.5.1, p.74). However this combination contains Picture Arrangement, which was found in this sample not to be a good choice for any short forms as it underestimates IQ. This tetrad also contains Vocabulary and Block Design, which are also highly problematic due to their cultural bias in this sample. With this tetrad, substituting Matrix Reasoning for either of the performance subtests does not improve the reliability and validity score or remove the biased subtests entirely, thus this tetrad is not an acceptable option for South African circumstances.

The tetrad suggested by *Reynolds, Willson and Clark (1983)* consists of *Information, Arithmetic, Picture Completion and Block Design.* This tetrad includes Block Design and Information which prejudice against certain groups in this sample. Substituting Matrix Reasoning for Block Design would eliminate one of the subtests which contain bias and increases the combination score (Table 4.5.1, p.74). However, Information is still potentially biasing, thus this is not an acceptable combination.

The tetrad suggested by *Coetzee and* Madge *(1981)* consists of *Similarities, Block Design, Arithmetic and Picture Completion.* This tetrad has good level of reliability and validity and only contains one subtest which is considered to be biased; namely Block Design. If Block Design is replaced by Matrix Reasoning, the bias is removed and the reliability and validity coefficients increase to 0.95 and 0.82 respectively (Table 4.5.1, p.74). This change then yields a subtest combination, which is mostly free from bias and is a very good option for a South African situation. Therefore the combination of *Similarities, Arithmetic, Picture Completion and Matrix Reasoning* should seriously be considered.

Considering the tetrad suggested by *Kaufman, Ishikuma and Kaufman-Packer (1991)* they have used *Similarities, Arithmetic, Picture Completion and Digit Symbol.* This combination does not include a single subtest which is consistently thought to be biased towards any group. This combination also contains a subtest representing each factor of the WAIS-III. Looking at the reliability and validity of this combination, these are very comparable to the best ones found using the dyad of Vocabulary and Matrix Reasoning as a basis. Thus this combination's validity is 0.81 and its reliability is 0.95 (Table 4.5.1, p.74). At the same time if Matrix Reasoning is substituted for Picture Completion, the validity increases to 0.84 and the reliability increases to 0.95, thus making this a marginally better option statistically. Therefore the combination *Similarities, Arithmetic, Matrix Reasoning and Digit Symbol* should seriously be considered as possibly the best tetrad option for South African use.

For the above tetrad of Similarities, Arithmetic, Matrix Reasoning and Digit Symbol, it could also be considered that the Arithmetic subtests could be replaced with Digit Span. This combination would still reflect the factor structure of the WAIS-III and would allow clinicians to choose an

alternative, which may be preferable if they are interested in differentiating more between the intelligence components as measured by digits forwards and backwards. Both of these options would also make very good neuropsychological screening tools, in that they contain Digit Symbol and Arithmetic or Digit Span, which are all considered very good indicators of brain damage (Lezak, 1995). Thus the possible tetrad options which can be used with all South Africans, who are fluent in English and have a matric, are as follows:

Table 5.1.4.2: WAIS-III Tetrad Suggestion for South Africans (Matric + English Fluency)

Tetrad	S+A+PC+MR
	S+A+MR+DSY
	S+DSP+MR+DSY

Briefly considering the other options suggested in the literature, it is found that the triad suggested by Kaufman, Ishikuma and Kaufman-Packer (1991) was to reflect the factor structure of the WAIS-R. Seeing that the WAIS-III, now has four factors, the consideration of a triad along these lines no longer holds. The triad suggested by Coetzee and Madge (1981) for the SA-WAIS should also not be applied to the WAIS-III, due to its overrepresentation of performance subtests.

The seven subtest version suggested by *Ward (1990)* consists of Information, Digit Span, Arithmetic, Similarities, Picture Completion, Block Design and Digit Symbol and was found to have excellent reliability and validity for this sample. This combination also includes at least one subtest from each factor. At the same time administering seven subtests out of eleven does not constitute much of a time saving and has not been a popular option with clinicians. However, this short form only contains two subtests which are considered culturally biased according to this sample. If Block Design is replaced with Matrix Reasoning and Information is not used, thus making this a six subtest short form, it would yield a more comprehensive option for clinicians who need to do a fuller assessment, but at the same time want to avoid the cultural bias

inherent in the other subtests. This six subtest short form would then consist of Digit Span, Arithmetic, Similarities, Picture Completion, Matrix Reasoning and Digit Symbol. It must be remembered though that this short form can still only yield an estimate of Full Scale IQ and further interpretations of the results can be problematic.

5.2 Subtest Reduction Short Form Suggestions: Conclusions

There are several subtest reduction short forms which can be considered for a South African context. These can be summarised as follows in Table 5.3.1:

Table 5.2.1: Summary of Short Form Suggestions (Dyad and Tetrads) for South Africans (with Matric and English Fluency)

SHORT FORM	DYADS	TETRADS	
USE	IQ ESTIMATE	IQ ESTIMATE	IQ ESTIMATE (with Neuro Screening)
Advantaged[#] and Disadvantaged[$] Group	**S+MR**	S+A+MR+PC	***S+A+MR+DSY*** S+DSP+MR+DSY
Advantaged[#] Groups Only	V+MR	V+S+MR+BD	V+A+MR+DSY V+DSP+MR+DSY

[#] Advantaged here refers to English and African first language speakers who have had good quality schooling, higher level of educational achievement and good English fluency.

$ Disadvantaged here refers to English and African First Language speakers who may not have had a good quality of schooling, only have a Matric, but have some English Language fluency.

Considering Table 5.2.1 above, it is clear that for the short forms suitable for disadvantaged and advantaged South Africans as divided in this study, the potentially prejudicing subtests have been removed and only subtests used which would be more culturally fair (or as close to this as can be hoped) are used. The option which is considered best, is the option of *Similarities, Arithmetic, Matrix Reasoning and Digit Symbol.* This tetrad combination has many advantages in many diverse situations. It gives a good estimate of Full Scale IQ for all groups in a South African

context, as investigated by this study. It has a validity of 0.81 and a reliability of 0.95, both being very acceptable coefficients of short forms. Thus this short form satisfies the criteria for having good validity and reliability, which are important criteria for a short form (Cyr & Brooker, 1984; Nagle & Bell, 1995; Tellegen & Briggs, 1976). The criteria set out by Kaufman (1972) and discussed in the literature review are also met by this short form. Thus this short form contains two verbal and two performance subtests, which correlate highly with the Verbal and Performance scales respectively (Table 4.1.1, p.54). At the same time a variety of mental abilities are measured, in fact reflecting each of the factors found in the WAIS-III. Finally it does form a 'clinically interesting picture' in terms of the WAIS-III, particularly due to the reflection of the factor structure.

Moreover, the subtests used in this short form are relatively short to administer. Although this was not part of the formal analysis of this study, this short form will take approximately 20 minutes to administer. The subtests used are also all from the first half of the entire test, thus minimising the potential that different levels of motivation and concentration would effect the short form administration (Nagle & Bell, 1995). The factor structure of the WAIS-III is also reflected in the short form. This however does not mean that the factor indexes can be calculated from this short form, but it can give an indication of where possible strengths and weaknesses may lie, thus it can act as a brief screening tool, as well as giving a good estimate of Full Scale IQ. In addition, these four subtests also reflect the split between the verbal and performance components of the WAIS-III, with Similarities and Arithmetic representing the Verbal scale and the Matrix Reasoning and Digit Symbol representing the Performance scale. The subtests also reflect the split between timed and non-timed subtests, giving an indication of the impact of these on the testee. The split between fluid and crystallised abilities is not as well represented, with a greater emphasis on fluid abilities. However this is a difficult balance to maintain when trying to

eliminate as much bias as possible, as the subtests tapping more crystallised abilities are also the more culturally biased. Thus while this balance is not well maintained, this may actually be what makes this combination more suitable for relatively wide use in a South African context.

The bias of this strongly recommended short form, of Similarities, Arithmetic, Matrix Reasoning and Digit Symbol, has been reduced as much as possible. However it should be kept in mind that the entire WAIS-III has elements of bias towards certain groups in it and thus a completely bias free short form of the WAIS-III is not a viable option. This combination will probably come as close to minimising the biases found on the Wechsler tests as can be expected.

While the combination of Similarities, Arithmetic, Matrix Reasoning and Digit Symbol is suggested to be the best tetrad for use with South Africans, the other combinations suggested in Table 5.2.1 allow for some choice. The dyad of Similarities and Matrix Reasoning, is a much briefer assessment and will only yield an estimate of Full Scale IQ, whereas the tetrads will give a better estimate of Full Scale IQ and particularly the more neuropsychologically sensitive combinations will give more information about a person's functioning. The dyad and tetrad short forms suggested for the advantaged groups are also included here, as these may be very useful short forms particularly for research purposes, where findings will want to be compared to that of other research. In these cases the combinations as suggested by the WASI would be the best choices to make, namely the dyad of Vocabulary and Matrix Reasoning and the tetrad of Vocabulary, Similarities, Matrix Reasoning and Block Design. These however should only be used with the relatively advantaged groups in South Africa.

5.3 The Item Reduction Short Form

Considering this type of short form for the WAIS-III, it was thought that a short form may be found that would retain as much of the structure of the full test as possible, as this had also been the hope of the developers of this type of short form (Satz & Mogel, 1962). This method of short form development has also been found to show no difference according to racial-ethnic or age groups (Adams, Kobos & Preston, 1977; Resnick & Entin, 1971). As each subtest is represented in this type of abbreviation in the same proportion as in the entire test, the amount of bias towards certain subgroups in the short form would be the same as in the entire test. Thus, if this short form proved a statistically acceptable option, considerations of bias towards subgroups in this sample would be minimal, in this way making it a good suggestion for a multi-cultural country like South Africa.

However, from the results of this analysis, it becomes clear that using an item reduction method for a short form is very problematic. The correlations are high for each subtest, yet the t-test analysis shows that there is a significant amount of difference for many of the abbreviated subtests using this method as compared to the full subtests (Table 4.7.1, p.87). What speaks most clearly against this type of short form is that significant differences are found according to t-tests on the Full Scale IQ's calculated according to this method. Thus while the correlations are good, this masks significant discrepancies. The results of this research, thus concur with that of previous research which suggested that the subtest scatter is altered with this type of abbreviation and thus this short form cannot be used to make interpretations in this regard (Edinger, Shipley & Watkins, 1986; Holmes, Armstrong, Johnson & Ries, 1966; Marsh, 1973; Watkins & Kinzie, 1970). However the results of this study go further and suggest that even the Full Scale IQ achieved in this fashion, is not comparable enough to warrant the use of this type of short form even for an estimation of Full Scale IQ alone. Thus it is the recommendation from this research that this type of short form not be used due to the significant differences found.

Besides the statistical problems with this type of short form, the practical implications are that this type of abbreviation is also more cumbersome in its application (Boone, 1991). To remember which items to administer and which to skip places much strain on the tester and the calculations required give much opportunity for errors to be made. The option of later administering the rest of the items, if a fuller assessment is needed, is a more complicated proposition than it is with a subtest reduction method (Boone, 1991). When considering testees who may not be so familiar with testing procedure and what is required of them in a testing situation (i.e. not test-wise), this type of abbreviation, will also not give them the time and number of items to learn what is required of them, as the option of extended learning and teaching are not present. Thus particularly with testees who are not "test-wise" this type of abbreviation should be viewed with extra caution.

While this short form, as such needs to be approached with much scepticism there may be some use for this type of abbreviation. For some subtests the correlations are very high, as well as the error levels very low, indicating that this type of abbreviation may be an option for some subtests, for example third items on Picture Completion, even items on Similarities, odd items in Information and even items on Picture Arrangement. The even items on Block Design may appear to warrant consideration here, these however are mainly the non-embedded designs, which would then only test one aspect of the ability this test taps and thus prove to be problematic.

Thus it may be considered that these subtests be abbreviated in a subtest reduction short form, or only these when the whole test is administered. This option however, will still need much consideration and further investigation, to ascertain if similar results are found with other samples. Only abbreviating some subtests, will not add to error rates, but item reducing subtests, in a subtest reduction short form, could increase error rates dramatically and thus this option still needs to be carefully considered. In the interim an item reduction type of short form is not recommended for use with the WAIS-III in South Africa.

5.4 Evaluation and Recommendations for Future Research

The following weaknesses of the present research need to be considered:

1. The sample size is very small. Particularly for reliability calculations the sample needs to exceed 60 (Jensen, 1980), which this sample only marginally exceeds. However the subtest reliabilities calculated were comparable to those of the American standardisation sample and thus the small sample did not compromise these results. The reliabilities of the short form options were also high, despite the small sample. The validities of the short forms were slightly lower, particularly for the subgroups, which consisted of even smaller numbers. These would certainly improve if the suggested short forms were validated on a larger sample. Despite the limitation of the sample size the statistical calculations are still valid.

2. The sample was also restricted in terms of age, educational achievement and English language fluency. Thus only people between 19 and 30 years of age, who had at least 12 years of education and who were relatively fluent in English were tested and the results can only be generalised to others with similar characteristics. However, in practice the WAIS-III will probably only be administered to testees in South Africa who are relatively fluent in English and have at least a matric. The study is however limited in terms of age applicability. The results can safely only be generalised to testees who are between 19 and 30 years of age. Older adults' performance on the WAIS-III subtests would need to be considered when the short forms are applied to them. This would particularly need to be the case with testees who are ageing, particularly due to the timed element of many of the subtests and the natural declines of old age. At the same time the restricted nature of the sample probably contributed to the subtest reliability coefficients being comparable to those of the American standardisation. Due to the restriction of the sample the IQ range, was restricted, limiting the variability of the

results, in this way contributing to better reliability and validity calculations as discussed above. Thus this restriction, although limiting the generalisability, has added to the significance of the results thus found.

3. Another short coming of this research is that the American items and standardisation were used in the administration of this research. Although this could not be avoided, due to the South African standardisation not being available, the results will need to be reconsidered in the light of the changes which the South African version of the WAIS-III will entail. The manner is which the protocols of this research were administered would allow this to be done once the South African standardisation is available. However the short forms which have been suggested as the best options in the present research, do not contain any of the subtests which were proposed to be changed and thus the results for these short forms will remain applicable.

The following strengths were also noted:

1. The results of this research are consistent and significant, allowing the results to be confidently generalised to other South African testees who are relatively fluent in English and have at least a matric. At the same time the results can probably also be generalised to adults older than 30 who are also relatively fluent in English and have a matric, as the changes in the scale scores of the test will control for differences of ageing. Also for the group that has been considered more privileged in this research, the findings should hold for those who have a lower level of education, however this is probably not the case for those who do not have English as a First Language and have had a lesser quality of schooling.

2. The short forms suggested as the best options in this thesis will not be effected by the changes of the South African version, thus allowing the results to be generalised to that version without problems.

3. The testers who administered the WAIS-III in this research were all well trained and experienced in testing. The environment in which the testing was done was quiet and free from distractions. These factors probably contributed to the testees performing to the best of their abilities and thus further increasing the validity of the results.

4. The structure of the research allows the results to be applicable to South Africans who have English as their first language and for whom the WAIS-III is being standardised. At the same time the present study also considered the applicability of these results to African First Language speakers, who are fluent in English and will probably also be tested by the WAIS-III.

In summary this research, appears to suffers from no serious methodological shortcomings and the results can thus be considered valid and the suggested short forms can be used with confidence for a South African population, who are relatively fluent in English and have a matric.

It is the recommendation of this research that the short forms suggested from this research be tested on the South African standardisation data, in this way yielding more accurate reliability and validity coefficients. At the same time the suggested short forms should be assessed for use on different clinical samples and for research purposes.

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APPENDIX A:

Table of Abbreviations

Abbreviations Used for WAIS-III Subtests, IQ Scales and Factor Indexes

PC	Picture Completion
V	Vocabulary
DSY	Digit Symbol
S	Similarities
BD	Block Design
A	Arithmetic
MR	Matrix Reasoning
DSP	Digit Span
I	Information
PA	Picture Arrangement
C	Comprehension
SS	Symbol Search
LN	Letter-Number Sequencing
OA	Object Assembly
VIQ	Verbal Intelligence Quotient
PIQ	Performance Intelligence Quotient
FSIQ	Full Scale Intelligence Quotient
VCI	Verbal Comprehension Index
POI	Perceptual Organisation Index
WMI	Working Memory Index
PSI	Processing Speed Index

APPENDIX B:

Initial Contact Sheet

WAIS-III Master's Research

Initial Contact Sheet

Surname: _____ First Name: _____

Contact Address: _____

Contact Telephone Number(s): _____

Gender: [Male] [Female]

Age: [21] [22] [23] [24] [25] [26] [27] [28] [29] [30]

Home Language: [English] [Xhosa] [Other African Language:]

Language at place of study or work: [English]

Schooling: [Private School] [DET]

Check that the 5 high school years were completed in the same category of school. [ ]

Name of School and Town: _____

Educational Level: [Matric Only] [Graduate]

If Matric only, check that they do not intend to, nor have tried to study further. [ ]

Ever been diagnosed with or had one of the following:

Learning Difficulty [Yes] [No]

Neurological Disorder [Yes] [No]

Psychiatric Disorder [Yes] [No]

Head Injury [Yes] [No]

If Yes to any of the above - give details: _____

_____

_____

Arranged Date of Testing: _____ Time: _____

Tester: _____ Venue: _____

Further Contacts? _____

Protocol Number: [ ]

APPENDIX C:

Answer Booklet

WAIS-III Master's Research

Answer Booklet

Protocol Number: _____

Gender: Male Female

Age: 21 22 23 24 25 26 27 28 29 30

Home Language: English Xhosa Other African Language: _____

Language at place of study or work: English

Schooling: Private School DET

Check that the 5 high school years were completed in the same category of school. _____

Where all 12 years of schooling completed in the same type of school: Yes No

If NO, give brief history of changes: _____

_____

_____

Educational Level: Matric Only Graduate

If Matric only, check that they do not intend to, nor have tried to study further. _____

Matric Symbol: A B C D E F

Matric Exemption: Yes No

Ever failed a year at school Yes No

If "Yes" when and why: _____

What have you done since leaving school (year by year): _____

_____

_____

_____

_____

_____

_____

Sentence Completion

Section A

Read the following paragraphs and then circle the most appropriate word which can be used to complete each sentence:

Example: The principal at Lebohang High School urged his pupils to come to school AT / ON / TO / BY time.

Paragraph 1:

The police said that the escaped convict was still IN / AT / BY / TO large but that they hoped to get the whole gang TO / AFTER / BEHIND / IN bars before the end of the week. They warned however that the convict was dangerous and would go FOR / IN / OVER / TO any length to avoid being caught. Apparently the prisoner got out by stretching himself out TO / IN / FROM / AT full length and thus reaching the top of the wall, was then able to hoist himself ACROSS / OVER / FROM / BEFORE the wall. The other prisoners were IN / OUT / WITH / BY on all his plans and held AT / OFF / WITH / IN the guards until he was well ON / OFF / UNDER / BEYOND his way. The officer AT / ON / IN / WITH charge promised to look AT / ABOUT / INTO / FOR the matter.

Paragraph 2:

The old man wanted to set BY / DOWN / ASIDE / FOR an amount of money for a rainy day or perhaps put it TOWARDS / FOR / AT / ABOUT a new car. He and his wife were TO / OUT / IN / OF one mind about this but then they were led BY / THROUGH / WITH / ALONG their noses by an unscrupulous salesman who talked them INTO / OVER / FROM / TO buying a car which was much more expensive than they could afford. When they realised what they had let themselves AT / OUT OF / ABOUT / IN FOR they confronted the salesman but he was immediately UPON / UP IN / OUT OF / AT arms and told them that they had already entered UNDER / WITH / BY / INTO a contract and must abide THROUGH / WITH / BY / IN its stipulations. The couple decided to take the salesman TO / AT / IN / ON court.

Section B

Which word/phrase correctly completes the sentence?
Please circle the number next to the most appropriate word/phrase.

Anne . . . . . there since morning. She refuses to go out.

1. has been sitting
2. was sitting
3. had sat
4. is sitting

The boat . . . . . soon after it had sprung a leak.

1. is sunk
2. had sunk
3. sinks
4. sank

They will be surprised to know that it is . . . . . informed the police.

1. me that
2. she whom
3. I who
4. him what

Which underlined word/phrase is used wrongly in each group of sentences?

1. The farmer raises chickens and then sells it.
2. Catch that dog and lock it in the garage.
3. Peel the potatoes and boil them in the salt water.
4. The police pursued the suspicious-looking men and eventually arrested them.

1. It is he who helped us.
2. Whose is this? Is it yours?
3. Which do you prefer, these or those?
4. The children have dressed themself.

1. Would you mind my opening the window?
2. I don't approve of she reading my letters.
3. Did you give it back without his asking you?
4. The weather won't stop your playing the match.

Which underlined word/phrase is used wrongly in each paragraph?

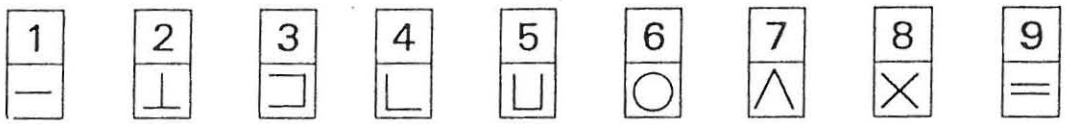
Tourism is fast becoming a major industry. The slogan "Sunny South Africa" is often used to attract tourists. The beaches, holiday farms and the Kruger National Park is visited by thousands of tourists every year. South Africa has much to offer and the world is slowly coming to realise this.

The Sahara is a land exposed to soil erosion. The source of its problems are the soil itself. The lack of tress means there is no shade to prevent the sun from burning off the surface water. The earth dries up and the plant life dies.

That cities are growing at a startling rate is apparent to anyone watching the spreading rings of shanties and squatters' huts that surrounds virtually every major Third World city. Yet some cities manage to cope.

This grandfather clock is said to have belonged to an Austrian emperor. It has chimes for the last fifty years and will possibly continue to chime for the next fifty. It will be auctioned tomorrow after being cleaned.

Digit Symbol - Coding



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9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

2	7	3	6	5	1	9	8	4	5	7	3	1	4	8	7	9	1	4	5

7	1	8	2	9	3	6	7	2	8	5	2	3	1	4	8	4	2	7	6

Digit Symbol - Incidental Learning

Pairing

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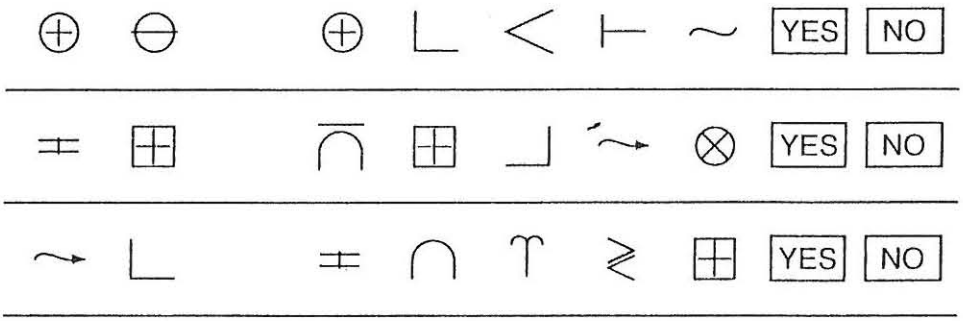
8	5	6	3	1	9	4	7	2

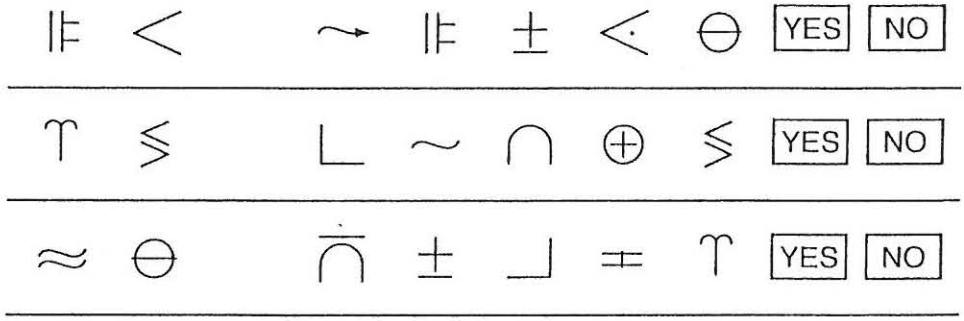
Free Recall

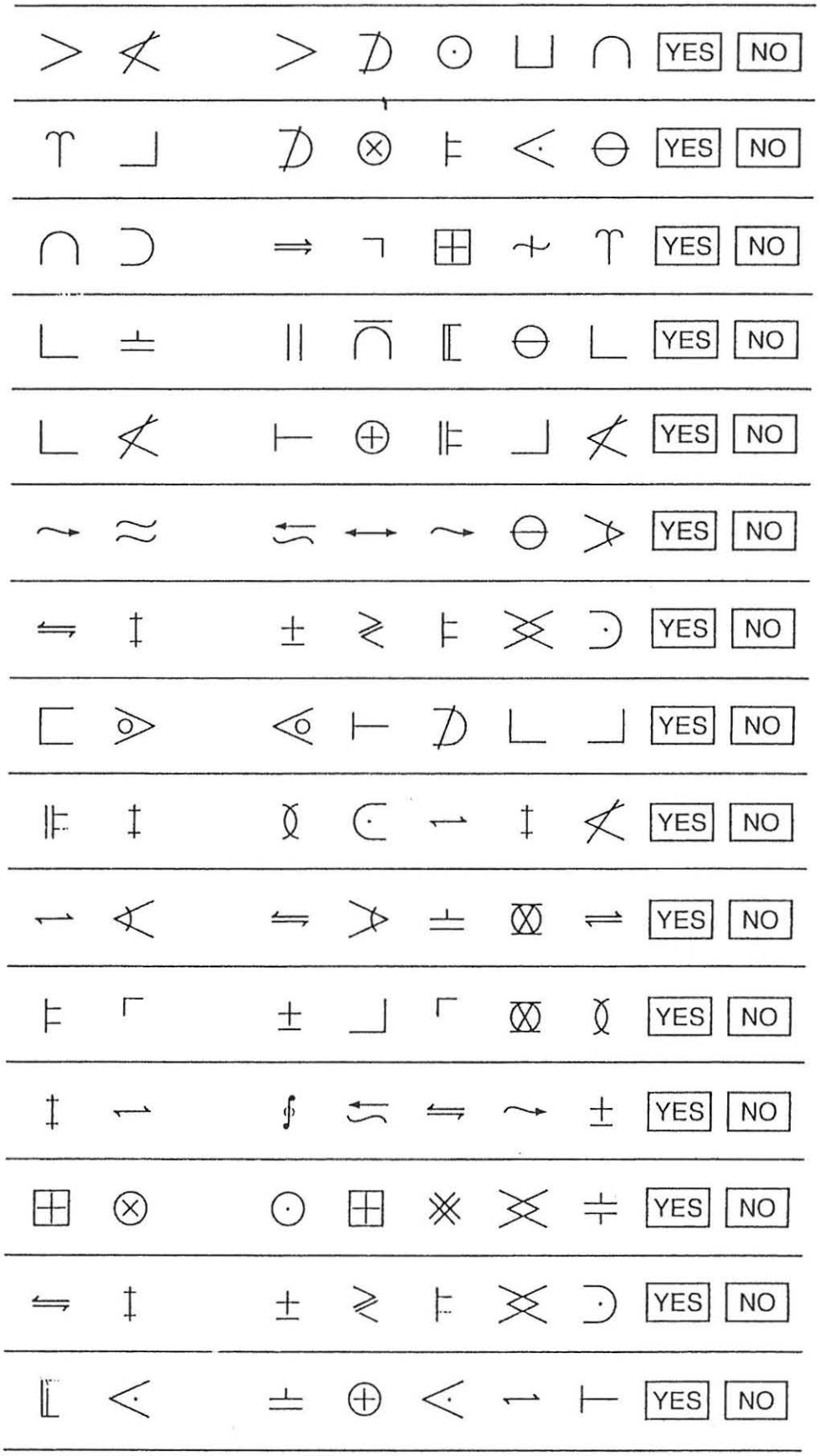
Symbol Search

Sample Items



Practice Items

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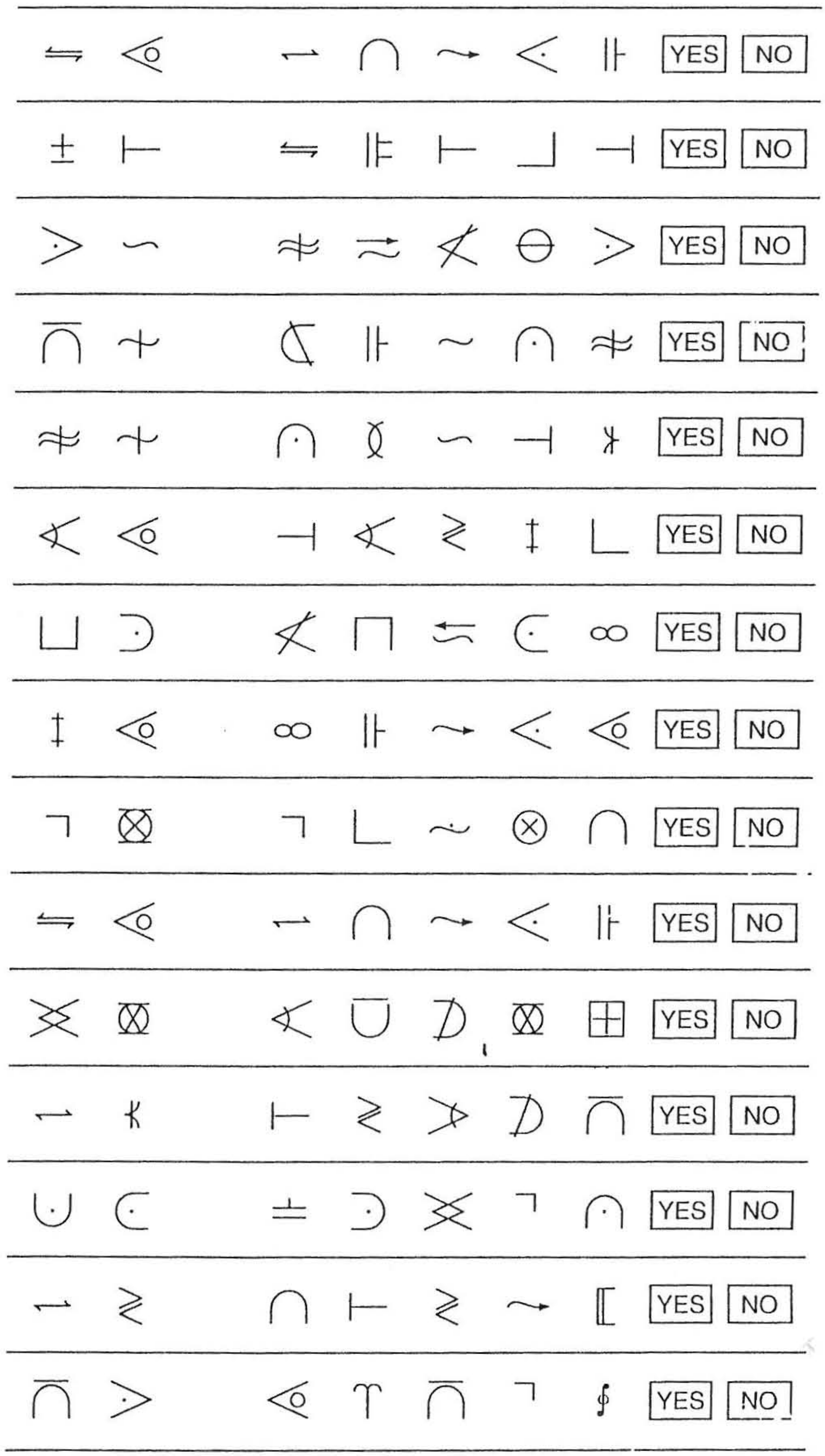
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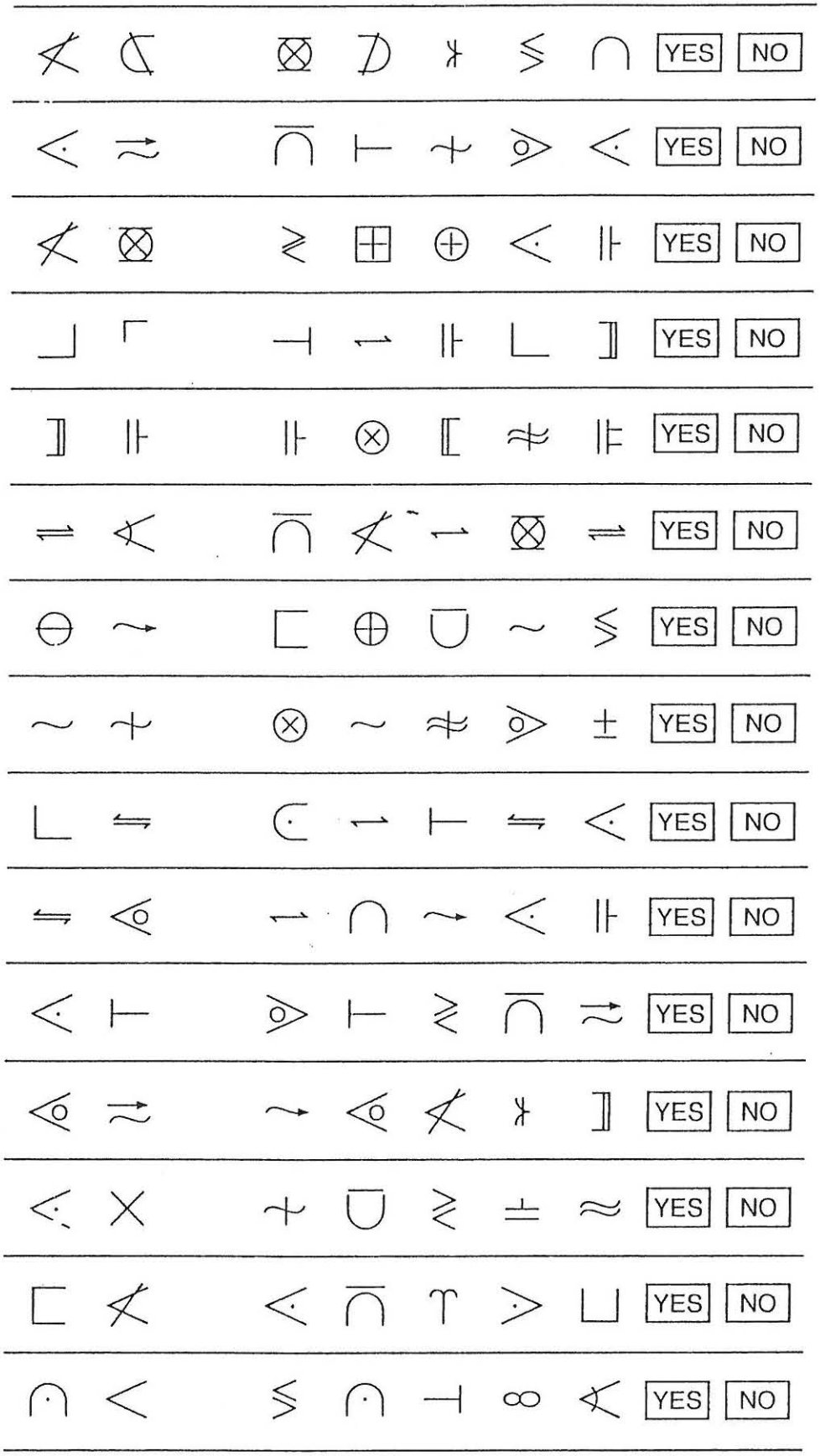
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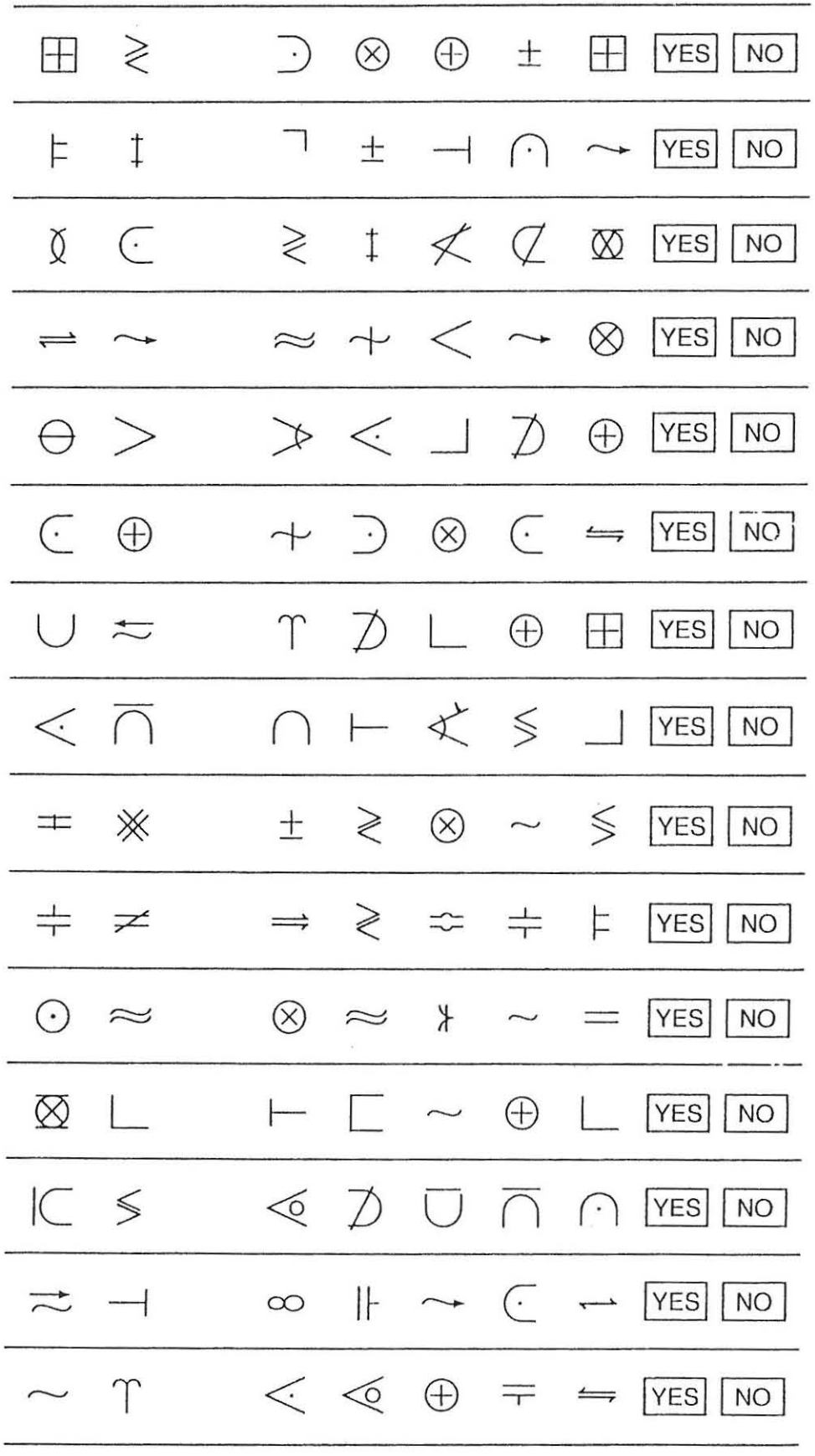

YES NO

Symbol Copy

Samples

APPENDIX D:

Response Booklet

WAIS-III Master's Research

Response Booklet

Protocol Number: [ ]

INFORMED CONSENT

In South Africa we have had various tests to measure IQ - you may have completed one at school or when applying for a job. These tests have been found to be outdated and problematic in various ways, especially in terms of their applicability to previously disadvantaged groups. In America and Britain they have now developed a new test: the Wechsler Adult Intelligence Scale-III (WAIS-III), which is hoped to be more fair and less culturally biased towards certain groups. We are conducting this research on the WAIS-III to see how specific variables in the South African context affect performance on this test. This will allow us to see if the use of this test in South Africa and for various population groups will be fair and acceptable in terms of the new labour legislation.

We are doing this research as part of our Masters in Clinical Psychology at Rhodes University, Grahamstown and would thus appreciate your co-operation in completing the tests and supplying us with certain demographic information. The information provided will be treated as confidential. The results will not be linked to specific participants and specific test performance will not be available to anyone besides the researchers. Results of this research may be used for presentation at conferences and for publication in professional journals.

I_____ have read the above and give my consent for the information given and test performance results to be used for the above mentioned research.

_____ Signed

_____ Date

SOCIO-ECONOMIC QUESTIONNAIRE:

CAREGIVERS

Who were your primary caregivers at various stages of schooling ?

	Pre-School	Primary School	High School	Post School
Mother	☐	☐	☐	☐
Father	☐	☐	☐	☐
Other 1:_____	☐	☐	☐	☐
Other 2:_____	☐	☐	☐	☐
Other 3:_____	☐	☐	☐	☐

What was/is the educational level of your parents/caregivers?

	Father	Mother	Other 1	Other 2	Other 3
None	☐	☐	☐	☐	☐
Less than Std 6	☐	☐	☐	☐	☐
Std 6 – 7	☐	☐	☐	☐	☐
Std 8 – 9	☐	☐	☐	☐	☐
Std 10/Matric	☐	☐	☐	☐	☐
Degree/Diploma +	☐	☐	☐	☐	☐

What kind of work did your parents/caregivers do?

	Father	Mother	Other 1	Other 2	Other 3
Unemployed	☐	☐	☐	☐	☐
Unskilled	☐	☐	☐	☐	☐
Semi-skilled	☐	☐	☐	☐	☐
Skilled	☐	☐	☐	☐	☐
Professional	☐	☐	☐	☐	☐

What were the other forms of income in the participant's home?

	Father	Mother	Other 1	Other 2	Other 3
Old Age Pension	☐	☐	☐	☐	☐
Disability Grant	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

TYPE AND QUALITY OF HOME

What kind of home did the participants live in across the various stages of their schooling?

	Pre-School	Primary School	High School	Post School
Informal dwelling/shack	☐	☐	☐	☐
Flat/cluster home/town house	☐	☐	☐	☐
Brick house	☐	☐	☐	☐
A traditional dwelling	☐	☐	☐	☐
Room in backyard of property	☐	☐	☐	☐
Other:_____	☐	☐	☐	☐

Across the various stages of schooling, was the participant's home:

	Pre-School	Primary School	High School	Post School
Owned	☐	☐	☐	☐
Rented	☐	☐	☐	☐
Other:_____	☐	☐	☐	☐

BASIC FACILITIES IN THE HOME

Across the various stages of schooling did the participant's home have:

	Pre-School	Primary School	High School	Post School
Running Water:	☐	☐	☐	☐
Electricity:	☐	☐	☐	☐
Flush Toilet:	☐	☐	☐	☐

EDUCATIONAL FACILITIES IN THE HOME

Across the various stages of the participants schooling did they have access to:

	Pre-School	Primary School	High School	Post School
Radio	☐	☐	☐	☐
Television	☐	☐	☐	☐
Books	☐	☐	☐	☐
Magazines/ Newspapers	☐	☐	☐	☐
Children's Books	☐	☐	☐	☐
Access to Libraries	☐	☐	☐	☐
Did your parents read to you	☐	☐	☐	☐
Pens and Pencils	☐	☐	☐	☐
Computer	☐	☐	☐	☐

1. Picture Completion

TIME LIMIT
20 seconds each item

REVERSE RULE
Score of 0 on Item 6 or 7, administer Items 1–5 in reverse sequence until two consecutive perfect scores are obtained

DISCONTINUE RULE
5 consecutive scores of 0

	Item	Response	Score (0 or 1)
1.	Comb		
2.	Table		
3.	Face		
4.	Briefcase		
5.	Train		
START → 6.	Door		
7.	Glasses		
8.	Pitcher		
9.	Pliers		

	Item	Response	Score (0 or 1)
10.	Leaf		
11.	Pie		
12.	Jogging		
13.	Fireplace		
14.	Mirror		
15.	Chair		
16.	Roses		
17.	Knife		
18.	Boat		

	Item	Response	Score (0 or 1)
19.	Basket		
20.	Clothing		
21.	Lockers		
22.	Cow		
23.	Tennis Shoes		
24.	Woman		
25.	Barn		
		Total Raw Score (Maximum = 25)	

2. Vocabulary

REVERSE RULE
Score of 0 or 1 on Item 4 or 5, administer Items 1–3 in reverse sequence until two consecutive perfect scores are obtained.

DISCONTINUE RULE
6 consecutive scores of 0

DO ADDITIONAL ITEMS

SCORING RULE
All Items: 0, 1, or 2 pts.

	Item	Response	Score (0, 1, or 2)
1.	Bed		
2.	Ship		
3.	Penny		
START → 4.	Winter		
5.	Breakfast		
6.	Repair		
7.	Assemble		

2. Vocabulary *(continued)*

Item	Response	Score (0, 1, or 2)
8. Yesterday		
9. Terminate		
10. Consume		
11. Sentence		
12. Confide		
13. Remorse		
14. Ponder		
15. Compassion		
16. Tranquil		
17. Sanctuary		
18. Designate		
19. Reluctant		
20. Colony		
21. Generate		
22. Ballad		
23. Pout		
24. Plagiarize		
25. Diverse		
26. Evolve		
27. Tangible		
28. Fortitude		
29. Epic		
30. Audacious		
31. Ominous		
32. Encumber		
33. Tirade		

Total Raw Score
(Maximum = 66)
(Include credit for items on previous page.)

Additional Items

34.	Negotiation		
35.	Marathon		
36.	Complicated		
37.	Financial		
38.	Virus		
39.	Illustrate		
40.	Vandalism		
41.	Superficial		
42.	Autobiography		
43.	Pandemonium		

3. Digit Symbol—

Coding
(previous page)

Time Limit	120"
Completion Time	
Total Raw Score	Maximum=133

Digit Symbol—

Incidental Learning (Optional)
(Response Booklet)

	Total Score
Pairing	Maximum=18
Free Recall	Maximum=9

Digit Symbol—

Copy (Optional)
(Response Booklet)

Time Limit	90"
Completion Time	
Total Raw Score	Maximum=133

4. Similarities

	Item	Response	Score (0 or 1)
1.	Fork–Spoon		
2.	Socks–Shoes		
3.	Yellow–Green		
4.	Dog–Lion		
5.	Coat–Suit		
START 6.	Piano–Drum		(0, 1, or 2)
7.	Orange–Banana		
8.	Eye–Ear		
9.	Boat–Automobile		
10.	Table–Chair		
11.	Work–Play		
12.	Steam–Fog		
13.	Egg–Seed		
14.	Democracy–Monarchy		
15.	Poem–Statue		
16.	Praise–Punishment		
17.	Fly–Tree		
18.	Hibernation–Migration		
19.	Enemy–Friend		
		Total Raw Score (Maximum = 33)	

5. Block Design

REVERSE RULE
Score of 0 or 1 on Item 5 or 6, administer Items 1-4 in reverse sequence until two consecutive perfect scores are obtained

DISCONTINUE RULE
3 consecutive scores of 0

SCORING RULE
Items 1-6: 2 pts. for each correct design in Trial 1
1 pt. for each correct design in Trial 2
0 pts. for each incorrect design in Trials 1 & 2
Items 7-14: Circle the appropriate score up to a maximum of 7 pts.

EXAMINEE (Leave this column blank)

	Design	Time Limit	Incorrect Design	Time in Seconds	Correct Design	Score (Circle the appropriate score for each design)
	1.	30"	Trial 1 Trial 2		Y N	0 Trial 2: 1 Trial 1: 2
	2.	30"	Trial 1 Trial 2		Y N	0 Trial 2: 1 Trial 1: 2
	3.	30"	Trial 1 Trial 2		Y N	0 Trial 2: 1 Trial 1: 2
	4.	30"	Trial 1 Trial 2		Y N	0 Trial 2: 1 Trial 1: 2
START	5.	60"	Trial 1 Trial 2		Y N	0 Trial 2: 1 Trial 1: 2
	6.	60"	Trial 1 Trial 2		Y N	0 Trial 2: 1 Trial 1: 2
	7.	60"			Y N	0 16"-60": 4 11"-15": 5 6"-10": 6 1"-5": 7
	8.	60"			Y N	0 16"-60": 4 11"-15": 5 6"-10": 6 1"-5": 7
	9.	60"			Y N	0 21"-60": 4 16"-20": 5 11"-15": 6 1"-10": 7
	10.	120"			Y N	0 36"-120": 4 26"-35": 5 21"-25": 6 1"-20": 7
	11.	120"			Y N	0 66"-120": 4 46"-65": 5 31"-45": 6 1"-30": 7
	12.	120"			Y N	0 76"-120": 4 56"-75": 5 41"-55": 6 1"-40": 7
	13.	120"			Y N	0 76"-120": 4 56"-75": 5 41"-55": 6 1"-40": 7
	14.	120"			Y N	0 66"-120": 4 46"-65": 5 36"-45": 6 1"-35": 7

EXAMINER

6. Arithmetic

Problem	Time Limit	Completion Time in Seconds	Correct Response	Response	Score (0 or 1)	Problem	Time Limit	Completion Time in Seconds	Correct Response	Response	Score (0 or 1)
1.	15"		3			11.	30"		$10.50		
2.	15"		7			12.	60"		30¢		
3.	15"		5			13.	60"		$186.00		
4.	15"		2			14.	60"		10		
START 5.	15"		$9.00			15.	60"		$600.00		
6.	15"		$4.00			16.	60"		43		
7.	30"		5			17.	60"		$51.00		
8.	30"		$1.50			18.	60"		$49.50		
9.	30"		8			19.	60"		1 of 4 or 5 of 20		(0, 1, or 2) 0 / 11"–60" 1 / 1'–10" 2
10.	30"		$3.60			20.	120"		96		0 / 11"–120" 1 / 1'–10" 2

Total Raw Score (Maximum = 22)

7. Matrix Reasoning

Note: Correct response appears in ***bold italic.*** Administer Sample Items A–C to all examinees.

Item	Response Options (Circle one)						Score (0 or 1)
A.	1	***2***	3	4	5	DK	
B.	1	2	3	4	***5***	DK	
C.	1	2	3	***4***	5	DK	
1.	1	2	***3***	4	5	DK	
2.	1	2	***3***	4	5	DK	
3.	1	***2***	3	4	5	DK	
START 4.	1	***2***	3	4	5	DK	
5.	1	2	***3***	4	5	DK	
6.	***1***	2	3	4	5	DK	
7.	1	2	3	4	***5***	DK	
8.	***1***	2	3	4	5	DK	
9.	1	***2***	3	4	5	DK	
10.	1	2	3	***4***	5	DK	
11.	1	2	3	4	***5***	DK	
12.	***1***	2	3	4	5	DK	

Item	Response Options (Circle one)						Score (0 or 1)
13.	1	2	3	***4***	5	DK	
14.	1	2	***3***	4	5	DK	
15.	1	***2***	3	4	5	DK	
16.	1	***2***	3	4	5	DK	
17.	***1***	2	3	4	5	DK	
18.	1	2	3	4	***5***	DK	
19.	1	2	***3***	4	5	DK	
20.	1	2	3	***4***	5	DK	
21.	1	2	***3***	4	5	DK	
22.	1	2	***3***	4	5	DK	
23.	1	***2***	3	4	5	DK	
24.	***1***	2	3	4	5	DK	
25.	1	***2***	3	4	5	DK	
26.	1	2	3	4	***5***	DK	

Total Raw Score (Maximum = 26)

8. Digit Span

Digits Forward Trial Item/Response	Trial Score	Item Score (0, 1, or 2)
START 1. 1 1-7		
2 6-3		
2. 1 5-8-2		
2 6-9-4		
3. 1 6-4-3-9		
2 7-2-8-6		
4. 1 4-2-7-3-1		
2 7-5-8-3-6		
5. 1 6-1-9-4-7-3		
2 3-9-2-4-8-7		
6. 1 5-9-1-7-4-2-8		
2 4-1-7-9-3-8-6		
7. 1 5-8-1-9-2-6-4-7		
2 3-8-2-9-5-1-7-4		
8 1 2-7-5-8-6-2-5-8-4		
2 7-1-3-9-4-2-5-6-8		

Digits Forward Total Score (Maximum = 16)

Digits Backward Trial Item/Response	Trial Score	Item Score (0, 1, or 2)
1. 1 2-4		
2 5-7		
2. 1 6-2-9		
2 4-1-5		
3. 1 3-2-7-9		
2 4-9-6-8		
4. 1 1-5-2-8-6		
2 6-1-8-4-3		
5. 1 5-3-9-4-1-8		
2 7-2-4-8-5-6		
6. 1 8-1-2-9-3-6-5		
2 4-7-3-9-1-2-8		
7. 1 9-4-3-7-6-2 5-8		
2 7-2-8-1-9-6-5-3		

Digits Backward Total Score (Maximum = 14)

Forward + Backward = (Maximum = 30)

9. Information

Item	Response	Score (0 or 1)	Item	Response	Score (0 or 1)
1.	Saturday		8.	Hamlet	
2.	Age		9.	Brazil	
3.	Ball		10.	MLK, Jr.	
4.	Months		11.	Civil War President	
START 5.	Thermometer		12.	Cleopatra	
6.	Sunrise		13.	Italy	
7.	Weeks		14.	Relativity	

9. Information *(continued)*

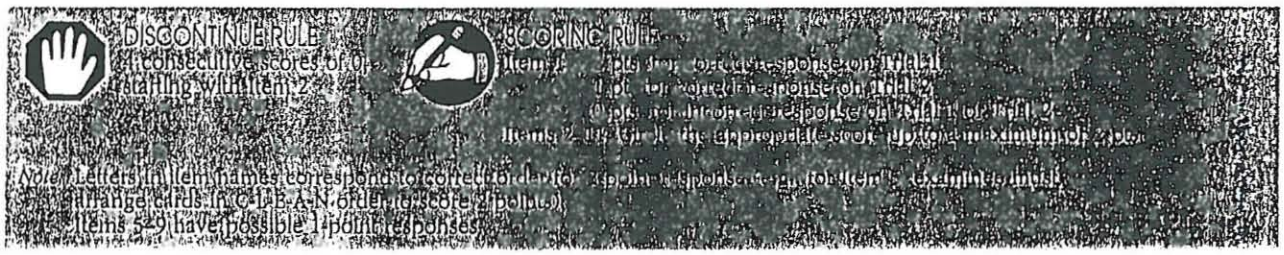
Item	Response	Score (0 or 1)	Item	Response	Score (0 or 1)
15.	Olympics		22.	Vessels	
16.	Sahara Desert		23.	Catherine	
17.	Genesis		24.	Continents	
18.	Sistine Chapel		25..	Curie	
19.	Gandhi		26.	World Population	
20.	Koran		27.	Speed of Light	
21.	Water		28.	Faust	

Total Raw Score
(Maximum = 28)
(Include credit for items on previous page.)

Additional Items

29.	Bird		
30.	Two Oceans		
31.	Stethoscope		
32.	Oldest City		
33.	Picasso		
34.	Telephone		
35.	Mountain		
36.	Country		
37.	Biko		
38.	World War II		
39.	Mona Lisa		
40.	Transplant		

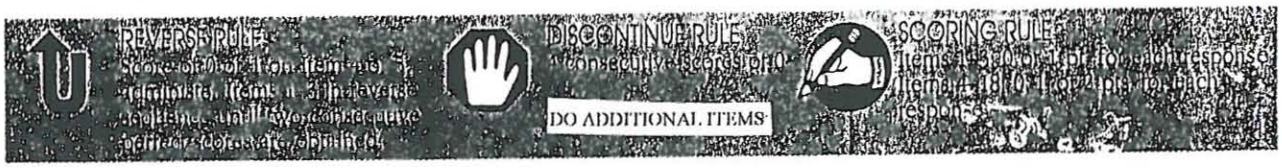
10. Picture Arrangement



Item (2 pts.)	Item (1 pt.)	Time Limit	Response Order	Completion Time in Seconds	Score (Circle One)
START 1. CAP Trial 1		30"			0 1 2
	Trial 2	30"			
2. BAKE		45"			0 2
3. OPENS		60"			0 2
4. CHASE		60"			0 2
5. CLEAN	NCLEA	90"			0 1 2
6. HUNT	THUN	90"			0 1 2
7. SAMUEL/AMUELS	SALMUE	120"			0 1 2
8. LUNCH	LUCNH	120"			0 1 2
9. CHOIR	HCOIR	120"			0 1 2
10. DREAM		120"			0 2
11. SHARK		120"			0 2

Total Raw Score (Maximum = 22)

11. Comprehension



Item	Response	Score (0 or 1)
1. Money		
2. Watches		
3. Clothes		
START 4. Envelope		(0, 1, or 2)
5. Food*		
6. Parole*		

* If the examinee replies with one idea, ask for a second response. Rephrase the test item saying, "Tell me another reason."

11. Comprehension *(continued)*

7. Child labor*	
8. Professional service	
9. Taxes	
10. History*	
11. Deaf	
12. Forest	
13. Jury*	
14. City land	
15. Marriage license	
16. Free press	
17. Swallow	
18. Shallow brooks	

Total Raw Score
Maximum = 33

Additional Items

19.	TV License		
20.	Legal*		
21.	Disaster		
22.	Make hay		
23.	Vessels		
24.	Defendant*		
25.	License		

12. Symbol Search

DISCONTINUE RULE
Discontinue after 120 seconds.

Time Limit	120"
Completion Time in Seconds	
Number Correct	
Number Incorrect	
Total Raw Score	Maximum = 60

13. Letter–Number Sequencing

DISCONTINUE RULE
After failure on all 3 trials of an item.

SCORING RULE
0 or 1 point for each response
Item Score: Trial 1 · Trial 2 · Trial 3

START

	Trial	Item/Response	Trial Score (0 or 1)	Item Score (0, 1, 2, or 3)
1.	1	L-2 (2-L)		
	2	6-P (6-P)		
	3	B-5 (5-B)		
2.	1	F-7-L (7-F-L)		
	2	R-4-D (4-D-R)		
	3	H-1-8 (1-8-H)		
3.	1	T-9-A-3 (3-9-A-T)		
	2	V-1-J-5 (1-5-J-V)		
	3	7-N-4-L (4-7-L-N)		
4.	1	8-D-6-G-1 (1-6-8-D-G)		
	2	K-2-C-7-S (2-7-C-K-S)		
	3	5-P-3-Y-9 (3-5-9-P-Y)		
5.	1	M-4-E-7-Q-2 (2-4-7-E-M-Q)		
	2	W-8-H-5-F-3 (3-5-8-F-H-W)		
	3	6-G-9-A-2-S (2-6-9-A-G-S)		
6.	1	R-3-B-4-Z-1-C (1-3-4-B-C-R-Z)		
	2	5-T-9-J-2-X-7 (2-5-7-9-J-T-X)		
	3	E-1-H-8-R-4-D (1-4-8-D-E-H-R)		
7.	1	5-H-9-S-2-N-6-A (2-5-6-9-A-H-N-S)		
	2	D-1-R-9-B-4-K-3 (1-3-4-9-B-D-K-R)		
	3	7-M-2-T-6-F-1-Z (1-2-6-7-F-M-T-Z)		

Total Raw Score (Maximum = 21)

14. Object Assembly

(Optional)

DISCONTINUE RULE
Do *not* discontinue.
Administer all items.

SCORING RULE
Enter time in seconds and enter number of correct junctures.
Apply time bonus and weightings and circle the appropriate score.

START

Item	Time Limit	Completion Time in Seconds	Number of Correct Junctures	Multiply by	Score (Circle the appropriate score for each object. Completion time in seconds.)
1. Man	120"		(0-5)	1	0 1 2 3 4 5 6 7 8 — 21-120 16-20 11-15 1-10
2. Profile	120"		(0-9)	1	0 1 2 3 4 5 6 7 8 9 10 11 12 — 36-120 31-35 21-30 1-20
3. Elephant	180"		(0-8)	1	0 1 2 3 4 5 6 7 8 9 10 11 — 51-180 31-50 21-30 1-20
4. House	180"		(0-14)	$\frac{1}{2}$*	0 1 2 3 4 5 6 7 8 9 10 — 111-180 71-110 51-70 1-50
5. Butterfly	180"		(0-8)	1	0 1 2 3 4 5 6 7 8 9 10 11 — 111-180 76-110 51-75 1-50

* Round half scores up.

Total Raw Score (Maximum = 52)

APPENDIX E:

Instruction Sheet

INSTRUCTIONS

General Introduction

I'll be asking you to do a number of things today like giving some words definitions and solving a few number problems. You will find some of these tasks easy, whereas others may be more difficult. Also, most people don't answer every question correctly or finish every item, but please give your best effort on all of the items. Do you have any question?

1. Picture Completion

I am going to show you some pictures in which there is some part missing.
Look at each picture and tell me what is missing.

Item 6:

Now, look at this picture. What important part is missing?

Following Items:

Now, what is missing in this one?

If Item 6 is failed:

You see the door knob is missing.

If Item 7 is failed:

You see, the nose is missing.

No further teaching

If object named rather than missing part:

Yes, but what is missing ?

If part that is off the page is mentioned:

Something is missing in the picture. What is it that is missing?

If unessential missing part is mentioned:

Yes, but what is the most important part that is missing?

2. Vocabulary

Now we are going to do something different. In this next section, I want you to tell me the meaning of some words. Now listen carefully and tell me what each word I say means. Are you ready?

Tell me what _____ means.

Prompt with:

Tell me more about it. OR Explain what you mean.

DO ADDITIONAL ITEMS

3. Digit Symbol Coding

In this section, I'm going to ask you to copy some symbols.
Look at these boxes. Notice that each has a number in the upper part and a special mark in the lower part. Each number has its own mark.
Now look down here where the squares have numbers in the top part but the squares at the bottom are empty. In each of the empty squares, put the mark that should go there.
Like this. Here is a 2; the 2 has this mark. So I put it in the empty square, like this.
Here is a 1; the 1 has this mark, so I put it in this empty square.
This number is a 3; the 3 has this mark. So I put it in the square.
Now fill in the squares up to this heavy line.

Now you know how to do them. When I tell you to start, you do the rest of them.
Begin here and fill in as many squares as you can, one after the other without skipping any.
Keep working until I tell you to stop. Work as quickly as you can without making any mistakes.
When you finish this line, go on to this one. Go ahead!

If any are skipped:
Do them in order. Don't skip any. Do this one next.

Digit Symbol - Incidental Learning

Pairing

Now I want you to fill in all of the symbols you can remember that go with these numbers, one after another, across both rows. Tell me when you're finished

Free Recall

In this area, I'd like you to write down all of the symbols you can remember, in any order. Tell me when you have finished.

Copy

These marks are the same ones that you matched with numbers earlier. I'd like you to copy each mark into the empty box below it as fast as you can. Watch me first.
Now you do it up to this line.
Now you copy the rest of the marks as fast as you can until I tell you to stop. Ready? Begin.

4. Similarities

Okay, let's go on. In this section, I am going to read two words to you, and I want you to tell me how they are alike.
In what way are _____ and _____ alike?

If response unclear or ambiguous:
What do you mean?
Tell me more about it.

If multiple acceptable answers:
Now which one is it?

5. Block Design (designs shown from your perspective)

Designs 1-5 : copy models made by examiner

Designs 6- 14: copy designs from book

Design 1-4:

Let's try a new one.

I am going to put these blocks together and make a design. Watch me.

Now make one just like this. Tell me when you are finished. Go ahead.

Trial 2:

Watch me again. Now, try it again and be sure to make it just like mine.

Design 5: (Demonstrate with your own set of blocks and leave them for examinee to see)

Now I am going to ask you to make some designs. you see these blocks? They are all alike. On some sides they are all red; on some, all white; and on some, half red and half white.

I am going to put some blocks together to make a design watch me.

Now make one just like this. Tell me when you have finished.

Design 6: (use examinee's blocks to demonstrate and then scramble - and let them do it)

This time we are going to put blocks together to make them look like this picture. Watch me first.

You see, the tops of the blocks look the same as this picture.

Now look at the picture and make one just like it with these blocks. Tell me when you are finished. Go ahead.

If unsuccessful for Design 5 or 6 - Trial 2: (and then do 1-4 in reverse order till perfect scores for 2)

Watch me again. Now try to make it just like mine. Tell me when you are finished.

Design 7-9:

Now make one just like this. Try to work as quickly as you can. Tell me when you have finished.

Design 10-14:

Now make one just like this using nine blocks. Be sure to tell me when you are finished.

6. Arithmetic

Now we are going to switch tasks again. In this next section, I will ask you to solve some arithmetic problems.

1. Place 3 blocks, all red sides facing up, about 2cm apart, in front of the examinee.
   How many blocks are there all together?
2. Place 7 blocks, like for 1.
   How many blocks are there all together ?
3. Place 7 blocks and demonstrate:
   If you have 7 blocks and take away 2 blocks, how many do you have left?
4. If you have 3 books and give 1 away, how many do you have left?
5. How much is R4 plus R5?
6. If you buy R6 worth of oil and pay for it with a R10 note, how much change should you get back?
7. Cooldrinks are sold 6 to a pack. If you want 30 cans, how many packs must you buy?
8. Chewing gum costs 25c per pack. How much would it cost to buy 6 packs?
9. How many hours will it take a person to walk 24 kilometres at a rate of 3 kilometres per hour?
10. If you buy 7 20c mints and give the shop assistant R5, how much change should you get back?
11. If you have R18 and spend R7 and 50c, how much will you have left?
12. Maria bought 6 lollipops for R1,60. An additional 20 cents sales tax was added to this price. How much did she pay for each lollipop including sales tax?
13. The price of baskets is 2 for R31. What is the price of 1 dozen baskets?
14. What is the average of these numbers: 10, 5 and 15?
15. A family bought some second hand furniture for two-thirds of what it had cost new. They paid R400 for it. How much did it cost new?
16. A family travelled 215 kilometres in 5 hours. What was their average speed in kilometres per hour?
17. A T-shirt that normally sells for R60 is reduced by 15% during a sale. What is the price of the T-shirt during the sale?
18. Chris has twice as much money as Robert. Chris has R99. How much money does Robert have?
19. Linda had 8 yellow paper clips, 5 green paper clips, and 7 orange paper clips. She picked out one paper clip without looking. What was her chance of picking out a green paper clip?
20. If 8 machines are needed to finish a job in 6 days, how many machines would be needed to finish the job in half a day?

7. Matrix Reasoning

I am going to show you some pictures. For each picture, there is a part missing. Look at all aspects of each picture carefully and choose the missing part from the five choices.

Sample A:

For Example, tell me which of these pictures should go here. Make sure you carefully look at the picture on top and at the response choices below before making your selection. If you think there is more than one correct answer to the problem choose the best one. Remember, you are to choose the one that best completes the pattern.

If incorrect:

For this item, the missing part should complete the pattern by making the picture the same colour. See, this choice would best complete the pattern because the squares are all yellow.

Sample B:

Now tell me which of these pictures should go here. Again, make sure you carefully look at the picture at the top and at the pictures below before choosing your answer. If you think there is more than one correct answer to the problem, choose the best one.

If incorrect:

There are a number of ways you can solve this problem. For instance, you can look at the pictures separating them into two columns. Notice the pictures in the left column are the same. They are both the same shape, and they are both blue. Now look at the right column. One of the choices below will make the picture on the right column the same as well. See, this choice here would make the pictures in the right column both yellow circles.

Sample C:

Now tell me which of these pictures should go here.

If incorrect:

All the pictures at the top are circles, and each large circle is followed by a small one. Therefore, the small circle is the best answer.

Items 1-26:

Now tell me which of these pictures should go here.

8. Digit Span

Digits Forwards

I am going to say some numbers. Listen carefully, and when I am through, I want you to say them right after me. Just say what I say.

Digits Backwards

Now I am going to say some more numbers. But this time when I stop, I want you to say them backwards. For example, if I say 7-1-9, what do you say?

If incorrect:

No, you would say 9-1-7. I say 7-1-9, so say it backwards, you would say 9-1-7. Now try these numbers. Remember, you are to say them backwards: 3-4-8

9. Information:

Now I am going to ask you some questions, and I would like you to tell me the answers.

If answer incomplete or unclear:

Explain what you mean OR Tell me more about it.

1. What is the day that comes after Saturday?
2. How old are you?
3. What is the shape of a ball ?
4. How many months are there in a year ?
5. What is a thermometer ?
6. In what direction does the sun rise ?
7. How many weeks are there in a year ?
8. Who wrote Hamlet ?
9. On what continent is Brazil ?
10. Who was Martin Luther King, Jr. ?
11. Who was President of the United States during the Civil War ?
12. Who was Cleopatra ?
13. What is the capital of Italy ?
14. Whose name is usually associated with the theory of relativity ?
15. In what country did the Olympic Games originate ?
16. On what continent is the Sahara Desert ?
17. What is the main theme of the Book of Genesis ?
18. Who painted the Sistine Chapel ?
19. Who was Mahatma Gandhi ?
20. What is the Koran ?
21. At what temperature does water boil ?
22. Name three kinds of blood vessels in the human body ?
23. Who was Catherine the Great ?
24. Name all the continents.
25. What was Marie Curie famous for ?
26. What is the world population ?
27. What is the speed of light ?
28. Who wrote Faust ?

DO ADDITIONAL ITEMS:

29. Name the largest living bird on earth.
30. Between which two oceans does South Africa lie ?
31. What is a stethoscope ?
32. Name the oldest city in South Africa.
33. What do Picasso, Michelangelo and Van Gogh have in common ?
34. Who invented the telephone ?
35. Which mountain range is the highest on earth ?
36. Who wrote "Cry the Beloved Country" ?
37. Who was Steve Biko ?
38. On which side did South Africa join World War II ?
39. Who painted the Mona Lisa ?
40. Who performed the world's first human heart transplant ?

10. Picture Arrangement

In this section, I am going to give you a group of cards that are in the wrong order. Put them together so that they tell a story that makes sense.

Item 1:

These pictures tell a story about a worker building a house, but they are in the wrong order. Put them in the right order so they will tell a story that makes sense.

In incorrect - Trial 2:

These pictures are about a worker building a house. The first one shows when work is just beginning on the house, the next one shows the house partly built, and the last one shows the house finished and being painted.

Now put the cards in the right order.

Items 2-11

I have some more sets of pictures for you to arrange. In each case, they are mixed up, and you are to put them in the right order so they make the most sensible story. Work as quickly as you can and tell me when you have finished

11. Comprehension

Now I am going to ask you to tell me some solutions to everyday problems or social concerns.

Can prompt with:

Explain what you mean OR Tell me more about it OR Tell me another reason.

1. What do people use money for ?
2. Why do people wear watches ?
3. Why do people wash clothes ?
4. What is the thing to do if you find an envelope in the street that is sealed, addressed, and has a new stamp on it ?
5. Tell me why many foods need to be cooked ?
6. Tell me some reasons that we have a parole system.
7. Tell me some reasons why child labour laws are needed.
8. Why does the state require people in some professions to obtain licenses before offering services to the public ?
9. Why should people pay taxes ?
10. Tell me some reasons it is important to study history
11. Why do people who are born deaf have trouble learning to talk ?
12. If you are lost in the forest in the daytime, how should you go about finding your way out?
13. What are some reasons a defendant would choose to be tried by a jury of peers ?
14. Why does land in the city cost more than land in the country?
15. Why does the state require people to get a license before they get married ?
16. Why is the free press important in a democracy?
17. What does this saying mean ? "One swallow doesn't make a summer."
18. What does this saying mean? "Shallow brooks are noisy".

DO ADDITIONAL ITEMS:

19. Tell me why one should be paying for a television license ?
20. Tell me some reasons why one would prefer to have a legal representative in court ?
21. When is an area declared disaster area ?
22. What does this saying mean: "Make hay while the sun shines" ?
23. What does this saying mean: "Empty vessels make the most noise" ?
24. What are some reasons a defendant would choose to be tried in a court of law ?
25. Tell me why all drivers must have a valid driver's license ?

12. Symbol Search

In the next task, I want you to look at two target shapes. Then see if you can find either one of them in the group of shapes next to them.

Sample Item 1:

Look over here. Notice there are two shapes on the left side and a group of shapes on the right side.

You are to mark the "YES" box if one of these shapes on the left side is the same as any of the shapes from the group on the right side.

For example, this shape here is the same as this shape here, so I will mark the "YES" box like this.

Sample Item 2:

For this second item, this shape here is the same as this shape here, so I will mark the "YES" box like this.

Sample Item 3:

Mark the "NO" box if none of the shapes on the left side is the same as any of the shapes from the group on the right side. In this case, none of the shapes here is in this group over here, so this time I will mark the "NO" box like this.

Practice Items:

Now you do these here. Go ahead.

If correct:

Good / Correct / Now you know what to do.

If incorrect:

That is not quite right.

Look here. Here is the shape. Now look over here. Here is the same shape. The shape is the same, so you mark the "YES" box.

OR Look here are the two shapes, but when we look over here, none of the shapes is the same. The shapes are not the same, so you would mark the "NO" box.

Items 1-60:

When I tell you to start, you do these the same way. Begin here and do as many as you can.

When you finish the first page, go on to the next page and so on.

Most people don't do all of them. Work as quickly as you can without changing your answers.

Don't skip any items and don't stop until I tell you to do so. Any questions?

Okay, Ready, Begin!

13. Letter-Number Sequencing

I am going to say a group of numbers and letters. After I say them, I want you to tell me the numbers first, in order, starting with the lowest number. Then tell me the letters in alphabetical order. For example, if I say B-7, your answer should be 7-B. The number goes first, then the letter. If I say 9-C-3, then your answer should be 3-9-C, the numbers in order first, then the letters in alphabetical order. Let's practice.

Practice Items:

6-F	(6-F)
G-4	(4-G)
3-W-5	(3-5-W)
T-7-L	(7-L-T)
1-J-A	(1-A-J)

14. Object Assembly:

Now I want you to put some puzzles together for me.

Item 1:

If you put these pieces together the right way, they will make something. Go ahead and put them together as quickly as you can. Tell me when you are finished.

If incorrect:

See, it goes like this.

Items 2-5:

Now put these pieces together as quickly as you can. Tell me when you have finished.

APPENDIX F:

Scoring Sheet

WAIS-III Master's Research

Scoring Sheet

Protocol Number: _____

		Age Adjusted Scaled Scores					
	Raw Score	VIQ	PIQ	VCI	POI	WMI	PSI
Picture Completion							
Vocabulary							
Digit Symbol							
Similarities							
Block Design							
Arithmetic							
Matrix Reasoning							
Digit Span							
Information							
Pic. Arrangement							
Comprehension							
Symbol Search			( )				
Let. Num. Sequencing		( )					
Object Assembly			( )				
Sum of Scaled Scores							
Index Scores (From Tables)							

Sum of Scaled Scores VIQ:	
Sum of Scaled Scores PIQ:	
Total:	
Full Scale IQ (From Table):	

Additional Scores:

Digit Symbol - Incidental Learning - Pairing	
Digit Symbol - Incidental Learning - Free Recall	
Digit Symbol Copy	
Vocabulary - Additional Items	
Information - Additional Items	
Comprehension - Additional Items	

Approximate Time Taken for the Protocol: _____