AN INVESTIGATION INTO THE EFFECTS OF SOCIO-ECONOMIC AND EDUCATION FACTORS ON WAIS-III PERFORMANCE IN A STRATIFIED SOUTH AFRICAN SAMPLE.

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ABSTRACT

The present study examined the effects of socio-economic status, quality and level of education on performance on the Wechsler Adult Intelligence Scale 3rd Edition (WAIS-III). The study was conducted within the context of the present Human Sciences Research Council (HSRC) WAIS-III standardisation process, cross-cultural psychometric research and the notion of test-wiseness. A South African sample (N = 68) comprising African first language (n = 40) and English first language (n = 28) participants, stratified for age (19 - 30 years), gender and educational attainment (Matric and Graduate) were utilised. Effects due to *quality of education* were determined by dividing the African language participants into those with private/model C schooling (n = 20) and those with DET schooling (n = 20). Effects due to *level of education* were determined by dividing the entire sample into those with Matric level education (n = 34) and those with Graduate level education (n = 34). Detailed demographic and socio-economic information were recorded for all participants, who completed the entire American version of the WAIS-III. Results revealed a highly significant positive correlation between high socio-economic status and WAIS-III Full Scale IQ. In addition the respective impact of the relatively poor quality of education and lower level of educational attainment on WAIS-III performance was substantial. These results were discussed in terms of their implications for cross-cultural research, the HSRC standardisation of the WAIS-III and the practical use of the WAIS-III in neuropsychological assessment.

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Chapter 1: Introduction

The Human Science Research Council (HSRC) recently took the decision to replace the existing South African Wechsler Adult Intelligence Scale (SAWAIS) with the Wechsler Adult Intelligence Scale 3rd Edition (WAIS-III) and to produce a relevant South African standardisation for this test. The Wechsler series are internationally the most widely used and researched individually administered intelligence tests currently in use (Kaufman & Lichtenberger, 1999). The plethora of research done on these various instruments has not prevented controversy following their various applications both inside America, where the tests were designed, and outside thereof (Kamin, 1974; Nell, 1999; Zindi, 1994). Much of this controversy surrounds the nature and definition of intelligence itself.

Sternberg and Salter (1982) argue that, although difficult to conceptualise at times, "there is a definition of intelligence at a very general level" and that definition is "goal-directed adaptive behavior" (p.3). As will be argued below, what is adaptive in different groups and cultures may vary widely (Ardila, 1995). Applying an intelligence test from one culture to another is therefore highly problematic (Helms, 1992), especially when political motives are involved. Examples of this can be found in the South African apartheid use of intelligence tests to justify its separate development policies (Claassen, 1997) and those used to discriminate against immigrants into the United States around the turn of the century (Kamin, 1974).

Many of the intelligence test differences found on racial comparisons have been attributed to a combination of educational, socio-economic and socio-cultural factors (Ardila, 1995; Helms, 1992; Nell, 1999). It has been argued that variations in language ability, pencil use, test anxiety and test concentration may contribute to, and effect performance on measures such as the WAIS-III (Nell, 1999) and are attributable to these very cultural, educational and socio-economic influences. Nell calls these factors 'test-wiseness' and describes them as "the most powerful moderator of test performance" (1999, p. 133). He adds further that most of these factors are

"entrenched classroom-type skills such as fluent reading, automatised knowledge of the alphabet, good pencil control and familiarity with copying tasks – all acquired through exposure to the formal education system" (p. 133). Taking Nell's point further it is evident that test-wiseness is likely to be affected by differential exposure within the school situation, as well as by differential aspects in the home situation depending on the socio-economic status of care-givers. South Africa, particularly, is a country with several diverse groups, each exposed to different socio-economic circumstances and educational facilities, and these may thus be differentially affecting test performance.

The current HSRC standardisation however fails to acknowledge the influence of environmental variables in its standardisation process (Nell, 1999). Demographic data collected in the standardisation do not differentiate between quality of education received and no substantive socio-economic data are collected. Considering these omissions in the HSRC standardisation process, it is crucial to determine whether the WAIS-III is affected by educational and socio-economic factors and to what degree. To ignore these important contributing factors could seriously affect subsequent use and interpretation of the WAIS-III in the South African context (Nell, 1999).

Hence the present study aimed to investigate the effects of socio-economic factors and quality and level of education on performance on the WAIS-III. This was achieved by administering the WAIS-III to a stratified South African sample. Socio-economic information was collected for each participant. The sample was stratified into two quality of education groups, being Department of Education and Training (DET) and Private or Model C school groups. In turn the DET and Private/Model C groups were divided into two levels of education, namely Matric and Graduate. In the South African context, where funding favoured previously white schools, Private and former white Model C schools represent, on average, a far greater quality of education than the previously black disadvantaged DET schools (Kallaway, 1984).

Chapter 2: Literature Review

2.1 Introduction

This study aims to investigate the effects of socio-economic status and education on IQ test performance, specifically on the Wechsler Adult Intelligence Scale 3rd Edition (WAIS-III), within the context of previous research into racial group differences and the present South African WAIS-III standardisation. Therefore research of this nature will be reviewed with particular reference to the history of intelligence tests, socio-economic status, education, culture, test-wiseness and to Wechsler's various attempts to measure intelligence.

2.2 The History of Intelligence Testing

It would appear that much of the impetus to create intelligence tests resulted out of the need to prove the superiority of certain groups, both social and racial. The beginnings of intelligence measurement thus motivated may be traced back to Francis Galton and the publication of *Hereditary Genius, its Laws and Consequences* in 1869 (Feinberg & Resnick, 1997). Galton coined the term 'eugenics' and sought to study the relationship of inheritance to race and talent. Galton's basic argument being that inherited talent had a larger influence than environmental influences. Later Galton's successor Karl Pearson and biologist Walter Weldon founded the journal *Biometrika* in 1901. While it later came to concentrate on statistical research theory, the early volumes of this journal were devoted to promoting the eugenics movement (Feinberg & Resnick, 1997). It was from this original source that many who hoped to show that certain groups were superior to others found inspiration.

While early research supported the eugenics movement this was to alter in the 1920's. What occurred was "a major paradigm shift, from race to culture, and from nature to nurture" (Feinberg & Resnick, 1997 p.11) resulting mainly from accumulating scientific evidence suggesting that

environmental influences played a powerful role in intelligence test performance. The racial argument was not however over and neither was the controversy. Eysenck's (1971) work in the United Kingdom and Jensen's (1969) work in the United States did much to keep the debate alive (Carroll, 1982). Jensen's 1969 article "*How Much Can We Boost IQ and Scholastic Achievement*?" rekindled the divergent views. Feinberg & Resnick (1997) argue:

> This debate, which raged from 1969 to 1975, raised questions about the meaning of IQ, the role of environment, the theory of intelligence, and the use of evidence. The debate was about theory and method in the nature versus nurture conflict. For the public and the popular press, however, it was about race, affirmative action, social programs, and whether the legislation on compensatory education and affirmative action could be maintained and defended. And the contributors often did not try to distance themselves from these issues (p.15).

What had previously been a largely academic debate had now entered the public sphere. The debate flared even hotter after the publication of Herrnstein and Murray's *The Bell Curve* in 1994. Theirs was an argument not just over whether one group was superior to another, but over how social programs should be reshaped in response. It is perhaps not then possible to divorce the development of intelligence tests from the socio-political context in which they were developed.

The first attempts to create psychometric tests can be traced back to James McKeen Cattell, who coined the term 'mental tests' in 1890 (Carroll, 1982; Feinberg & Resnick, 1997). The first intelligence test was described by Frenchmen Binet and Simon in 1896, later to be known as the Binet-Simon Scale (Huysamen, 1983). Lewis Terman, an American, converted this test for English use and after limited trials applied it to 1.7 million army recruits between 1917 and 1919 (Feinberg & Resnick, 1997). This test became known as the *Stanford-Binet*, and together with the original Binet-Simon, was to become the prototype for the development of many intelligence tests, including the Wechsler tests (Carroll, 1982). This test also introduced the term intelligence quotient (IQ) into common use (Huysamen, 1983). Later developments in the USA included the

Army Alpha Test and Army Beta Test, both used on World War I recruits, and the National Intelligence Test and the Terman Group Test of Mental Ability (Carroll, 1982; Feinberg & Resnick, 1997). From these origins developed a group test called the Scholastic Ability Test (SAT) which has been the basis of much research and debate (Carroll, 1982), and is taken by all prospective college students in the USA.

The earliest tests standardised for use in South Africa were the Stanford-Binet and Army Beta Test (Claassen, 1997). The first standardisations were carried out on white individuals only. The South African version of the Stanford-Binet was to become known as the Fick Scale (Claassen, 1997). Early research on differences between white and black samples, using the Stanford-Binet, although acknowledging environmental factors, leaned strongly towards the inherent superiority of the white individual (Claassen, 1997). The *South African Group Test of Intelligence*, a pen and pencil test, was published in 1930, while the *Army General Classification Test*, based on the Army Alpha of the First World War, was extensively used during the Second World War (Huysamen, 1983). The New South African Group Test (NSAGT) replaced the existing South African Group Test in 1956, with revisions published in 1963 and 1965 dividing these tests into Junior, Intermediate and Senior levels (Huysamen, 1983). In 1964, the New South African Individual Scale, an individually administered test, was introduced. In 1980 it was renamed the Senior South African Individual Scale (SSAIS) and along with the South African Wechsler Adult Intelligence Scale (SAWAIS) has been the dominant individual intelligence used in this country for the past three decades (Huysamen, 1983).

The Wechsler-Bellevue Intelligence Scale (W-BIS) was created by David Wechsler in 1939 and was replaced by the Wechsler Adult Intelligence Scale (WAIS) in 1955 (Nell, 1994; Huysamen, 1983). Efforts to produce a South African version of the Wechsler-Bellevue Adult Intelligence

Scale began in 1947 (Nell, 1994). Wechsler's original test (the W-BIS) was based on a number of older tests, some dating back to the Binet-Simon (Nell, 1994). The creation and standardisation of what became known as the South African Wechsler Adult Intelligence Scale (SAWAIS), was only completed in 1969 (Claassen, 1997; Nell, 1994; Pieters & Louw, 1987). As noted above, by this stage the Wechsler-Bellevue had been replaced by the extensively revised Wechsler Adult Intelligence Scale (WAIS). This not withstanding, the South African authorities named their version after the newer test, despite the fact that most of the items were close to thirty years old (Nell, 1994). This test has however remained in use till the year 2000, despite serious critiques (Pieters & Louw, 1987; Nell, 1994).

Since the introduction of the SAWAIS, the Wechsler Adult Intelligence Scale Revised (WAIS-R) has been developed and introduced in 1981, and very recently the Wechsler Adult Intelligence Scale 3rd Edition (WAIS-III) in 1997. The various editions of this American based test remain the most widely accepted intelligence test in this domain internationally (Kaufman & Lichtenberger, 1999), and its various features have been standardised for local use, for example, in the United Kingdom, Australia and New Zealand (Crawford, Gray & Allan, 1995).

Specifically the WAIS-III introduces several advances on its predecessors (Kaufman & Lichtenberger, 1999). Three additional subtests have been added namely Matrix Reasoning, similar to the popular Raven's Progressive Matrices tests and which tests for visual information processing, abstract and fluid reasoning; Symbol Search, which measures visual processing speed, planning and perceptual organisation; Letter-Number Sequencing, which tests working memory, attention and sequencing ability (Kaufman & Lichtenberger, 1999). These subtests strengthen the factor indexes, which are the most important addition to the WAIS-III. These are Verbal Comprehension and Working Memory, both verbal in orientation, as well as Perceptual

Organisation and Processing Speed, both performance in nature. These allow for a more subtle interpretation of results, particularly with regard to neuropsychological assessment (Kaufman & Lichtenberger, 1999). While content has been altered, administration has also been substantially altered, with the introduction of reverse items on most subtests. This allows for the use and assessment of learning, particularly with severely impaired individuals. In summary, the WAIS-III is a substantial improvement on the WAIS-R, and now caters not only for the measurement of IQ, but is now designed with the clinical neuropsychologist firmly in mind (Kaufman & Lichtenberger, 1999).

The decision by the Human Science Research Council (HSRC) to standardise the WAIS-III thus places South Africa abreast of the latest international developments in cognitive testing. Two groups, a main standardisation group, who speak English in the home most of time, and an experimental group comprising various language groups, will be tested (Claassen, 1998). The first group will comprise 900 individuals and the second 700 individuals. The standardisation group will be stratified by age, educational level and gender. Unlike the American standardisation sample, the age range will be between 16 and 69 years, with those between 70 and 89 not being tested. The experimental group will comprise three subgroups; an African first language subgroup, who speak English at work or place of study most of the time; an Afrikaans subgroup who speak English at work or place of study most of the time; and an Afrikaans subgroup who speak Afrikaans at work or place of study most of the time. The entire experimental group will be stratified in the same manner as the standardisation sample, by gender and education level, but will be restricted to the 20 to 34 age range. This will allow for comparisons to be made between these various experimental groups and the standardisation sample group with the same age range. The possible effects of language use and English proficiency on performance will thus be investigated. The completeness of this approach for the South African standardisation has however been called into question, particularly in relation to demographic details of participants relating to socio-economic status and education (Nell, 1999).

Demographic details collected for the current HSRC WAIS-III standardisation for each participant concentrate on basic details such as age, gender, ethnic group, educational level and language. There are only two questions concerning urban versus rural factors. Only if the subjects are between 16 and 19 years of age, is the educational level of parents or caregivers collected. The entire demographic questionnaire contains only 15 items, and this includes the subject's name and address. There are no questions relating to educational quality or to more detailed socio-economic factors, such as home conditions. Merely recording the level of education achieved does not adequately assess the quality of that education. As Nell (1999) points out, in developing countries the standard of education varies widely, and should thus be assessed in more detail.

Despite these reservations, the standardisation of the WAIS-III in South Africa will overcome many of the problems associated with the SAWAIS, which include its outdated content and limited standardisation (Pieters & Louw, 1987). However most of the population of South Africa are not of European extraction and the vast majority speak a first language which is not English. Thus the application of the WAIS-III, despite its wide acceptance, has to be done with much caution. In an attempt to understand the possible problems which may be encountered, a survey of attempts to apply Wechsler's various instruments to other cultures will be presented.

2.3 Applying Wechsler Tests to Different Cultures

A universalist conception of intelligence would argue that the measurement of intelligence can be achieved with the same instruments in different cultures (Nell, 1999). The application of various Wechsler tests to different cultures has however called this notion into question.

Modifications to the American standardised WAIS and the WAIS-R were necessary when applying these tests in Argentina (Insua, 1983). Extensive modifications to the subtests

Vocabulary, Information, and Comprehension were necessary. Moderate alteration to the Arithmetic subtest was also required. A simple translation from English into Spanish did not suffice on Vocabulary as the Latin origins of many difficult items on this subtest, such as 'terminate', 'tranquil' and 'audacious', proved very easy when administered in Spanish. Despite these alterations when age controlled samples, of Argentine and American individuals were compared, the American group significantly outperformed the Argentine group. Scores were similar on most subtests except Digit Symbol, Vocabulary, Arithmetic and Similarities, where the American groups were significantly superior. The educational level of the Argentine group was lower than the American group, and in addition probably of a poorer quality, and Insua hypothesises this as the explanation for the differences, except for Digit Symbol which may be a result of "unknown cultural and personality factors" (1983, p.436). The factor structure amongst both samples was however stable, suggesting that the same underlying abilities were being tested.

Even in English speaking populations modifications to the original American-based Wechsler tests were necessary. In Ireland James and Dalton (1993) produced alternate questions for the WAIS-R Information subtest. The researchers felt that this subtest was the most culturally biased of all the WAIS-R subtests. A similar exercise was carried out in New Zealand (Petrie, Dibble, Long-Taylor & Ruth, 1986). In a more recent New Zealand study, a variety of neuropsychological measures, including WAIS-R Vocabulary, Digit Span and Block Design subtests, were applied to Maori men, urban and rural, aged 16 to 24, all from poor educational backgrounds. (Ogden & McFarlane-Nathan, 1997). While performance on Digit Span was within the normal range (American standardisation), Vocabulary scaled scores were lower (approximately 2 points), while Block Design scaled scores were higher (approximately 2 points) than would be expected. The low Vocabulary score, consistent with low educational achievement, is consistent with Kaufman, McLean & Reynolds' (1988) finding with African-American individuals who took part in the

WAIS-R standardisation who also obtained low scores on this subtest. The Block Design score was surprising, especially considering the sample's educational background. The authors speculate that perhaps "Maori have a particular aptitude for visuospatial perception, construction, and memory" and that "Maori culture is certainly rich in designs not unlike" (p.9) the Block Design patterns.

The application of western IQ tests to very different cultures, such as African cultures is obviously even more difficult (Kendall, Verster & Von Mollendorf, 1988). Zindi (1994) compared the results of 204 black working-class Zimbabwean children with a matched sample of 202 white London children on the Wechsler Intelligence Scale for Children - Revised (WISC-R). Overall the English group had a mean Full Scale IQ of 94.7 while the Zimbabwean group had a mean IQ score of 67.09. The Zimbabwean group fell consistently below the English group by approximately 2.56 scaled points (0.85 standard deviations) on each subtest. At the same time the English group had scored approximately one scale point (0.3 standard deviations) below the American norms, while the Zimbabwean group, were approximately 3 - 4 scaled points (1.3 standard deviations) below the same American norms (recalculated by Nell, 1999 p.132). Zindi also used the Raven's Progressive Matrices, a possibly more culture-fair test, as a comparison. Again the English group outperformed the Zimbabwean sample with mean IQ's being 96.71 and 72.36 respectively.

Zindi found the WISC-R results consistent with previous literature which had "singled out Information, Vocabulary and Comprehension on the WISC-R Verbal scale as the most difficult sub-tests for Blacks" (1994, p.551) in comparison to white samples. This being understandable when the test is given in a foreign language. However Zindi finds the Raven's results less easy to understand, as the test has "less cultural bias since the use of language is not necessary for its

administration" (p. 551). He argues that "Zimbabwean pupils as a whole, especially those from rural areas, are not as familiar with psychometric testing as their English counterparts" and that it is "a known fact that pupils in Western societies are accustomed to taking tests, not only in schools, but even at home where parents in a bid to improve their children's IQs get involved in testing" (p.551). Also that some test items "have concepts which are only too familiar to children living in Western societies but not necessarily to those in Africa" (p.551). Then, referring to Sternberg's "adaptive behaviour" hypothesis, referred to above, Zindi argues that "this view [of intelligence] might be different among some Africans who may see intelligent behaviour as the ability to produce food, looking after members of the extended family and proficiency in hunting skills" (1994, p.552). "If Western intelligence omits activities which are valued as intelligent behaviour by Africans, there is a likelihood that some items on Western designed tests become irrelevant and unrelated to African cultural values and African theories of intelligence" (p. 552) and it is then not surprising that performance is lower by comparison.

In South Africa Avenant (1988) applied the WAIS-R to a sample of 203 black South Africans, aged over 18, with educations at least to the Standard 7 level. This sample was made of 140 prison warders and 63 students from historically black universities, such as Fort Hare, University of Zululand, University of the North and MEDUNSA. Slight alterations to the subtests Information, Arithmetic, Comprehension and Similarities were made, drawing mainly on the SAWAIS for replacement items. The university undergraduates scored better than the prison warders, but fell 1.3 standard deviations below the American standardisation sample, with a mean Full Scale IQ of 77 (recalculated in Nell, 1999 p.132). The prison warder's mean Full Scale IQ was 73. No significant differences between Verbal and Performance IQs were found. While not specified in the research, it could be postulated that the sample which Avenant used reflects a group with a poor education background. The students which these universities draw upon are

generally from poorer socio-economic backgrounds who are unable to afford the traditionally white universities, such as UCT, Wits and Rhodes.

After discussing many problems associated with applying Wechsler's various tests to other cultures, it would be important to point out a successful application. The study of a large United Kingdom sample on the WAIS-R showed that the American norms and distribution were very statistically similar, and the WAIS-R could thus be applied with limited caution in the UK (Crawford, Gray & Allan, 1995). The UK sample was stratified according to age, sex and social class. Perhaps this is not that surprising, considering the similarities these two countries share in relation to culture, language, socio-economic status and the educational quality and level of its inhabitants. However many countries and cultures, and even groups within countries, do not share equivalence with respect to such factors particularly in terms of socio-economic status. A review of the effects of socio-economic status on intelligence test performance will now be presented.

2.4 Socio-Economic Factors and IQ

Despite a recent increase in the literature investigating the relationship between socio-economic variables and IQ test performance, the history of this idea stretches back to at least 1911 (Herrick, 1951). Summarising the literature in 1951, Herrick found consistent consensus regarding the ability of those from higher socio-economic status groups to outperform those from a lower group. Drawing on 9 studies from between 1911 and 1947, Herrick concludes "that the level of education of the parents, their income, interests in reading and books, and nature of housing are particular elements which tend to be significantly related to differences in the intelligence-test performance of their children" (1951, p.14). More specifically "it appears that these studies indicate that, in general, test items which are essentially linguistic or scholastic in nature show comparatively large differences in favour of children from high socioeconomic backgrounds, while

test items which are primarily perceptual or 'practical' in nature show smaller differences or differences in favour of children from lower socioeconomic backgrounds" (1951, p.14).

In the early 1950's work at the University of Chicago sought to investigate the effects of socioeconomic levels on childrens' intelligence test performance (Eells, 1951). Findings were that there was a "definitely significant" (p.53) relationship between IQ and socio-economic status. Eells found that differences were "largest for verbal and smallest for picture, geometric-design, and stylized-drawing items" (1951, p.54). The verbal items of the tests used were described by Eells as appearing to be of "relatively academic or bookish vocabulary" (p.54). Commenting on this Eells considered many of the items "involve words, objects, or concepts with which high-status pupils probably have more opportunity for familiarity through home and other non-school experiences. A number of such items also appear to involve definite school learning" (p.54). Thus the interplay between exposure outside of the school environment, coupled with exposure within the formal school environment is highlighted by these findings. In the same study Eells compared "ethnics" and "nonethnics" performance.

> Differences between the mean IQ's and mean percentile ranks of low-status ethnics and of low-status nonethnics are small (never more than 3 IQ points or 5 percentile-rank points) and are in most cases not significant. In no case do they even approach the magnitude of the differences found between high-status and low-status pupils. (Eells, 1951 p.55)

Eells' study thus revealed that when comparing ethnic or racial groups where socio-economic status is controlled, differences between these groups were not significant. Differences were however accounted for by socio-economic status and educational variables.

These findings were consistent with Kaufman's (1973) analysis of the WPPSI (Wechsler Preschool and Primary Scale of Intelligence) standardisation sample. Findings were that there was

a "significant relationship between SES [socio-economic status] and each of the WPPSI IQs" (p. 356). Particularly when the father's occupational level was highest or lowest, were the largest differences noted. However Kaufman used only the fathers occupational level to determine socio-economic status, which is perhaps not an adequate measure of this variable.

Amante and colleagues (Amante, Van Houten, Grieve, Bader & Margules, 1977) investigated the relationship between intellectual and various perceptual-motor deficits in relation to ethnicity and socio-economic status. He argues that "the prevalence of central nervous system pathology is inversely correlated with socioeconomic status" and that these "appear to be etiologically related to various forms of obstetrical pathology, which are themselves linked with social class and ethnicity" (p.524). At the performance level these deficits appear as various "cognitive and motor abilities - including general intelligence, gross motor processes, psycholinguistic skills, auditory discrimination or information-processing abilities, and visual-motor functions" (p.524). Their study of socio-economic factors was restricted to white subjects and divided into 2 groups, a "manual class" and a "nonmanual class" by means of an unpublished questionnaire, the Hollingshead Index of Social Position. Significant differences between measured IQ were found, with the "manual group" scoring a mean IQ of 102 (with a standard deviation of 11), while the "nonmanual group" scored a mean IQ of 109 (with a standard deviation of 9). Similar differences were found on visual-motor tasks and on the Bender Gestalt copy test. No significant differences were found on auditory discrimination tasks. The authors argue that the distribution of cognitive abilities "is a function of a broad-ranging interrelated set of cultural, social, demographic, political, and economic forces" and thus "social forces appear to be the primary determinants behind the ecological distribution of central nervous system pathology" (p.531). Research conducted by Nichols & Anderson (1974) indicated that controlling for socio-economic status, geographic residence and comparable neo-natal care resulted in reducing differences between black - white ethnic groups on the Stanford-Binet and Wechsler Intelligence Scale for Children (Nichols & Anderson, 1974).

It is possible to use demographic variables to estimate IQ levels, indicating the powerful effect these variables have on IQ test performance. Krull, Scott and Sherer (1995) attempted to determine the influence of certain demographic variables, namely age, education, occupation and race, on WAIS-R performance. Using the American standardisation sample they showed that the use of these demographic variables could very accurately mimic results obtained on the full test. These results were similar to those found on a previous study of the effects of background variables used to predict pre-morbid IQ levels (Barona, Reynolds & Chastain, 1984). Crawford and Allan (1997) attempted similar research on a United Kingdom sample. Their results were very consistent with the American findings. Occupational classification was the best overall predictor variable, accounting for 42%, 43% and 25% of FSIQ, VIQ and PIQ respectively. When age and years of education were added to the equation these variables accounted for 53%, 53% and 32% of FSIQ, VIQ and PIQ respectively. Consistent with the American findings, it would seem that these variables have a greater effect on Verbal IQ and Full Scale IQ, than on Performance IQ.

Low socio-economic circumstances can have subtle negative influences on individuals, particularly growing children. Nutrition is one such effect. Wachs et al. (1996) undertook an extensive study of Egyptian adults in an attempt to determine the effects of nutritional intake on cognitive performance. Four subtests of the Egyptian WAIS-R were used together with the Raven's Progressive Matrices to determine cognitive performance. Results indicated that WAIS-R performance could be predicted using male weight (as an indicator of nutrition). Socio-economic status and IQ were also significantly correlated amongst men, but not amongst women. Gender differences had marked influence on the results. "Specifically, for men, the overall pattern suggests a stronger influence of nutrition on cognition (Raven total, WAIS-R) and reflectivity (Raven reaction time) with a lessor contribution of sociodemographic factors (trend for Raven reaction time). In contrast, for women, the overall pattern of results suggests a strong primary

contribution of educational level (Raven total and, Raven reaction time, WAIS-R), with a lessor contribution of dietary quality (WAIS-R). The specific relevance of education level for female cognitive performance holds even when general social class (SES) is statistically partialed" (p. 149). The authors speculate that the "greater salience of nutrition for male cognitive performance may reflect the hypothesized overvulnerability of men to biological stressors" (p.150). The influence of education on female performance is considered to be "congruent with previous research findings". In either case, male and female cognitive performance is largely related to factors (nutrition and education) which result from the general advantage of being in a higher socio-economic status group.

An interesting history of socio-economic change and IQ is presented by Verster and Prinsloo (1988), and Claassen (1997), with regard to the history of differences between English and Afrikaans speaking South Africans. In 1952 mean differences on the Raven's Progressive Matrices of approximately half a standard deviation (7.5 IQ points) in favour of the English pupils were found. In 1957, during the standardising of the New South African Group Test (NSAGT), English pupils out-scored Afrikaans pupils by an average of 10 points on the non-verbal part of the test. A study of differences showed that Afrikaans pupils came from homes with much lower levels of education (Claassen, 1997). During the standardisation of the Wechsler-Bellevue, in 1959, differences of 7.0 and 8.2 and 12.5 and 13.9 points favouring English participants were found on the verbal and the performance scales on groups younger and older than 44 respectively (Verster & Prinsloo, 1988). Differences between the age groups were attributed to the different experiences, especially education, of the participants. Differences between the English and Afrikaans groups were attributed to lower incomes and wealth of the Afrikaans population in general. As Claassen points out, again the "mean reported IQ differences were thus strongly associated with socio-economic status" (1997, p.300).

In 1965 the NSAGT was applied to over sixty thousand South African Standard 6 pupils. The mean difference, still favouring the English pupils, for the non-verbal part of the test was reduced to 7.4 IQ points (half a standard deviation). By 1981 the IQ difference for the non-verbal part of the NSAGT Intermediate was again reduced to 4.5 IQ points or one third of a standard deviation (Claassen, 1997). Thus in the space of thirty years the IQ differences had been reduced from 10 to approximately 5 IQ points. Claassen attributes this rapid improvement to the social, residential and economic changes, which the Afrikaans speaking population underwent during these years.

> During this period Afrikaans-speaking whites went through a period of rapid urbanisation. Their level of education and income also increased dramatically. It seems that the gradual convergence of mean scores between English-speaking and Afrikaans-speaking whites over 30 years corresponds fairly well with a more general process of cultural and economical convergence between the populations. This is consistent with the view that culture, in its widest sense, plays a significant role in shaping the nature and level of intellectual abilities. (Claassen, 1997 p.300)

What emerges from this historical review is that there is a strong trend towards higher IQ test scores accompanying increasing acculturation, better education and higher income levels.

In summary there appears to be extensive support for the notion that socio-economic status has a large effect on IQ test performance. This influence appears to be greater than the effect of variables such as "ethnicity" or race. Socio-economic status confers various benefits on the individual which includes availability of parents, health and education. This latter advantage may prove to the largest benefit of socio-economic advantage and will be explored in detail below after considering the issue of measuring socio-economic status.

2.5 Measuring Socio-Economic Status

After reviewing the effects of socio-economic status on cognitive test performance it becomes important, particularly in terms of the present study, to discuss the measurement of this variable.

Various methods have been employed in the literature. Amante, Van Houten, Grieve, Bader & Margules (1977) used the Hollingshead Index of Social Position, an unpublished scale, while Wachs et. al. (1996) designed their own unspecified "composite index", based on paternal occupation, home quality and family assets. Kaufman (1973) made exclusive use of the father's occupational status to measure socio-economic status in the children who took part in the WPPSI standardisation. Nell (1999) argues that in South Africa factors such as the presence of running water and electricity in the home should be measured. In addition Nell suggests that the number of persons per habitable room living in the home, as well as the presence of books, magazines, radio, television and home computer should not be ignored. Based on the above literature, and with Claassen's (1985) *Socio-Economic Deprivation Questionnaire* unknown to the author at the time of testing, a socio-economic status questionnaire was constructed for the purposes of the present research (see Appendix D). Broadly the questionnaire was divided into four areas considered to be relevant to socio-economic status. These were: primary caregivers, quality of home, basic facilities in the home and educational facilities in the home. The questionnaire measured factors across the time periods of before school, during primary school, during high school and after finishing school.

Primary Caregivers: The presence and absence of primary caregivers during the various stages of the participant's upbringing were recorded, as well as the educational and occupational level of the caregivers. Any other source of income in the home, such as old age pensions or disability grants, were also recorded.

Quality of Home: The quality of the home in which the participants grew up and whether this was owned or rented was measured.

Basic Facilities in the Home: The presence of electricity, running water and a flush toilet in the home were also measured.

Educational Facilities in the Home: The presence of a radio, television, books, magazines, newspapers, children's books, pens, paper and paper, and a home computer were recorded. In addition access to libraries and whether the participants were read to were also recorded.

2.6 Education and IQ

The relationship between educational achievement and IQ scores is now well established (Ceci, 1991; Kaufman, McLean & Reynolds, 1988), and IQ scores can be used as a proxy to predict potential educational level attainable (Carvajal & Pauls, 1995; Matarazzo & Herman, 1984). Kaufman and colleagues studied the WAIS-R standardisation sample and found that education main effects were statistically significant for all subjects within each of the four age groups (Kaufman, McLean & Reynolds 1988). Correlation's between education years attained and FSIQ, for the Wechsler-Bellevue were recorded as 0.64, between 0.69 and 0.72 for the WAIS, and between 0.62 and 0.63 for the WAIS-R (Matarazzo & Herman, 1984). As Matarazzo & Herman point out, what is not addressed in these correlations "is the issue of cause and effect" (p.631). Is it intelligence effecting educational achievement or education effecting IQ scores? However well established the correlation between Full Scale IQ and education may be, differential effects thereof on scoring across cultural groups and on neuropathological populations is less well known.

In an attempt to address this imbalance, Finlayson and colleagues (Finlayson, Johnson & Reitan, 1977) studied a group of brain-damaged and non-brain-damaged individuals divided into university graduates (15 years of education and greater), high school graduates (12 years only) and those with less than 10 years of education. Using the Wechsler-Bellevue, the Full Scale, Verbal and Performance IQ scores were computed. Most interesting to note, the brain-damaged university group's mean Full Scale and Verbal IQs were higher than the poorly educated non-

brain-damaged individuals. As may be expected this was not true of the Performance scale, being more sensitive to cerebral impairment, but the difference was still less than 9 points. The mean for all the six Verbal subtests was also higher in the brain-damaged university group compared to the poorly educated but non-impaired group. These results point to considerable caution being needed when interpreting neuropsychological test performance. It also highlights the fact that education has an enduring and powerful effect on IQ scores, particularly the Verbal scale.

In a similar study Anthony, Heaton & Lehman (1980) found education to be a large factor in the misdiagnosis of brain-damage. Brain-damaged individuals who were younger, more intelligent and better educated were more likely to receive a false negative diagnosis (i.e. not to be correctly diagnosed as brain damaged when in fact they were brain damaged). While older, less intelligent, and less well educated individuals were more likely to receive a false positive diagnosis (i.e. to be incorrectly diagnosed as brain-damaged). Adams, Boake and Crain (1982) investigated brain-damaged and non-brain-damaged subjects, using the WAIS and other tests, and found that classification of poorly educated individuals as "neurologically impaired" was possible despite the lack of supporting evidence. The effect of education could thus depress performance into the "impaired" range with certain individuals. The researchers did not however speculate as to why certain individuals or groups may be more susceptible to educational bias than others.

A study of elderly African-Americans and white individuals (Manly et. al., 1998a) found significant differences between the groups in favour of the white group. When the education of the participants was controlled, many of the differences became non-significant, except for measures of "figure memory, verbal abstraction, category fluency, drawing, and figure memory" (p.1243). Education was measured by years of education and the authors note that the "variability in the characteristics of school experience of each ethnic group" may be different and may not be "measured adequately by our years-of-education variable" (p. 1243). The quality of education

may thus play an even more important role. As they note of their own sample, "most of our African-American participants were raised in the South and were educated in segregated, rural schools" (pp. 1243-1244). This study indicates that education makes a large contribution to cognitive test performance, but does not explain entirely the different performances, which may be better explained when quality of education is added.

In a study of nondemented, rural elders (Marcopulos, Mc Lain & Giuliano, 1997) education was "an important predictor" (p. 111) of neuropsychological test performance. This research confirmed previous research of the vulnerability of elderly, poorly educated ethnic group members to be incorrectly diagnosed as demented or cognitively impaired. In a similar study of educational effects on performance, this time utilising better educated individuals, it was found that education was a significant predictor of performance on all WAIS-R subtests, except Digit Symbol (Compton, Bachman & Logan, 1997). Here elderly individuals with a better education were able to resist cognitive decline better than those that were less well educated. In a study of the factor structures of elderly individuals (75 and elder) on the WAIS-R, it was found that those individuals who had 12 or more years of education had a different factor structure than those with less than 12 years education (Paolo & Ryan, 1994). This points to the enduring effect of education on cognitive test performance (Wolfle, 1980), even into the very late years of life.

Avenant's (1988) study, noted earlier, found significant differences on all subtests, except Digits Forwards, when comparing her African language South African sample of prison warders, who had 9-12 years of education, with an African language university undergraduate group who had 12 or more years of education. Largest differences were found on Information, Comprehension, Similarities and Digit Symbol favouring the better educated students. These subtests, Digit Symbol excluded, draw on acquired knowledge as well as entrenched verbal skills. Both groups scored well below the expected mean (as noted above p. 11). In contrast Shuttleworth-Jordan (1996), drawing on African language students from more privileged educational backgrounds,

found a consistent trend for non-significant differences on a variety of neuropsychological measures, including Digit Span and Digit Symbol.

In an interesting investigation into practice effects on WAIS-R performance it was found that significant gains were made by participants (Rapport, Brines, Axelrod & Theisen, 1997). Practice effects fall into two categories: item specific factors and procedural factors. This second factor is very interesting in terms of the present study, as it points to the fact that familiarity with procedure is as important as familiarity with content. Individuals who arrive already familiar with procedures, would thus fall into the test-wise category (Nell, 1997), while those completely unaware of these procedures would fall into the non-test-wise category. Rapport, Brines, Axelrod & Theisen (1997) found also that "individuals with Average and High-Average Full Scale IQ at initial testing benefit more from prior exposure to the WAIS-R than do individuals with Low-Average IQ at initial testing" (p.378). They refer to this as the "rich get richer" phenomenon. This finding also supports Horn & Cattell's (1966) theory of fluid and crystallised intelligence, where fluid intelligence allows experience to be converted into crystallised intelligence.

An interesting notion arises as to whether practice effects extend to the theory that staying in the educational system longer increases scores on IQ measures. Hernnstein and Murray (1994) argue that although schooling effects IQ performance, the effect is small. This has been widely disputed (Winship & Korenman, 1997). Using the same data as *The Bell Curve* authors, Winship & Korenman found that "a year of education most likely increases IQ by somewhere between 2 and 4 points" (1997 p.218). This being twice to four times the estimate that Hernnstein and Murray arrived at. Any research into educational effects on IQ scores must confront the obstacle that "individuals with higher initial intelligence may select, or be selected into, higher levels of schooling" (Winship & Korenman, 1997 p.219). In other words that educational achievement is a

result of intelligence - not intelligence a result of education. To overcome this, longitudinal research has to conducted in which an initial IQ assessment can be compared to later IQ assessments, comparing those with initially equal IQ's but now with differing education levels. The literature that will be reviewed falls into this category, as does Hernnstein & Murray's (1994) and Winship & Korenman's (1997) analyses referred to above.

The earliest study of this type was carried out by Lorge in New York in 1921-22 and followed up 20 years later (cited in Winship & Korenman, 1997). Regression analyses based on the data of these studies (calculated by Winship & Korenman, 1997 p.220) revealed estimates increases of 2.28 and 2.37 IQ points per year of education, although certain assumptions were made with the data making it somewhat less reliable. Harnqvist (1968) used a sample of approximately 5000 Swedish boys, tested at thirteen years of age and then re-tested five years later. After controlling for family background and initial IQ, Harnqvist found that one additional year of schooling increased IQ by 2-3 points. In another Scandinavian study, Lund and Thrane (1983) used a sample of 7 703 Norwegian children to do a similar analysis. Of the original sample, 3 400 were re-tested approximately five years later when entering military service. The sample was reduced to 2 485 to include only those with adequate information regarding both testing and education. Using a covariance model, and correcting for measurement error on initial testing, revealed estimates between 2.5 and 2.8 IQ points increase per year of education. Drawing on Swedish military testing, Husen and Tuijnman (1991) found the effect of schooling to be 4.2 IQ points per year of schooling (recalculated by Winship & Korenman, 1997 p. 223). Methodological problems with this research may account for a probable overestimation of effect (Winship & Korenman, 1997). The relationship is however still in evidence, even if overestimated.

Korenman and Winship (1997) cite research indicating that those who were deprived of education in Holland during the Second World War lost 3.33 points of IQ per education year lost. These

authors also cite research from Virginia USA where schooling was stopped from 1959 to 1964 to prevent racially integrated schooling. This research estimates losses to be 6 points of IQ per lost year of education, although again Korenman and Winship suggest that this may be an overestimation based on research methodology.

Wolfle (1980) created a sophisticated correlational model which used several assessments of IQ, and educational input to determine the effects of education on IQ scores. This results in an estimation of an increase of 1.07 IQ points per year of education. This research also controlled for socio-economic status, father's education, age and gender. However this model for determining education effect on IQ has been called into question (Winship & Korenman, 1997). Nonetheless even this study points to the effect of education on measured IQ performance.

In summary the above literature points to the powerful effect of education on IQ test performance. The influence of education on normal as well as neuropathological subjects was noted, as well as the powerfully established relation of IQ and educational achievement. Finally literature indicating that every year of formal education achieved contributes to IQ test performance was presented.

2.7 Culture and Acculturation Factors

Besides socio-economic status and education, a third factor - culture - has been put forward as an explanation for differences on cognitive test performance (Ardila, 1995; Kendall, Verster & Mollendorf, 1988; Shuttleworth-Jordan, 1996; Zindi, 1994). Helms defines culture as the "learned or acquired behaviours or [the] traits attributable to the socialization experiences resulting from membership in particular systems or institutions within society" (1992 p. 1091). Ardila argues that cognitive abilities "usually measured in neuropsychological tests represent, at least in their contents, learned abilities, and it is evident that scores will correlate with the subject's learning

opportunities and contextual experiences" (1995 p.144). These contextual experiences obviously differ from culture to culture and therefore what "is relevant, and worth learning for an Eskimo, does not necessarily coincide with what is relevant and worth learning for an inhabitant of New York, Mogadishu, Manaus, or Bogota" (Ardila, 1995 p.144). It is the culture, through it's values, language and practices, which "provides specific models for the ways of thinking, acting and feeling" (Ardila, 1995 p. 144) which the individual of that culture then adopts and internalises. That differences have been found across cultures serves to support this point. High levels of performance on western cognitive test would thus reflect an individual who was steeped in western culture. Thus it has also been argued that it is the level of acculturation, which is defined as the extent to which individuals from other cultures adopt western-European culture, which is the determining factor in cognitive test performance (Helms, 1992; Manly et al., 1998b).

Considering this point of acculturation, Helms (1992) asks the very valid question: why is there never a study of cultural equivalence attached to standardised cognitive ability tests? Despite the mounting evidence that the application of westernised tests to non-western individuals is fraught with difficulties the type of correction has not been attempted. In a detailed critique of both the biological (nature) and the environmental (nurture) positions Helms (1992) argues strongly for the culturalist perspective on cognitive test performance. She dismisses the biological perspective entirely arguing that when "one compares White groups with one another, environmental quality and culture of origin are fortuitously controlled" while "when comparisons are made across racial groups, environmental quality and exposure to White culture are no longer controlled" (p.1084). What is commonly described as deficits in scores "may instead be difference in acculturation or the learning of White culture" (p. 1084). Intelligence test scores then become "a proxy for the level of mastery of White culture" and further "that Black individuals who perform at the same level as Whites are intellectually superior to the extent that they are functioning so well in a

'foreign' cultural context" (p.1085). Helms critiques the environmental perspective which, she argues, is implicit with "the assumption that White-American culture defines the most intellectually rich environment" (p.1086). She contends that studies showing socio-economic status as a major factor in test performance are flawed, as they impose "White cultural definitions of SES on Black samples and the assumption of socioeconomic homogeneity within the population of Black Americans" (p. 1088). These studies, she contends, have also not measured the amount of acculturation as an intervening variable, which contaminates these studies. There is also very little reference in the psychometric literature, Helms argues, to the effects of oppression on test performance, not to mention any attempts to measure this effect.

Helms (1992) insists that "valid investigation of cultural influences on test performance across racial groups requires the specification and assessment of dimensions thought to characterise each (racial) cultural group, such behaviors, beliefs, and values" (p.1091). This not being possible, the amount of acculturation should then be measured. Caution is again required, as acculturation, "or the learning of culture, is a dynamic process that individuals undoubtedly accomplish at different rates, even within the same ostensible environment. Consequently, knowledge of a person's racial group membership reveals nothing about the amount or type of culture the person has absorbed" (p.1091). This point has also been made in South Africa in relation to cognitive test usage (Shuttleworth-Jordan, 1996; Shuttleworth-Jordan & Bode, 1995). While solutions are not simple, Helms proposes, amongst other things, that measures be developed to assess the level of individual acculturation. However, in the absence of this and "demonstrably culturally equivalent" cognitive tests, use should be made of "separate racial group norms" (p.1098).

Almost as if in response to the Helms suggestions, Manly et al. (1998b) engineered a sophisticated and extensive study of acculturation effects on cognitive test performance. The

researchers note that as a whole, "previous studies of ethnic group differences in neuropsychological test performance among neurologically normal individuals have shown that substantial discrepancies between scores of ethnic minorities and Whites persist, despite equating groups on other demographics such as age, education, sex, and socioeconomic background" (p. 292). They propose acculturation as the intervening variable, and define it as "the level at which an individual participates in the values, language, and practices of his or her ethnic community versus those of the dominant culture". Using a researched African-American acculturation scale, and a self-developed procedure to analyse the use of "Black English", individuals from the African-American community, were assessed as to their level of acculturation. The acculturation scale, recorded information such as traditions, values, beliefs, assumptions and interracial attitudes. An extensive neuropsychological battery was also administered.

Results of the Manly et al. (1998b) study indicated that "a large proportion of [the] neurologically normal African-American sample scored more than 1 standard deviation below the normative mean (T score less than 40) on many of the measures" (1998b, p.296). Significant amounts of variance between the self-report acculturation scale subtests and several measures of performance, specifically the Category Test, Trails B time, WAIS-R Information, Boston Naming Test, WAIS-R Block Design, Trails A time, WAIS-R Digit Symbol, learning components of the Figure and Story Memory Tests, and Grooved Pegboard - dominant hand, were found. A significant relation between acculturation, as measured by "Black English" use, and Trails B time and WAIS-R Information subtest was found. However after accounting for acculturation, the African-American group differences became non-significant, except for the Story Learning Test. These results thus strongly suggest that cultural differences within ethnic groups effect cognitive test performance. The researchers note that the "significant association of acculturation with measures that are strongly associated with achievement in traditional educational settings, such as WAIS-R Information and Vocabulary, suggest that quality of education may be a mediating variable in the relationship between" (p.300) acculturation and cognitive test performance. They

suggest the development, through the study of acculturation, of less culturally biased cognitive measures. Otherwise, the use of "separate ethnic group norms" would be an improvement "over the current use of demographic corrections based on mainly White norms" (p.300). This study uncovers the influence of culture on subtle cognitive processes, and future similar research is in very great need. These results also confirm Shuttleworth-Jordan (1996) findings with relatively well educated and accultured African language individuals who scored within the normal range on a number of neuropsychological measures.

2.8 Test-Wiseness and IQ

Very closely related to the concept of culture is Nell's concept of 'test-wiseness'. Test-wiseness is argued to be a composite of socio-economic, educational and cultural variables, all of which combine to determine the individual's competency when faced with a western psychometric test (Nell, 1999). This notion of test-wiseness is similar to Anastasi's (1982) notion of test sophistication. She argues that those individuals who have prior experience in taking tests of various kinds have a distinct advantage over those that do not. This contributes to "self-confidence and better test-taking attitudes" (p.43), amongst other advantages. Other cross-cultural researchers (Ardila, 1995; Zindi, 1994) also support this notion. The literature reviewed thus far relates in part to the misapplication of IQ tests to various cultures. Nell (1999) argues that these results are due to the fact that individuals from these groups and cultures are not test-wise.

Nell (1999) cites education as a major component of test-wiseness, arguing that amongst the most important components of test-wiseness are "entrenched classroom-type skills" (p. 133). While the highest standard passed may be the most accessible variable it does not reflect the vast differences in education that can be found in developing countries such as South Africa (Kallaway, 1984; Nell, 1999). Quality of schooling differs widely. In relation to the quality of schools Nell asks the following pertinent questions: "does each child have a desk? are there sufficient writing

instruments and paper for each child? is there heating and electricity? is there a school library, and if so, what are it's quality and accessibility? do the children in the higher primary grades have access to computers?" and is there even "a science laboratory" (1999, p. 133)? Secondly, Nell argues that while English literacy should be the product of education, in South Africa even this cannot be taken for granted. This can be very problematic as the "WAIS-III and other IQ tests take literacy for granted, assuming that test takers can read a newspaper and other everyday materials fluently, comprehend what they read, and write well enough to take messages and summarise instructions" (p. 133). Translation of tests into home languages may also not be a solution, as has been found in Argentina (Insua, 1983), and "may block access to terms and concepts [individuals] have acquired through the medium of the English language" (Nell, 1999 p.134). Also closely associated with test-wiseness is socio-economic status and urbanisation. Urbanisation exposes the individual to a stimulus rich environment "with its ubiquitous print and electronic media, and the imperative demands this environment makes for basic numeracy and the ability to read at least directional and warning signs, [which] acts like formal schooling (though more diffusely) to inculcate the elements of test-wiseness" (p.134). The socio-economic level of the home environment should be assessed for all those taking cognitive tests Nell argues, and should look into whether the home has "running water and electricity, the number of people per habitable room, and the presence in the home of books, magazines, radio, television, and a home computer" (p.134).

In summary, the notion of test-wiseness brings together a number of interrelated factors, all of which, singularly or in combination, affect cognitive test performance. These factors are those of education, socio-economic status, urbanisation and acculturation. The first two are the primary focus of the present research.

2.9 Summary of Literature

Within the context of the present HSRC standardisation process of the WAIS-III and previous

cross-cultural group comparisons, research on the relation of socio-economic status and education to IQ test performance was reviewed. This strongly indicated that length of education, and probably quality of education, play a large role in IQ test performance. Research into home circumstances, so called socio-economic factors, indicated that high socio-economic status, even if defined by western notions, is significantly related to higher performance on IQ tests. Finally the notion that culture, or rather acculturation, has a large influence on IQ test performance was investigated. Limited research has been conducted in this area, but this evidence strongly suggests that relatively acculturated individuals, that is those from other cultures who have adopted Western culture, perform better than relatively non-acculturated individuals on cognitive tests. Thus Nell's (1999) notion of test-wiseness, being a composite of Western privilege in the home and in the educational setting, coupled with the adoption of Western cultural values with its facilitating effect on psychometric test performance, is strongly supported by the existing literature.

2.10 Indications for the Present Research

The review of the above literature indicates that test-wiseness and it's related factors, namely socio-economic status, education and culture, play a substantial role in determining performance on measures such as the WAIS-III. Considering the omissions with respect to education and socio-economic variables collected in the HSRC standardisation of the WAIS-III, the effect of these variables, within the South African context, need to be specifically ascertained. Thus, with respect to the present HSRC standardisation of the WAIS-III and to cross-cultural studies of cognitive performance, the present study aims to empirically investigate the effects of socio-economic status and quality and length of education on WAIS-III performance using a stratified South African sample.

Chapter 3: Methodology

3.1 Introduction

The present study formed part of a larger research project that conducted the following analyses on WAIS-III performance:

1) The differential effects of socio-economic circumstances and quality and level of education on overall performance on the WAIS-III and on the individual subtests.
2) The differential effects of language of origin on the overall performance on the WAIS-III and on the individual subtests.
3) The differential effects of gender on the overall performance on the WAIS-III and on the individual subtests.
4) Analysis of the WAIS-III towards the development of a short-form, considering the differential effects of levels and types of education and language of origin (Rust, 2000).

The present study addressed the first level of analysis presented above, being an investigation of the effects of socio-economic factors and quality and level of education on WAIS-III performance.

3.2 Data Collection

The data were collected by four intern clinical psychologists, trained in psychometric assessment, under supervision of a clinical neuropsychologist in the Department of Psychology at Rhodes University.

3.3 Participants

WAIS-III protocols were obtained from 68 volunteer participants stratified in a manner which would facilitate each of the various studies described above, and as delineated in Table A. Whilst the number of participants in each cell is small, analysis entailed the combination of a number of cells. For example in the quality of education analysis, the entire first row of Table A, being African first language individuals who were private or model C schooled (n=20), were compared to the entire second row of Table A, being African first language individuals who were DET schooled (n=20). Participant numbers were restricted due to the lengthy assessment process used in this study and the limited nature of the research projects (all being mini-theses constituting 25% of a clinical psychology degree). In addition certain participants, particularly African language matriculants with private or model C schooling, were difficult to locate. Individuals from privileged schooling backgrounds tended to pursue tertiary education and finding matriculants in these categories was problematic. Participants were between the ages of 19 and 30 (mean age 24.06 years), approximately one decade being frequently used in normative data collections (Mitrushina, Boone & D'Elia, 1999). In this way the effects of age on performance were considered to be minimised.

Table A: Participants Stratified According to First Language, Type and Level of Education, and Gender.

	Matric		Graduate	
	Female	Male	Female	Male
African First Language- Private/Model C School Education	5	5	5	5
African First Language – DET School Education	5	5	5	5
English First Language – Private School/Model C Education	7	7	7	7

Specifically the 68 participants were stratified as follows:

1) Language Categories

The participants comprised African first-language speakers (n=40) who were either working or studying in English, and English first-language speakers (n=28) who were either working or studying in English. First language was ascertained by self report, with basic English competency confirmed via observation at time of testing.

2) Quality of Education Categories

The participants were divided into those who underwent primarily a private or model C school education (n=48) and those that underwent an education in a school under the previous Department of Education and Training (DET) (n=20). It is argued that the former would represent a superior education and the latter a lower quality of education (Kallaway, 1984). Participants were required to have four years of education and to have matriculated from these schools. The African first language sample was divided equally between private/model C (n=20) and DET (n=20) schooled groups, with 14, 6 and 20 participants from private, model C and DET schooling backgrounds respectively. The English first language speakers were all required to have had a private or model C high school education (n=28), with 18 private schooled participants and 10 model C schooled participants.

3) Level of Education Categories

Participants were also equally divided according to the level of education achieved (mean 14.50 years), being those that had only a matric (n=34) and those who have completed at least a three-year tertiary education (n=34). Years of education was calculated according to the number of years it usually takes to achieve the education level achieved, rather than the number of actual years it took to complete the level achieved. Thus Matric was recorded as 12 years, a degree/diploma as 15 years, an honours degree as 16 years and a masters degree as 18 years.

4) Gender

All groups, as depicted in Table A, equally comprised male (n=34) and female (n=34) participants.

Participants were obtained via personal contacts of the researchers, through schools, universities and places of work in the Eastern Cape. Participants outside of this geographic area were obtained in a minor number of cases (two from the Western Cape and one from Gauteng). Participants were excluded if they had a past history of any serious head injuries, learning difficulties, neurological or psychiatric disorder (although no potential participants were in fact excluded on these grounds).

3.3.1 Descriptive Statistics of Participants

The following were the descriptive statistics for the various sub-groups involved in the present study categorised by age, years of education and mean WAIS-III Full Scale IQ (Tables B-D).

Table B: Participant's Age, Years of Education and Full Scale IQ for the Entire Sample.

	N	Mean	Minimum	Maximum	Std. Dev.
Age	68	24.06	19.00	30.00	2.95
Years of Education	68	14.50	12.00	20.00	2.29
Full Scale IQ	68	103.53	63.00	135.00	18.47

For the entire participant sample (Table B above), the mean age is 24.06 years, the mean number of years of education attained is 14.50 years and the mean WAIS-III Full Scale IQ is 103.53. Kolmogorov-Smirnov tests confirmed that the all 21 scale items (subtests, indexes and IQs) of the present sample were normally distributed, with $p>0.20$ for 17 scales and $p>0.10$ for the remaining 4 scales.

Table C: Participant's Mean Age (and Standard Deviation) per Language and Education Group.

	Matric		Graduate	
	Mean	(SD)	Mean	(SD)
DET, African 1st Language N=10 per cell	25.60	(3.86)	27.40	(3.86)
Private/model C, African 1st Language N=10 per cell	21.40	(1.58)	24.00	(2.79)
Private/model C, English 1st Language N= 14 per cell	23.64	(2.41)	22.93	(1.33)

The mean age per language and education group is given in Table C above. The mean age for the Matric and Graduate DET schooled groups falls 1.54 years and 3.34 years above the overall mean age of all participants respectively. The mean age of the African first language private/model C school groups fall below the overall mean age, with the graduates only very marginally below, while the matric group almost 2.5 years below the overall mean age. The English private/model C group mean ages are also below the overall mean age but to a much lesser extent than the African private/model C groups.

Table D: Participant's Mean Years of Education Attained per Language and Education Group.

	Matric	Graduate
	Mean (SD)	Mean (SD)
DET, African 1st Language N=10 per cell	12.20 (0.42)	16.50 (1.58)
Private/model C, African 1st Language N=10 per cell	12.60 (0.70)	16.30 (1.16)
Private/model C, English 1st Language N=14 per cell	12.57 (0.51)	16.71 (1.38)

The mean number of years of education attained for all the matric groups range between 12.20 and 12.60 years (see Table D above) and indicates that there are no substantial differences between the groups on this variable. The three graduate groups' mean years of education attained are also virtually equivalent ranging from 16.30 to 16.70 years.

3.4 Test Materials

The following materials were used to collect the data: an Initial Contact Sheet (Appendix A), an Informed Consent Form (Appendix B), a Demographic Data Sheet (Appendix C), Socio-Economic Questionnaire (Appendix D), Language Proficiency Test (Appendix E), Answer and Response Booklets (Appendix F), administration instructions, a Scoring Sheet (Appendix G) and the WAIS-III test kit itself. These items (explicated below) were administered in the following order.

3.4.1 Initial Contact Sheet

This single page information sheet (see Appendix A) was completed when potential participants were initially contacted and was used to ensure that participants met all the stratification criteria of age, language, type and level of schooling and gender. Exclusion criteria of serious head injuries, learning difficulties, neurological and psychiatric disorders, were contained here, and thus any potential participant who met the exclusion criteria could be excluded at this point. The sheet also recorded contact details and the arranged time and place of testing, as well as the name of the tester.

3.4.2 Informed Consent

Participants were given a verbal explanation as to the aims and background of this study. In addition they were given, at the time of testing, a written consent form, which they were requested to sign and date (see Appendix B). This consent form contained a written explanation of the underlying need for the research and guaranteed complete confidentiality to all participants.

3.4.3 Demographic Data Sheet

Demographic details for each participant were collected. This included age, gender, first language, type of schooling received, level of education achieved, matric symbol, whether they had attained a matric exception and a brief outline of their activities since completing school (see Appendix C).

3.4.4 Socio-Economic Questionnaire

Comprehensive socio-economic details were obtained from all participants(see Appendix D). Drawn up by the researcher, due to the lack of a pre-existing relevant local socio-economic scale, the questionnaire was based on the relevant literature, as discussed above (section 2.5 p. 17). Factors were divided into the following areas:

1) Caregivers

This included who was present in the home to care for the participant; caregiver education and occupational level, and whether there were other forms of income in the home such as a disability grant or a pension of some kind.

2) Type and quality of home

This area primarily recorded whether participants were brought up in brick homes, informal dwellings, traditional dwellings or other home types and whether these were owned or rented.

3) Basic home facilities

The factors recorded were the presence of running water, electricity and a flush toilet in the home.

4) Educational facilities in the home

This section covered the presence of the following items in the home - radio, television, books, magazines and newspapers, children's books, pens, pencils and paper, a personal computer and well as whether the participant was read to as a child and whether he/she had access to libraries.

It took an average 10 minutes to complete this questionnaire. Relevant changes in circumstances across time periods, specifically divided into before school, during primary school, during high school and after high school, were also recorded (see Appendix D). Scoring of the overall socio-economic status of each participant was done utilising four separate methods, as discussed under Statistical Procedure (3.7.1 p. 40) below.

3.4.5 Language Proficiency Test

A pencil and paper language proficiency test was administered to all participants. This formed part of the second level analysis discussed above and was not for analysis as part of the present study, and thus will not be discussed in any further detail here. The test took approximately 15 minutes for participants to complete (see Appendix E).

3.4.6 WAIS-III Test, Answer Booklet, Response Booklet, Instructions & Scoring Sheet

An answer booklet was designed based on the standard WAIS-III answer booklet (see Appendix F). A response booklet, which contained the language proficiency test, the Digit Symbol, Digit Symbol Copy and the Symbol Search subtests, was also drawn up (see Appendix F). A summarised set of instructions was drawn up for ease of use and standardised administration (see Appendix G). A scoring sheet, to summarise raw, scaled and IQ scores was also drawn up and attached to each protocol (see Appendix H).

The standard WAIS-III was used, with minor alterations to the Arithmetic subtest (such dollars to rands, as designed and used by the HSRC for its standardisation process) with all participants. Thus all subtests including the optional Symbol Search, Letter-Number Sequencing and Object Assembly subtests were administered to all participants. In addition several additional items were administered on Vocabulary, Information and Comprehension. These are the possible replacement items, which the HSRC is considering to replace possible culturally biased items, on these subtests. These additional items were not scored or utilised in the present study. However, the administration of these additional items will for these protocols to be re-scored once the HSRC standardisation is complete, for the purposes of possible future research,.

3.5 Procedure

Participants were recruited, as discussed above, through personal contacts of the researchers, through schools, universities and places of work. After the initial contact sheet was completed, a

testing arrangement was made individually with each participant. Testing took place in a variety of settings, including the participant's homes, researcher's homes, the Psychology Department and Psychology Clinic of Rhodes University and various places of work. Time of testing varied, although the majority of testing took place in the evenings, due to the work and study commitments of the participants. Testing always took place in a quiet, private room, which afforded optimal conditions for performance. Testing time usually ran to slightly more than 3 hours, with a mid-way break taken in almost all cases. In some situations, for practical purposes, testing had to take place over more than one session. Participants who requested feedback were given such after the test had been scored by the research team. This feedback was of a general nature, indicating categories of performance rather than numerical IQ scores, and highlighting the strengths of participants.

3.6 Data Processing

The protocols were scored according to the WAIS-III manual scoring criteria. Consensus amongst the research team was achieved in cases of scoring uncertainty. As noted above, the HSRC additional items were not scored. Raw scores were recorded on the scoring sheet. Scaled scores were calculated using the American standardisation and then used to calculate the Full Scale IQ, Verbal IQ, Performance IQ and the various factor Indexes. The entire data of each protocol, including the scoring for each item on every subtest, was entered onto a computer spreadsheet. This allowed for double-checks of addition to be done. All other demographic, socio-economic and language test information were also entered onto the spreadsheet for analysis.

3.7 Statistical Procedure

The statistical procedure for the analysis of socio-economic status and education variables are dealt with separately.

3.7.1 Socio-Economic Status

One aim of the present study was to investigate socio-economic status as a variable effecting WAIS-III performance utilising the entire participant sample. Firstly this was accomplished by determining a number of overall socio-economic status groups and then determining how these groups performed on the WAIS-III in relation to each other. Secondly the individual items making up the socio-economic questionnaire were also investigated as to their relationship with WAIS-III performance. An additional investigation, utilising only the African first language participants, on a limited number of the more statistically significant individual items, was also conducted. This additional investigation was conducted as the African language group constituted a more diverse group, being DET as well as private/model C schooled, than the English language group which comprised only relatively privileged individuals.

In order to allocate participants into groups with respect to socio-economic status, four separate methods were utilised (henceforth described as methods 1-4). Presence of items was used to numerically score the questionnaire, with presence defined as appearing in at least three of the four periods over which the various variables were recorded. Presence of the variable in two or less periods was therefore scored as absent. A possible maximum score of 60 on the various methods was determined and thus participants were divided into various status groups accordingly. For low/high differentiation's (methods 1 and 3) those scoring between 0 and 30 were categorised as falling into the low group, while those above 30 were categorised into the high group. For low/medium/high differentiation's (methods 2 and 4), 0 - 20 indicated low, 21 - 40 indicated medium, and 41 - 60 high, categorisations respectively.

The first method (1) excluded those that did not have complete data concerning any one of the following: mother and father's education and occupational level; quality of home; basic facilities in

the home; and educational facilities in the home; which were used to determine overall socio-economic status. This resulted in 14 participants being excluded, with 5 participants falling into the low group and 49 falling into the high group. The second method (2), using the same information and exclusions as the first method, divided participants into low, medium and high groups, with 1, 8 and 45 in each group respectively. The third overall analysis (method 3) used the same data as the first two methods, except that the educational level and occupational level of parents were excluded, which were essentially the data which could not be provided by many participants, divided participants into high and low groups, with all 68 participants represented. The final method (4) was the same as the third method, except dividing participants in low, medium and high groups.

The following analyses in terms of Full Scale IQ were then conducted on these groups: chi-square, correlation coefficient and Spearman ranked correlations. All chi-square analyses were conducted using the frequency table set out below (Table B), which divided subjects according to Full Scale IQ into one of 3 ranges: 85 and below, 86 to 105 and 106 and above.

Table E: Chi-Square Frequency Table

	High	Medium	Low	Total
Up to 85				
86- 105				
106 and above				
Total:				

Individual items making up the socio-economic questionnaire were than analysed, for all participants, in terms of Full Scale IQ using the following: regression coefficients for caregivers educational and occupational levels; correlation coefficients (parametric) and Spearman ranked (non-parametric) correlations for presence of a brick home, presence of basic facilities in the home, and presence of the educational facilities in the home; and chi- squares (utilising the same frequency table above) for caregivers educational and occupational level (taking the higher of

either), the presence of a brick home, the presence of basic facilities in the home and the presence of educational facilities in the home. Presence of items was defined as above (i.e. appearing in three of the four possible periods recorded). The individual items which related to other income in the home and whether homes were owned or rented did not yield useful information and were not analysed. Bonferroni's adjustment to the significance levels of the individual items was applied, with significance levels reported at $p<0.025$ and $p<0.005$.

The further analysis of individual items for the African language participants was restricted to regression coefficients for caregivers educational and occupational level (mother and father only), and chi-squares (utilising the same frequency table above) for caregivers educational and occupational level (taking the higher of either), the presence of a brick home, the presence of basic facilities in the home and the presence of educational facilities in the home (excluding the 'were you read to' variable).

3.7.2 Education

In terms of the aims of this study, the effects quality of education and level of education were investigated. Three separate t-test analyses, using only the African first language participants, were used to determine the effects of quality of education. The first t-test compared the entire DET schooled group with the entire private/model C schooled group. The second t-test restricted the analysis to the Matric only groups, while the third t-test restricted analysis to the Graduate only groups. Bonferroni's adjustment was applied to the matric and graduate group comparisons, with significance reported at $p<0.025$ and $p<0.005$. A two-way analysis of variance (2xANOVA), was used to determine the effects of quality and level of education within the African first language participants. Finally the effects of level of education within the English first language group was investigated by a t-test comparison of its Matric and Graduate subgroups.

Chapter 4: Results

Results will be presented firstly, with regard to socio-economic status, and secondly, with regard to education. Results of socio-economic analyses are divided between overall socio-economic status and the individual items which comprise the overall scale. Results of education analyses are divided between quality and level of education.

4.1 Socio-Economic Status

The results of the enquiry into the effects of socio-economic status on WAIS-III performance will be reported in the following order: i) Firstly, outcome with respect to the four categorisations of overall socio-economic status. ii) Secondly, outcome with respect to selected individual items from the overall scale.

4.1.1 Overall Socio-Economic Status

As set out in the methodology (section 3.7.1 p. 40), four separate methods for determining socio-economic status were utilised. The results of methods 1 to 4 are set out in chi-square frequency tables (Tables 1 to 4 pp. 44 - 45) below. These frequency tables divide participants into three Full Scale IQ ranges; 85 and below, 86 to 105, and 106 and above, again as specified in the methodology above. Correlation coefficients and Spearman rank correlations for each of methods 1 to 4 with WAIS-III Full Scale IQ appear in Table 5 (p. 45).

Tables 1 - 5 reveal overall SES to be significantly related to IQ test performance, with all chi-squares significant at the $p<0.01$ level. At best only 5 participants from a low SES group achieved a Full Scale IQ of 85 or higher (see Table 3 p. 44). Correlation coefficients and Spearman rank correlations with WAIS-III Full Scale IQ (see Table 5 p. 45) were also significant at the $p<0.01$ level, except for method 1 (overall low/high analysis) in which both the correlation coefficient and

Spearman ranked coefficient were only significant at the $p<0.05$ level. The results obtained are thus consistently significant across the various methods utilised to measure overall socio-economic status and therefore the relationship, between socio-economic status and WAIS-III performance, does not appear to depend on the various ways in which socio-economic status are measured in this study.

Table 1: Method 1 Overall Socio-Economic Status: Low-High Frequency Table for Three WAIS-III Categories.

	Socio-Economic Status		
WAIS-III Full Scale IQ	Low	High	Total
Up to 85	3	3	6
86- 105	2	13	15
106 and above	0	33	33
Total	5	49	54

Pearson Chi-square Value = 15.52** Significance (* $p < 0.05$; ** $p < 0.01$)

Table 2: Method 2 Overall Socio-Economic Status: Low-Medium-High Frequency Table for Three WAIS-III Categories.

	Socio-Economic Status			
WAIS-III Full Scale IQ	Low	Medium	High	Total
Up to 85	1	5	0	6
86- 105	0	3	12	15
106 and above	0	0	33	33
Total	1	8	45	54

Pearson Chi-square Value = 38.29** Significance (* $p < 0.05$; ** $p < 0.01$)

Table 3: Method 3 Overall Socio-Economic Status: Low-High Frequency Table for Three WAIS-III Categories.

	Socio-Economic Status		
WAIS-III Full Scale IQ	Low	High	Total
Up to 85	8	5	13
86- 105	4	16	20
106 and above	1	34	35
Total	13	55	68

Pearson Chi-square Value = 21.12** Significance (* $p < 0.05$; ** $p < 0.01$)

Table 4: Method 4 Overall Socio-Economic Status: Low-Medium-High Frequency Table for Three WAIS-III Categories.

	Socio-Economic Status			
WAIS-III Full Scale IQ	Low	Medium	High	Total
Up to 85	3	9	1	13
86- 105	0	7	13	20
106 and above	0	2	33	35
Total	3	18	47	68

Pearson Chi-square Value = 38.27** Significance (* $p < 0.05$; ** $p < 0.01$)

Table 5: Correlation & Spearman Ranked Correlation Analysis of Overall Socio-Economic Status Methods 1-4 with WAIS-III Full Scale IQ.

	Correlation Coefficient	Spearman Rank Coefficient
	r-value	r_s-value
1. Overall SES - Low/High	0.5113*	0.4688*
2. Overall SES - Low/Medium/High	0.7460**	0.6806**
3. Overall SES - Low/High	0.5405**	0.5172**
4. Overall SES - Low/Medium/High	0.6999**	0.6755**

Significance (* $p < 0.05$; ** $p < 0.01$)

4.1.2 Individual Socio-Economic Items

Analyses of individual items, with the exception of the 'other income in the home' and the 'home owned or rented' variables, making up the overall SES for all participants are presented in Tables 6, 7 and 8 (pp. 46 - 47) below. Selected individual items, analysed for the African Language participants only, appear in Tables 9 and 10 (p. 48).

Chi-square analysis (Table 6 p. 47) of individual SES items for all participants reveals significant frequency distribution on all items except 'Access to Libraries', 'Access to Pens', 'Pencils and Paper', and 'Access to a Personal Computer'. 'Access to Books', 'Magazines and Newspapers', and 'Were you Read to as a Child' were significant at the $p<0.05$ level, with all other items showing a significant frequency distribution at the $p<0.01$ level. Chi-square analysis (Table 10 p. 48) for African language participants, revealed similar results, however 'Access to a Radio', 'Access to

Books', 'Access to Magazines and Newspapers' were not significant, with 'Access to Children's Books' significant at the $p<0.025$ level, after taking Bonferroni's adjustment into account.

Regression coefficient analysis for all participants (Table 7 p. 46) showed that both Mother and Father's education and occupational level were highly correlated to Full Scale IQ, at $p<0.01$. Grandmother's education (where involved in participants upbringing) for all participants was related to Full Scale IQ, significant at the $p<0.05$ level, while her occupational level was not significantly related. Isolating the African first language participants on regression coefficient with Full Scale IQ showed similar results (Table 9 p. 48).

Applying correlational coefficient analysis and Spearman ranked correlational analysis to the individual SES items for all participants (Table 8 p. 47) showed significant relationships on all items except Access to Libraries and Access to Pens, Pencils and Paper in the home. All items were significant at the $p<0.01$ except 'Access to a Radio', 'Access to Books', 'Access to Magazines and Newspapers', which were significant at the $p<0.05$ level.

Table 6: Chi-square Analysis of Individual SES Items for All Participants.

Socio-Economic Variable	Chi-Square Value
Parents Education Level	25.485**
Parents Occupational Level	31.201**
Brick Homes	32.933**
Water	24.877**
Electricity	28.11**
Flush Toilet	34.241**
Radio	13.404**
Television	35.424**
Books	6.015*
Magazines and Newspapers	8.357*
Childrens Books	20.213**
Access to Libraries	3.738
Pens, Pencils and Paper	2.436
Personal Computer	5.986
Were You Read to as a Child?	7.830*

Significance (* $p < 0.05$; ** $p < 0.01$)

Table 7: Regression Analysis of Caregiver's Education and Occupational Level with WAIS-III Full Scale IQ for All Participants.

Socio-Economic Variable	r-Value
Mothers Education	0.6922**
Fathers Education	0.5896**
Grandmothers Education	0.5986*
Mothers Occupational Level	0.6743**
Fathers Occupational Level	0.5935**
Grandmothers Occupational Level	0.2556

Significance (* $p < 0.05$; ** $p < 0.01$)

Table 8: Correlation and Spearman Rank Correlation Analysis of WAIS-III Full Scale IQ with Individual Socio-Economic Items for All Participants.

Socio-Economic Variable	Correlation Coefficient	Spearman Rank Correlation
	r-Value	r_s-Value
Brick Home	0.6107**	0.5601**
Water in Home	0.5943**	0.5737**
Electricity in Home	0.6351**	0.6158**
Flush Toilet in Home	0.6856**	0.6546**
Access to Radio	0.4082*	0.3809*
Access to Television	0.6825**	0.6446**
Access to Books	0.2863*	0.2946*
Access to Magazines/ Newspapers	0.3286*	0.3421*
Access to Children's Books	0.5444**	0.5434**
Access to Libraries	0.2315	0.2344
Access to Pens & Pencils	0.0510	0.0751
Access to a Computer	0.2848**	0.2934**

Significance (* $p < 0.05$; ** $p < 0.01$)

Table 9: **Regression Coefficient Analysis of Selected Socio-Economic Status Variables with WAIS-III Full Scale IQ for African Language Participants.**

Socio-Economic Variable	r - Value
Mothers Education	0.6941**
Fathers Education	0.6885**
Mothers Occupational Level	0.7065**
Fathers Occupational Level	0.5943**

Significance (* $p < 0.025$; ** $p < 0.005$ with Bonferroni's adjustment)

Table 10: **Chi-square Analysis of Individual Socio-Economic Status Items for African Language Participants.**

Socio-Economic Variable	Chi-Square Value
Parents Education Level	17.716**
Parents Occupational Level	14.705**
Brick Homes	17.061**
Water	10.696**
Electricity	13.536**
Flush Toilet	16.527**
Radio	6.242
Television	17.086**
Books	2.079
Magazines and Newspapers	4.835
Childrens Books	9.849*
Access to Libraries	0.325
Pens, Pencils and Paper	2.130
Personal Computer	1.018

Significance (* $p < 0.025$; ** $p < 0.005$ with Bonferroni's adjustment)

4.2 Education

The results of the enquiry into the effects of education on WAIS-III performance will be reported in the following order: i) Firstly, outcome with respect to quality of education. ii) Secondly, outcome with respect to level of education. For ease of reference the full results, including subtest, Indexes and IQs of all education and language groups are given in Table 11 below.

Table 11: Performance on Subtests, Indexes and IQs for each Language and Education Group.

	African First Lang. Private/model C Group Matric	African First Lang. DET Group Matric	African First Lang. Private/model C Group Graduates	African First Lang. DET Group Graduates	English First Lang. Private/mode l C Group Matric	English First Lang. Private/model C Group Graduate
	n=10	n=10	n=10	n=10	n=14	n=14
Picture Completion	10.10	6.50	11.20	8.90	12.21	13.00
Vocabulary	8.50	4.40	13.10	9.30	10.57	15.43
Digit Symbol	11.30	6.10	10.90	9.10	11.50	12.43
Similarities	10.20	6.10	12.60	10.30	11.00	13.57
Block Design	8.40	6.10	9.60	8.70	11.14	11.64
Arithmetic	10.40	7.40	11.70	9.40	10.00	13.50
Matrix Reasoning	12.10	7.40	12.40	9.60	12.43	13.36
Digit Span	10.60	6.70	11.40	9.80	10.86	12.86
Information	8.40	6.10	13.10	9.90	10.29	13.86
Picture Arrangement	8.90	4.20	12.00	6.60	10.57	11.43
Comprehension	11.00	6.50	13.90	10.70	10.50	13.93
Symbol Search	8.50	5.50	10.40	7.80	10.07	11.78
Let-Numb. Seq.	11.40	8.00	12.10	10.80	11.14	13.57
Obj. Assembly	7.10	4.90	8.30	6.30	9.79	9.86
Verbal Comm. Index	94.50	75.20	116.00	99.00	103.14	124.29
Perceptual Org. Index	100.90	80.10	105.90	94.10	111.86	116.29
Working Memory Index	104.50	83.60	109.70	99.50	103.86	119.79
Processing Speed Index	99.20	77.60	103.30	91.20	104.29	111.64
Verbal IQ	98.90	77.20	116.10	98.80	102.71	124.93
Performance IQ	100.80	74.90	107.80	90.40	110.50	116.14
Full Scale IQ	99.90	74.40	113.40	94.90	106.57	123.00

4.2.1 Quality of Education

The differences in quality of education were analysed with t-tests for the entire DET and private/model C school African language groups and are presented in Table 12 (p. 51 below). Further t-test analyses compared African language matric participants with DET schooling with matric participants with private/model C schooling (Table 13 p. 52) and African language graduate participants with DET schooling with graduate participants with private/model C schooling (Table 14 p. 53). A two-way analysis of variance (ANOVA), investigating the effects of quality and level of education for the African language participants is presented in Table 15 (p. 54).

4.2.1.1 DET Education vs. Private/Model C Education

The t-test comparison of all African language individuals who were DET schooled with all individuals who were private/model C schooled (Table 12 p. 51) revealed significant differences for all subtests, Indexes and IQs, except for the Block Design subtest. Letter-Number Sequencing and Object Assembly differences were significant at the $p<0.05$ significance level with all other subtests, Indexes and IQs significant at the $p<0.01$ significance level. All significant differences favoured private/model C schooling.

A two-way analysis of variance (Table 15 p. 54) for all African language participants investigating the effects of quality and level of education, revealed effects due to quality of education significant on all subtests, Indexes and IQs. Block Design and Letter Number Sequencing at the $p<0.05$ level with all other differences significant at the $p<0.01$ level. These results are similar to the t-test comparison of the same groups (Table 12 p. 51), except that Block Design variance is significant at the $p<0.05$ level, as opposed to the non-significant result revealed on the t-test, while Object Assembly variance is significant at the $p<0.01$, compared to the $p<0.05$ level on the t-test. Again all significant differences favoured private/model C schooling.

Table 12: **A t-test Comparison of WAIS-III Subtest Scaled Scores, Indexes and IQs (and Standard Deviations) by Education Type (Private/model C and DET).**

	African First Lang. Private/model C Group Total n=20	African First Lang. DET Group Total n=20	t - Value
	Mean (SD)	Mean (SD)	
Picture Completion	10.65 (2.45)	7.70 (2.97)	3.42**
Vocabulary	10.80 (3.47)	6.85 (3.18)	3.75**
Digit Symbol	11.10 (2.75)	7.60 (2.52)	4.19**
Similarities	11.40 (2.92)	8.20 (3.11)	3.35**
Block Design	9.00 (2.32)	7.40 (2.92)	1.92
Arithmetic	11.05 (3.30)	8.40 (2.14)	3.01**
Matrix Reasoning	12.25 (3.29)	8.50 (3.14)	3.69**
Digit Span	11.00 (3.06)	8.25 (2.63)	3.05**
Information	10.75 (3.13)	8.00 (2.94)	2.87**
Picture Arrangement	10.45 (3.24)	5.40 (2.14)	5.82**
Comprehension	12.45 (3.12)	8.60 (3.07)	3.94**
Symbol Search	9.45 (2.31)	6.65 (2.54)	3.65**
Let-Numb. Sequencing	11.75 (2.47)	9.40 (3.27)	2.57*
Object Assembly	7.70 (2.82)	5.60 (2.04)	2.71*
Verbal Communication Index	105.25 (15.70)	87.10 (15.90)	3.63**
Perceptual Organisation Index	103.40 (12.81)	87.10 (14.72)	3.74**
Working Memory Index	107.10 (13.87)	91.55 (13.72)	3.57**
Processing Speed Index	101.25 (11.70)	84.40 (11.40)	4.61**
Verbal IQ	107.50 (14.52)	88.00 (13.64)	4.38**
Performance IQ	104.30 (13.26)	82.65 (12.97)	5.22**
Full Scale IQ	106.65 (13.53)	84.65 (14.07)	5.04**

Significant Difference (* $p < 0.05$; ** $p < 0.01$)

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4.2.1.2 DET Education vs. Private/Model C Education - Matrics Only

The t-test comparison between the African language participants with matric attained from DET schools and private/model C schools revealed significant differences on all items except Block Design, Information, Letter-Number Sequencing and Object Assembly subtests (Table 13 p. 52), all favouring private/model C schooling. The Arithmetic, Digit Span, Symbol Search and the Working Memory Index differences were significant at the $p<0.025$ significance level, with all other tests, Indexes and IQs significant at the $p<0.005$ level, taking Bonferroni's adjustment into account.

Table 13: A t-test Comparison of WAIS-III Subtest Scaled Scores, Indexes and IQs (and Standard Deviations) by Matrics of Education Type (Private/model C and DET).

	African First Lang. Private/model C Group Matric n=10		African First Lang. DET Group Matric n=10		t - Value
	Mean	(SD)	Mean	(SD)	
Picture Completion	10.10	(2.60)	6.50	(2.12)	3.39**
Vocabulary	8.50	(3.31)	4.40	(1.08)	3.73**
Digit Symbol	11.30	(2.91)	6.10	(1.85)	4.77**
Similarities	10.20	(3.08)	6.10	(1.60)	3.73**
Block Design	8.40	(2.71)	6.10	(2.18)	2.09
Arithmetic	10.40	(3.62)	7.40	(1.35)	2.45*
Matrix Reasoning	12.10	(3.35)	7.40	(3.13)	3.24**
Digit Span	10.60	(3.24)	6.70	(2.58)	2.98*
Information	8.40	(2.37)	6.10	(2.23)	2.24
Picture Arrangement	8.90	(1.91)	4.20	(1.69)	5.83**
Comprehension	11.00	(3.16)	6.50	(2.55)	3.50**
Symbol Search	8.50	(2.27)	5.50	(2.46)	2.83*
Let-Numb. Sequencing	11.40	(2.50)	8.00	(3.74)	2.39
Object Assembly	7.10	(3.67)	4.90	(1.60)	1.74
Verbal Communication Index	94.50	(13.66)	75.20	(8.24)	3.82**
Perceptual Organisation Index	100.90	(14.64)	80.10	(9.76)	3.74**
Working Memory Index	104.50	(16.11)	83.60	(14.61)	3.04*
Processing Speed Index	99.20	(12.54)	77.60	(9.22)	4.39**
Verbal IQ	98.90	(14.98)	77.20	(6.70)	4.18**
Performance IQ	100.80	(14.28)	74.90	(7.89)	5.02**
Full Scale IQ	99.90	(14.28)	74.40	(7.00)	5.07**

Significant Difference (* $p < 0.025$; ** $p < 0.005$ with Bonferroni's adjustment)

4.2.1.3 DET Education vs. Private/Model C Education - Graduates only

The t-test comparison of African language graduates with DET and private/model C education backgrounds revealed less significant differences than the combined and matric groups (Table 14 p. 53) with all significant differences favouring private/model C schooling. However the analysis revealed significant differences, with Bonferroni's adjustment, at the $p<0.025$ level on Symbol Search, the Processing Speed Index and Performance IQ. Significant differences at the $p<0.005$ level, with Bonferroni's adjustment, were found on Vocabulary, Information, Picture Arrangement and Comprehension subtests, as well as on the Verbal Communication Index, Verbal IQ and Full Scale IQ.

Table 14: A t-test Comparison of WAIS-III Subtest Scaled Scores of Subtests, Indexes and IQs (and Standard Deviations) by Graduates of Education Type (Private/Model C and DET).

	African First Lang. Private/model C Group Graduate n=10		African First Lang. DET Group Graduate n=10		t - Value
	Mean	(SD)	Mean	(SD)	
Picture Completion	11.20	(2.30)	8.90	(3.31)	1.80
Vocabulary	13.10	(1.66)	9.30	(2.63)	3.86**
Digit Symbol	10.90	(2.73)	9.10	(2.23)	1.62
Similarities	12.60	(2.32)	10.30	(2.83)	1.99
Block Design	9.60	(1.78)	8.70	(3.09)	0.80
Arithmetic	11.70	(2.98)	9.40	(2.37)	1.91
Matrix Reasoning	12.40	(3.41)	9.60	(2.88)	1.99
Digit Span	11.40	(2.99)	9.80	(1.62)	1.49
Information	13.10	(1.66)	9.90	(2.28)	3.58**
Picture Arrangement	12.00	(3.62)	6.60	(1.90)	4.18**
Comprehension	13.90	(2.42)	10.70	(1.89)	3.29**
Symbol Search	10.40	(2.01)	7.80	(2.15)	2.79*
Let-Numb. Sequencing	12.10	(2.51)	10.80	(2.04)	1.27
Object Assembly	8.30	(1.57)	6.30	(2.26)	2.30
Verbal Communication Index	116.00	(8.78)	99.00	(12.30)	3.56**
Perceptual Organisation Index	105.90	(10.87)	94.10	(15.92)	1.94
Working Memory Index	109.70	(11.46)	99.50	(6.59)	2.44
Processing Speed Index	103.30	(11.07)	91.20	(9.32)	2.64*
Verbal IQ	116.10	(7.50)	98.80	(9.43)	4.54**
Performance IQ	107.80	(11.82)	90.40	(12.63)	3.18*
Full Scale IQ	113.40	(9.03)	94.90	(11.67)	3.96**

Significant Difference (* $p < 0.025$; ** $p < 0.005$ with Bonferroni's adjustment)

Table 15: **Two Way Analysis of Variance (ANOVA) of Performance of African Language Participants on WAIS-III Scaled Scores (Standard Deviations) of Subtests, Indexes and IQs - by Two Levels of Education (Graduate & Matric) - and by Two Qualities of Education (Private/model C & DET).**

	Level			Quality			Inter-action
	Graduate	Matric		Private/model C	DET		
	Mean (SD)	Mean (SD)	F-Value	Mean (SD)	Mean (SD)	F-Value	F-Value
Picture Comp.	10.05 (3.02)	8.30 (2.96)	4.45*	10.65 (2.45)	7.70 (2.97)	12.64**	0.61
Vocab.	11.20 (2.89)	6.45 (3.19)	41.86**	10.80 (3.47)	6.85 (3.18)	28.67**	0.04
Digit Symbol	10.00 (2.60)	8.70 (3.57)	2.78	11.10 (2.75)	7.60 (2.52)	20.16**	4.76*
Similarit.	11.45 (2.78)	8.15 (3.18)	17.12**	11.40 (2.92)	8.20 (3.11)	16.10**	1.27
Block Design	9.15 (2.50)	7.25 (2.67)	5.81*	9.00 (2.32)	7.40 (2.92)	4.12*	0.79
Arithmetic	10.55 (2.87)	8.90 (3.08)	3.69	11.05 (3.30)	8.40 (2.14)	9.53**	0.17
Matrix Reasoning	11.00 (3.39)	9.75 (3.97)	1.53	12.25 (3.29)	8.50 (3.14)	13.75**	0.88
Digit Span	10.60 (2.48)	8.65 (3.48)	5.30*	11.00 (3.06)	8.25 (2.63)	10.53**	1.84
Inform.	11.50 (2.54)	7.25 (2.53)	38.91**	10.75 (3.13)	8.00 (2.94)	16.29**	0.44
Picture Arrangmnt	9.30 (3.95)	6.55 (2.98)	13.03**	10.45 (3.24)	5.40 (2.14)	43.95**	0.21
Compreh.	12.30 (2.68)	8.75 (3.63)	19.43**	12.45 (3.12)	8.60 (3.07)	22.85**	0.65
Symbol Search	9.10 (2.43)	7.00 (2.77)	8.87**	9.45 (2.31)	6.65 (2.54)	15.77**	0.08
Let-Numb. Seq.	11.45 (2.33)	9.70 (3.56)	3.98	11.75 (2.47)	9.40 (3.27)	7.18*	1.43
Object Assembly	7.30 (2.15)	6.00 (2.97)	2.87	7.70 (2.82)	5.60 (2.04)	7.49**	0.02
V-Comm Index	107.45 (12.15)	88.05 (15.86)	42.48**	105.25 (15.70)	87.10 (15.90)	27.27**	0.11
P-Organ. Index	99.10 (14.88)	87.85 (17.40)	5.30**	103.40 (12.81)	87.10 (14.72)	15.60**	1.19
W-Mem. Index	104.15 (13.90)	87.15 (17.05)	6.87**	107.10 (13.87)	91.55 (13.72)	14.93**	1.77
P-Speed Index	107.50 (13.57)	84.85 (14.79)	6.94*	101.25 (11.70)	84.40 (11.40)	25.15**	2.00
Verbal IQ	100.00 (14.58)	90.50 (16.14)	36.31**	107.50 (14.52)	88.00 (13.64)	36.69**	0.47
Perfm. IQ	104.60 (10.79)	94.05 (18.41)	8.95**	104.30 (13.26)	82.65 (12.97)	33.15**	1.28
Full-Scl IQ	97.25 (11.73)	88.40 (15.41)	24.57**	106.65 (13.53)	84.65 (14.07)	41.15**	1.04

Significance (* $p < 0.05$; ** $p < 0.01$)

4.2.2 Level of Education

The effects of level of education within the African language groups was investigated by a two-way analysis of variance, including quality of education (Table 15 p. 54), and within the English language group by a t-test comparison of the matric and graduate groups (Table 16 p. 56).

4.2.2.1 Educational Level Effects in African Language Group

The two-way analysis of variance for African language participants (Table 15 p. 54), which was also referred to for quality of education effects, revealed the following significant effects for *level of education*: Picture Completion, Block Design, Digit Span and the Processing Speed Index at the $p<0.05$ significance level, while differences on Vocabulary, Similarities, Information, Picture Arrangement, Comprehension and Symbol Search subtests, the Verbal Communication, Perceptual Organisation and Working Memory Indexes, and Verbal, Performance and Full Scale IQs were significant at the $p<0.01$ level, all favouring the graduates. Interaction effects between quality and level of education were only present for the Digit Symbol subtest at the $p<0.05$ significance level. All differences favoured graduates over matriculants

4.2.2.2 Level of Education Effects in Private/model C English Group

The t-test analysis presented in Table 16 (p. 56) reveals the effects of level of education on the English language private/model C schooled group. Vocabulary, Arithmetic, Information, Comprehension subtests, Verbal Communication and Working Memory Indexes, and Verbal and Full Scale IQs differences were significant at the $p<0.01$ level. Similarities and Letter-Number Sequencing differences were significant at the $p<0.05$ level, with all differences favouring the graduates over matriculants.

Table 16: A t-test Comparison of WAIS-III Scaled Scores (and Standard Deviations) of Subtests, Indexes and IQs by English Speaking Private/model C Schooled Matrics and Graduates.

	English First Lang. Private/model C Group Graduate n=14	English First Lang. Private/model C Group Matric n=14	t - Value
	Mean (SD)	Mean (SD)	
Picture Completion	13.00 (2.72)	12.21 (3.26)	0.69
Vocabulary	15.43 (2.14)	10.57 (2.68)	5.30**
Digit Symbol	12.43 (1.91)	11.50 (1.87)	1.30
Similarities	13.57 (2.31)	11.00 (2.88)	2.60*
Block Design	11.64 (2.50)	11.14 (2.91)	0.49
Arithmetic	13.50 (1.91)	10.00 (2.91)	3.76**
Matrix Reasoning	13.36 (3.03)	12.43 (2.79)	0.84
Digit Span	12.86 (2.74)	10.86 (3.63)	1.64
Information	13.86 (1.51)	10.29 (2.27)	4.90**
Picture Arrangement	11.43 (2.53)	10.57 (2.28)	0.94
Comprehension	13.93 (1.82)	10.50 (2.18)	4.53**
Symbol Search	11.78 (2.33)	10.07 (2.70)	1.80
Let-Numb. Sequencing	13.57 (2.24)	11.14 (2.93)	2.46*
Object Assembly	9.86 (2.69)	9.79 (3.02)	0.07
Verbal Communication Index	124.29 (8.41)	103.14 (11.36)	5.60**
Perceptual Organisation Index	116.29 (10.60)	111.86 (15.36)	0.89
Working Memory Index	119.79 (11.23)	103.86 (16.17)	3.03**
Processing Speed Index	111.64 (11.07)	104.29 (11.97)	1.69
Verbal IQ	124.93 (8.20)	102.71 (10.96)	6.07**
Performance IQ	116.14 (9.78)	110.50 (13.46)	1.27
Full Scale IQ	123.00 (8.44)	106.57 (12.15)	4.16**

Significant Difference (* $p < 0.05$; ** $p < 0.01$)

Chapter 5: Discussion

The results of this study will be discussed first in terms of the effects of socio-economic status (SES) on WAIS-III performance and then in terms of the effects of quality and level of education on WAIS-III performance. The overall implications in terms of both SES and education variables will be explored separately, after which the discussion will be extended, in order to appraise the overall findings of the present study in terms of the concepts of acculturation and test wiseness. This will be followed by a discussion of the practical implications arising out of the research findings, conclusions, evaluation of the research and recommendations for future research.

5.1 Socio-Economic Status

The present study sought to relate WAIS-III Full Scale IQ to socio-economic status (SES), including both overall SES level, and to the individual SES items which made up the overall scale. Before proceeding, the validity of the SES questionnaire will be discussed.

5.1.1 Critical Evaluation of Socio-Economic Questionnaire

The sample used in this study comprised two quality of education groups. One group comprised individuals who underwent private/model C schooling (n=48), and considering the cost of such schooling, probably fell into a higher SES range. The other participants had received DET schooling (n=20), possibly indicating that they originated from lower SES backgrounds. However, half the individuals with DET schooling had attained degrees, while the other half attained matriculation. It would thus be difficult to place all DET participants into a "low" SES category immediately, as the attainment of matric and especially progression to tertiary education would probably be beyond those in the very poorest levels of society. These preliminary assumptions about the participants with respect to SES would arguably place approximately 48 individuals into the "high" SES range with the remaining 20 participants divided between the

"low" and "medium" SES categories. Accordingly the various overall SES categorisations (see Tables 1-4 pp. 44 - 45) calculated in the present study, have a high level of equivalence with the proportions suggested above, in that 49, 45, 55 and 47 individuals fall into a "high" SES category on methods 1-4 respectively. This left 5, 9, 13 and 21 participants in the "low" and "medium" SES categories on these same methods respectively. Thus the construct 'overall socio-economic status' is broadly commensurate with a qualitative estimate of socio-economic status (Kline, 1993). Also lending support to the validity of the questionnaire was the fact that the majority of items from the four sections of the questionnaire were individually significantly correlated with WAIS-III Full Scale IQ (Tables 6-8 pp. 46 - 47). Further the attempt made in this study to measure SES is more comprehensive than those which used single variables to measure such a complex factor, such as Kaufman's (1973) much cited work which only used the father's occupational level.

However a cautionary note is required in that the sample used in this study does not represent the general South African population. It does in fact represent an educationally advantaged group in that the majority of the sample enjoyed private/model C schooling (n=48) and that half the sample had completed degrees (n=34), while the other half had completed matric (n=34). Thus the categories of high, medium or low SES are largely relative to each other and should not be seen as absolute categories of SES with respect to the general population. While an individual in this study may be described as belonging to a "low" SES group, in terms of the general population the individual might feasibly fall into a "medium" SES category.

5.1.2 Overall Socio-Economic Status

The results of all analyses, using chi-squares, correlation coefficients and Spearman ranked coefficients, showed a powerful positive relationship between *overall SES* and Full Scale IQ (Tables 1 - 5 pp. 44 - 45). These results confirm the findings of a substantial body of previous research which found similar relationships (Amante et al., 1977; Eells, 1951; Claassen, 1997; Kaufman, 1973; Nichols & Anderson, 1974; Verster & Prinsloo, 1988; Wachs et al, 1996). The results given in Tables 1 - 4 show that on four analyses only one individual from a relatively low SES group managed to score a Full Scale IQ over 105. In fact, at best only five participants from the same relatively low SES group scored above a Full Scale IQ of 85 (Table 3 p. 44). On the other three methods used, at best only two participants from a relatively "low" SES group scored a Full Scale IQ above 85 (Table 1 p. 44). The reverse situation is for the most part not true of the higher SES groups, where up to five individuals fell below a Full Scale IQ of 85 (Table 3 p. 44). This may suggest that SES privilege is no guarantee of IQ advantage, but that this advantage needs to be coupled with other factors to produce higher IQ scores. However, on the contrary, having a low SES background does appear to place a ceiling effect on IQ scores.

5.1.3 Individual Socio-Economic Items

Individual items of the overall SES questionnaire were significantly related to Full Scale IQ in most cases. The *educational and occupational level of parents* was found to be highly related to the Full Scale IQ performance of their children (Tables 6 & 7 pp. 46 - 47). This confirms previous research findings (Amante, Van Houten, Grieve, Bader & Margules, 1977; Eells, 1951; Kaufman, 1973). It is clear that better educated parents with more skills and experience will be able to stimulate their children through their own inherent knowledge and provide a stimulus rich environment. Children thus grow up seeing their caregivers reading, writing and taking an interest in knowledge and learning. This variable may also be measuring the effects of inherited potential,

in that intelligent parents are more likely to have intelligent children. The educational and occupational levels of parents can also used as general approximations of overall SES and thus the significant relationship found may be indicating the general benefits that accrue from this apart from the direct intervention of the parents.

The availability of *facilities in the home* such as electricity, running water and a flush toilet, were found in this study to be significantly related to WAIS-III Full Scale IQ. These facilities have benefits beyond their normal utility. Their presence results in less time being spent collecting water or firewood which allows for more time to be spent on other pursuits, which may stimulate learning and skill development. Further, such facilities, particularly running water and flush toilets, also allow for a more hygienic home, which then leads to less serious illnesses infecting the home occupants. The effects of health problems on cognition, as discussed in the literature, has been extensively empirically validated (see Lezak [1995] pp. 170-276 for an comprehensive review), including the deleterious effect of malnutrition on intellectual performance (Wachs et al. 1996).

The presence of a *radio*, of a *television* or of *children's books*, was found to be significantly related to WAIS-III Full Scale IQ (Tables 7 - 8 p. 47). These allow for further stimulation of the growing child, however the exact way in which these items aid cognitive development remains difficult to determine. It could be argued that the role played by these media is rather broadly to orientate the individual towards western culture, as has been argued elsewhere (Nell, 1999). Thus the advantage of these media is insidious and subtle and may not relate directly to the educational value of television or such related ideas. It could also be argued that the presence of these items of technology, which are relatively expense to acquire and maintain, may indicate the wealth of the family in general, which as a whole has effect on cognitive development, rather than the item itself. Thus it could be also be argued that it is not the radio or television per se, but the socio-

economic status indicated by these items which is being measured in this study. Analysis of individual items, but restricted to the African language participants (Tables 9 - 10 p. 48), revealed results very similar to those which were found for the entire sample.

Exceptions to the significant relationships to WAIS-III Full Scale IQ noted above, were *access to books, magazines and newspapers*, and *pens and pencils*, as well as *access to libraries*, which were either not significant or not consistently significantly related on all measures (Tables 7 - 8 p. 47). It may be argued that merely having books in the home does not result in them being read or modelled by the parents as items to be used. Informal observation was that many of the participants from lower SES backgrounds had only a family Bible or prescribed school books in their homes. This may have resulted in almost all participants indicating the presence of books in the home, when many of these books were never read, that these books were not of an educational nature, or that participants never saw their parents reading for themselves. The same may also be true of access to libraries, in that mere access does not equal use thereof or the modelling of their use by parents, especially parents who may be functionally illiterate. The quality of these libraries was also not assessed in this study. Thus although these items did not uniformly yield a significant relationship, this is likely to be due to a shortcoming of the SES questionnaire used in this study, which may have recorded the presence rather than the use of certain factors. These items may not therefore be irrelevant in cognitive development as implied by a first glance assessment of the findings of the present research.

5.1.4 Summary of Socio-Economic Status Variables

With due regard to the possible shortcomings of the SES questionnaire used in the present study, the results obtained strongly supported the notion that SES is related to IQ test performance. Both overall and individual SES items confirmed this notion, this despite the fact that the present

research used an educationally restricted sample, which may have minimised results which a broader sample with respect to educational level is likely to have revealed. In other words, had a less educationally restricted sample been used, the results obtained may have shown an even more powerful influence of socio-economic status on WAIS-III performance, than the already potent results which were obtained in the present research.

5.2 Education

5.2.1 Introduction

Firstly, the effects of *quality of education* will be discussed with respect to comparisons between all the African first language speakers who had received DET schooling and all African language participants who had received private/model C schooling, as well as between the matric and graduate sub-groups which make up these groups. Secondly, the effects of *level of education* will be discussed with respect to comparisons between both the African language matric and graduate groups and the English language matric and graduate groups. Discussion for both quality and level of education will consider the results generally, followed by specific reference to WAIS-III Full Scale IQ, and to the verbal and performance subtests comprising the entire test.

5.2.2 Effects of Quality of Education

The analysis of variance (Table 15 p. 54) shows that WAIS-III subtests, indexes and IQs were significantly affected by the quality of education variable. Two subtests, Block Design and Letter-Number Sequencing, were significant at the $p<0.05$ level, while all other subtests, indexes and IQ scales differences were significant at the $p<0.01$ level, all favouring participants with private/model C schooling. This very powerful effect of quality of education is confirmed with the t-test comparison of the African first language participants who had undergone DET schooling and those who had undergone private/model C schooling (Table 12 p. 51). Here Block Design

differences were significant not significant, while Letter-Number Sequencing and Object Assembly differences were significant at the $p<0.05$ level, with all other subtests, indexes and IQ differences significant at the $p<0.01$ level, again favouring the private/model C schooled participants. Considering that this study was stratified very strictly for age, gender and level of education, the large differences in performance with respect to quality of education between these groups are very striking.

A caution should perhaps be noted as this study also argues that socio-economic status and acculturation are factors which influence cognitive test performance. These two variables have however not been controlled for in the comparisons made above. It could however be argued that this would be practically impossible with respect to SES, as access to superior schooling is in fact largely a result of high SES. As argued above, better quality education is often seen as one the major advantages of higher SES, and therefore it would be very difficult, if not impossible, to find individuals from lower SES backgrounds who had benefited from expensive private/model C schooling. Degrees of acculturation, as an intervening variable, could possibly have been controlled. However, as will be discussed below (section 5.3), it could be argued that the African language participants who underwent private/model C schooling, have in fact been subjected to an acculturation process by attending these schools, and that this has in fact contributed to their performance on the WAIS-III. Therefore it would appear as if the factors of SES and acculturation, are not so much intervening variables, as they are contributing variables, which accompany quality schooling and cannot be divorced from them.

5.2.2.1 Full Scale IQ

To appraise the effects of quality of education groups (DET and private/model C) in terms of WAIS-III Full Scale IQ, the results for the various groups will firstly be compared to the WAIS-R

standardisation data stratified for education level. This will allow for the results of the various groups to be assessed in terms of international performance levels. Secondly, the performance of the African first language DET groups versus African first language private/model C groups will then be compared with each other.

WAIS-III standardisation data stratified for educational level has not, to the author's knowledge, been made available as yet. WAIS-R standardisation data stratified for education level is however available (Matarazzo & Herman, 1984). This data should be adequate for comparison purposes considering that the WAIS-R correlates well with the WAIS-III (Wechsler, 1997). The WAIS-R standardisation data stratified for level of education attained are as follows:

Years of Education Attained	WAIS-R Full Scale IQ	
8 or fewer years:	86.4	
9 - 11 years:	96.4	
12 years:	100.1	
13 - 15 years:	107.4	
16 and greater years:	115.3	(Matarazzo & Herman, 1984)

In the present study of the WAIS-III, an initial assessment of Full Scale IQ performance of the African language education groups reveals two divergent trends in relation to what may have been expected for groups with these education levels (summarised in Table 17 below).

Table 17: Summary of Participant's Mean WAIS-III Full Scale IQ Scores for African Language Participants by Education of Quality (DET & Private/model C) and Level of Education (Matric & Graduate) Groups.

	Matric	Graduate
	Mean (SD)	Mean (SD)
DET, African 1st Language N=10 per cell	74.40 (7.00)	94.90 (11.67)
Private/model C, African 1st Language N=10 per cell	99.90 (14.28)	113.40 (9.03)

The *matric* group with DET schooling falls well below the WAIS-R standardisation data set out above, by 25.70 mean Full Scale IQ points, this being a comparison those with who have attained 12 years of education. The matric group with private/model C schooling however falls only very minimally below, by only 0.20 mean Full Scale IQ points, compared to this same standardisation data. The *graduate* group with DET schooling has a mean years of education attained of 16.50 years (Table D p. 35) and thus could be compared with either the 13-15 years or the 16 and greater years of education attained categories, which were used on the WAIS-R standardisation. The DET graduates fall 12.50 and 20.40 points below the 13-15 years and 16 and greater categories respectively, with both comparisons revealing large differences. The graduates with private/model C schooling also fall below these Full Scale IQ levels by 1.90 mean Full Scale IQ points when compared to 16 and greater years attained category. They however fall 6 mean Full Scale IQ points *above* the 13-15 years attained category.

Importantly, it has been noted that with the development of progressive WAIS tests, higher scores being obtained on the WAIS over the WAIS-R (Culross & Lakshmanan, 1998), and higher scores on the WAIS-R over the WAIS-III (Wechsler, 1997). The WAIS-R and WAIS-III comparison, published in the WAIS-III technical manual (Wechsler, 1997), found participants scoring 3 points higher on the WAIS-R compared to the WAIS-III. The implications of this in terms of the present study is that had the African language participants from private/model C schools completed the WAIS-R (instead of the WAIS-III) they would probably have scored within or above the WAIS-R education appropriate normative ranges. Thus it is argued that these African language participants, who have benefited from private/model C schooling, are likely to fall above the normative ranges should the WAIS-III standardisation data stratified for educational be made available. However it is also argued that participants who received DET schooling would still score substantially lower on the same WAIS-III stratified data.

In summary the results suggest that an African language individual, needing to overcome language and cultural handicaps, can be raised to the level, or above the level, of a comparative American individual, after having benefited from a quality education such as is available at private or former model C schools in South Africa. This is true of both the matric and the graduate groups in the present study.

Returning to the groups within the present study, a comparison with respect to the *quality of education groups* in terms of Full Scale IQ reveals large and significant differences in favour of the private/model C group in comparison to the DET group. The comparison of all African language participants who underwent DET schooling with all African language participants who underwent private/model C schooling shows Full Scale IQ mean differences of 22 points, or 1.5 standard deviations, in favour of the participants who attended private/model C schools, significant at the $p<0.01$ level (Table 12 p. 51). Considering the sub-groups, the *matric* DET and *matric* private/model C school group comparison of Full Scale IQ shows mean differences of 25 points or 1.67 standard deviations, again in favour of the private/model C school matriculants, significant at the $p<0.005$ level (Table 13 p. 52). The comparison of African language *graduate* participants with DET schooling and African language *graduate* participants with private/model C schooling reveals Full Scale IQ mean differences of 18.5 points, or 1.23 standard deviations, again favouring the private/model C schooled participants, significant at the $p<0.005$ level (Table 14 p. 53). The differences between the participants who have received DET and private/model C schooling have thus narrowed with the greater exposure to education received by the graduates. The differences are however still large, with both graduates and matric differences on quality of education significant at the $p<0.005$ level.

The powerful influence on Full Scale IQ exerted by quality of education can be noted by an *informal comparison* of the African language participants who had attained a *matric* from a private/model C school with African language *graduates* who received DET schooling. These university graduates have a mean years of education attained of 16.50 years, compared with 12.60 years for the private/model C matric group. However the matric group with private/model C schooling outperforms the DET graduate group by 5.00 mean Full Scale IQ points.

5.2.2.2 Verbal Subtests

Significant effects due to quality of education were revealed for *all verbal subtests*, at the $p<0.01$ level, except Letter-Number Sequencing, which was significant at the $p<0.05$ level, all favouring private/model C over DET schooling. This is evident on the t-test (Table 12 p. 51) and the two-way ANOVA (Table 15 p. 54) comparing the African first language participants who had undergone DET with private/model C schooling.

5.2.2.3 Performance Subtests

On the t-test (Table 12 p. 51) and two-way ANOVA (Table 15 p. 54) comparisons of the African language participants with DET schooling and African language participants with private/model C schooling, differences significant at the $p<0.01$ level on all subtests were revealed except for Block Design, which was not significant on the t-test, yet had differences which were significant at the $p<0.05$ level on the two-way ANOVA, with all differences favouring private/model C schooling over DET schooling. These results are perhaps contrary to expectations, as performance subtests on previous WAIS instruments have been least effected by educational *level* (Kaufman, McLean & Reynolds, 1988). The sensitivity of performance subtests to *quality* of education has however never been investigated. The results of the present study show performance subtests to be acutely sensitive to quality of education.

The only subtest which showed an interaction effect, between level and quality of education, was Digit Symbol, significant at the $p<0.05$ level (Table 15 p. 54). Whereas in all other instances, subtests follow regular patterns for scores to be higher for graduates compared with matriculants, regardless of whether participants had received DET or private/model C schooling, this was not the case with Digit Symbol. Here, the DET graduates showed the typical pattern of a higher score compared with the matriculants, whereas the private/model C graduates in fact show no improvement (in fact a very marginal decline). This may suggest that Digit Symbol may be acutely sensitive to the benefits of good quality schooling (i.e. to the advantages of test-wiseness), to such an extent that once it has been received tertiary education does not substantially improve it. This is not however the case with those individuals from poor educational backgrounds who benefit from tertiary education exposure.

In summary the results of the present study show *Full Scale IQ, verbal and performance subtests to be highly sensitive to the effects of quality of education*, which strongly supports Nell's (1999) notion that schooling inculcates test-wiseness which in turn facilitates performance on cognitive measures. This is observable on subtests which are traditionally sensitive to educational exposure, such as the verbal subtests, but also on measures thought not to be effected by education, such as Digit Symbol, as noted above.

5.2.3 Effects of Level of Education

The analysis of variance (Table 15 p. 54) of *African* language participants shows that many of the subtests, all the indexes and all the IQs are effected by level of education, favouring graduates over matriculants. Picture Completion, Block Design, Digit Span and the Processing Speed Index differences were significant at the $p<0.05$ level. Differences on Vocabulary, Similarities, Information, Picture Arrangement, Comprehension, Symbol Search, the Verbal Communication,

Perceptual Organisation and Working Memory Indexes, as well as the Verbal, Performance and Full Scale IQs were significant at the $p<0.01$ level. These results indicate that a variety of skills are effected by level of education. It also appears that the verbal subtests show greater difference than the performance subtests, although Picture Arrangement and Symbol Search are exceptions here.

The t-test comparison of the *English* first language, matrics and graduates who all received private/model C schooling (Table 16 p. 56) reveals that all the significant differences are found on the verbal subtests. Similarities, Letter-Number Sequencing differences are significant at the $p<0.05$ level, while Vocabulary, Arithmetic, Information, Comprehension and the Verbal Communication and Working Memory Indexes differences are significant at the $p<0.01$ level, all favouring the graduates. Digit Span is the only subtest on the verbal scale which does not show a significant difference, while no performance subtest shows a significant difference.

Considering that the English language group was stratified for age, gender, educational quality and educational attainment, which provided a measure of control for SES and cultural factors, these results are very suggestive of the following possibilities: that educationally loaded verbal skills are what separates those individuals who go on to tertiary education and succeed thereat; or that tertiary education results in improved verbal skills. These possibilities will explored further below.

5.2.3.1 Full Scale IQ

The analysis of variance (Table 15 p. 54) comparing *African* language matriculants and African language graduates reveals WAIS-III Full Scale IQ to be effected by level of education, with differences in favour of the graduates significant at the $p<0.01$ level. This is confirmed by the t-test comparison (Table 16 p. 56) of *English* language matrics who received private/model C

schooling and English language graduates who received private/model C schooling, where mean Full Scale IQ differences of 16.43 points, were significant at the $p<0.01$ level. These results confirm the existing literature which has shown performance on Wechsler tests to be positively influenced by level of education (Kaufman, McLean & Reynolds, 1988; Wolfle, 1980).

5.2.3.2 Verbal Subtests

The effect of level of education on the two-way ANOVA (Table 15 p. 54) for *African* language participants show non-significant differences for Arithmetic and Letter-Number Sequencing, which are both working memory index items, with the other working memory index item, Digit Span, having differences in favour of the graduates, significant at the $p<0.05$ level. The other verbal subtests: Vocabulary, Similarities, Information and Comprehension all reveal differences favouring the graduates, significant at the $p<0.01$ level. This is confirmed by the t-test comparison (Table 16 p. 56) of the *English* language matrics and graduates, where all the verbal subtests except Digit Span, had significant differences, again favouring the graduates.

It can thus be observed, that the verbal scale on the WAIS-III is highly sensitive to both level of education, as has been observed previously (Kaufman, McLean & Reynolds, 1988), and quality of education effects, as found in the present study. The more crystallised subtests, Vocabulary, Information, Comprehension and Similarities appear the most effected by level of education. The working memory items, which draw less on crystallised intelligence resources than the other verbal subtests (Kaufman & Lichtenberger, 1999), appear least effected by level of education effects.

5.2.3.3 Performance Subtests

The two-way ANOVA comparing *African* language matrics and graduates (Table 15 p. 54) shows Picture Completion and Block Design differences significant at the $p<0.05$ level, while

Picture Arrangement and Symbol Search differences were significant at the $p<0.01$ level, all favouring graduates. Digit Symbol, Matrix Reasoning, and Object Assembly show no significant differences for level of education. As the two-way ANOVA combines the quality of education groups, some of these differences observed may be effected by this factor. When comparing *English* language matrics and graduates participants with private/model C schooling (Table 16 p. 56), where no such combining of quality of education groups occurs, no performance subtests showed any significant differences. The performance subtests thus appear less effected by level of education than the verbal subtests, which is consistent with previous findings (Kaufman, McLean & Reynolds, 1988).

5.2.3.4 Level of Education Effects in Relation to Quality of Education

It may be important, particularly in terms of the South African context, to consider the effects that level of education has on individuals who originate from different quality of education backgrounds. If the results of the African and English speaking participants, in terms of level of education, are considered it would appear that certain verbal skills are improved by level of education, while performance skills remain relatively less effected. As noted above, of these verbal tests, those which are the most crystallised in nature, Vocabulary, Information and Comprehension (Kaufman & Lichtenberger, 1999) appear most positively effected by level of education. While Similarities, and the concentration and working memory tests of the verbal scale, Arithmetic, Digit Span and Letter-Number Sequencing, appear to benefit least. This appears to concur with accepted theory (Wolfle, 1980), which would argue that continued exposure to stimulation, through education, would result in increased verbal and crystallised resources.

The comparison of the African language *matrics* with DET and private/model C schooling however showed significant differences *on both verbal and performance subtests*, again favouring

the private/model C schooled individuals (Table 13 p. 52). A comparison of the African first language *graduates*, who have undergone DET and private/model C schooling (Table 14 p. 53), shows significant differences on Symbol Search and Picture Arrangement, both performance tests, as well as Vocabulary, Information and Comprehension which are of the verbal and crystallised variety, all in favour of the private/model C schooled graduates. Picture Arrangement, it may be argued has a narrative verbal component, which leaves only Symbol Search significant amongst the more pure performance subtests. The other tests, which are significantly different, are again the *crystallised subtests*. Level of education effects these crystallised subtests the most and it would thus be expected that the gaps on these subtests would have been closed with continued education. It can however be observed that significant differences on the performance subtests are almost completely absent indicating that the differences observed when comparing the matrics have been ameliorated with continued education received by the graduates. The results of the present study thus suggest that continued education, at a tertiary institution, for those who originate from poor quality schools, has relatively more effect on performance subtests, and while effecting verbal subtests, the differences caused by quality of education effects are not reduced.

These results thus present a mixed picture suggesting the following:

1) That as would be expected, length of education, observable both within the African and English first language groups, positively effects verbal crystallised intelligence.
2) That when individuals however originate from poor educational backgrounds, tertiary education reduces fluid-performance differences, to a much greater extent than crystallised-verbal ability differences are reduced. Thus, as the results of this study show, when these two groups (DET and private/model C) are compared at matric level, differences in both performance and verbal are observable, while the graduate differences are almost exclusively on the verbal scale.

This may lead one to consider whether fluid skills are being underdeveloped in poor educational settings, thus leading to their potential being realised in better quality tertiary educational settings. Certainly the caricature of formally DET schools, is of pupils doing better in 'learning subjects' such as history, rather than 'abstract subjects', such as mathematics. This caricature extends to university settings where these pupils are often seen as doing better in similar 'learning' majors, such as law, and that not enough register in the 'abstract' sciences. These caricatures may be true, not because of racial stereotypes, but because these individuals have not had their fluid intelligence resources stimulated in poor educational settings. University then stimulates these latent abilities and the gap between those from poor educational backgrounds and those from better educational backgrounds is closed. However the gap which exists in the area of crystallised abilities is not affected by tertiary education to the same degree, and the differences remain significant. The disadvantage in the area of verbal-crystallised abilities thus persists and appears the most intransigent to modification.

Possibly the only way for universities to close the gap between graduates from diverse educational backgrounds, which in this study amounts to 18.50 mean Full Scale IQ points, is by targeting verbal skills for specific remedial attention. This would close the Verbal IQ gap with the Performance IQ gap closing naturally as the students have their fluid intelligence resources stimulated.

The results of this study, together with arguments relating to fluid and crystallised intelligence, and educational stimulation thereof, also appear to relate to two other phenomena, which have appeared in the literature recently. These are the continuing rise in IQ across the world and the relative decline in Spearman's g, which will be explored in the next section.

5.2.3.5 Increases in IQ and Decreases in Spearman's g

James Flynn has been noting the relative increases in IQ scores over several decades (Flynn, 1987) and that this trend has continued with the WAIS-III (Flynn, 1998). Flynn's research suggests increases in IQ over time at between 0.30 and 0.17 IQ points per year, but probably closer to 0.25 points (Flynn, 1998). The trend in IQ gains appears to be slowing and although Flynn notes this he does not posit an explanation therefore. Husen & Tuijnman (1991) commentating on Flynn's earlier work, argue that the gains over time are due the "expansion of formal schooling in most industrial countries" (p. 17) over this period. This would also account for the declining rates of IQ gains as the expansion of schooling in these nations slows.

Another related trend has been observed with regard to the loading of Spearman's g on Wechsler tests in Japan, the USA, France and Scotland (Lynn & Cooper, 1994). It has been noted on these IQ tests that in populations with lower IQs there is a greater loading of Spearman's g in comparison with populations with relatively higher IQs. This is calculated by determining the mean intercorrelations between subtests, with higher intercorrelations suggesting a higher proportion of Spearman's g (Lynn & Cooper, 1994). Lynn & Cooper have hypothesised that with increasing IQs over time, there will be a concurrent relative decline of Spearman's g loading on IQ tests. This has been confirmed through analysing the standardisation of the WISC, WISC-R, WAIS and the WAIS-R in various countries. It can be argued that Spearman's g is close to Horn & Cattell's (1966) concept of fluid intelligence. Fluid intelligence lays the foundation upon which crystallised intelligence builds. Crystallised intelligence is thus the result of the working of fluid intelligence on experience. Greater stimulation leads to greater crystallised intelligence, while fluid intelligence remains relatively constant.

It could therefore be argued that the presence of relatively larger amounts of Spearman's g in low IQ groups represents the unused potential of that group. As the potential is utilised, through stimulatory experience, the relative size of fluid intelligence (or Spearman's g) declines. What is more interesting in terms of the present study is what constitutes the stimulatory experience, which leads to greater crystallised intelligence. The findings of the present study suggest education, and particularly good quality education, constitutes such stimulation, as individuals who were educated in private/model C schools outperformed those individuals who were educated at DET schools. The trends of increasing quantity and quality of education in various industrialised nations over the past century, noted above, would thus suggest that there would be a relative decline in fluid intelligence in relation to crystallised intelligence. This is confirmed by the present study where the effects of education on verbal subtests were noted on both quality and level of education analyses.

This process of crystallised intelligence evolving out of fluid intelligence over time is similar to the effects of level of education on individuals originating from relatively poor education backgrounds (i.e. DET schools), noted above. While speculative, it may be inferred from this that fluid intelligence needs to be the initial intelligence which is built up, which can then function to build crystallised resources. The graduate comparison, between individuals who received DET schooling and those that received private/model C schooling, showed that this process had begun, with the gap between fluid intelligence largely closed, but with the crystallised intelligence gap still substantial. It would follow from this argument that given time the gap on the crystallised tests would also close, as stimulation worked on the fluid resources which have now been acquired.

5.3 Acculturation

Acculturation was defined in the literature as the extent to which individuals from other cultures adopt the culture and values of the dominant culture of the society in which they reside. While this study is not directly concerned with acculturation, it could be argued that there is a powerful acculturation force at work in most private/model C schools. These schools are usually based on very traditional formats, and are usually very English in their styles of education. African speaking individuals attending these schools would be required to speak the dominant language of the institution, being English, thus marginalising use of their home language. All classes, sporting instruction and general cultural activity would also be done through the medium of English. Many of these institutions are also of the boarding school variety, resulting in English being spoken in the evenings as well, as opposed to those who may speak their first languages at home. The African individual who attends these schools thus has no option but to assimilate the culture of the institution, which is attended.

In contrast, most previously DET schools allow for the retention of African culture to a much greater extent. This is because although English is advocated as the medium of instruction it often is not used as such. Pupils attending these schools often converse with their teachers and fellow pupils in their home languages and thus acquire only limited command of the English language.

Thus the division made in this study between private/model C and DET schools is also indirectly a separation between more and less acculturated African language individuals. The African language private/model C school group thus is a high socio-economic (based on the expense of private/model C schooling), a well educated and an acculturated group. Thus the findings that the IQs scores for the African language participants who received private/model C schooling, both the matric and the graduate groups, are very close to the American norms for the equivalent

education levels should not be surprising. These findings support the contention that acculturation plays a role in cognitive test performance, and when coupled to socio-economic and education advantages lifts individuals to the level of the original group for which the test in question was designed. It could be argued, following Helms (1992), that in fact these individuals are more intelligent than those with equivalent IQs as they have achieved these scores despite the cultural bias of the test.

5.4 Test-Wiseness

Test-wiseness was found in the literature to be a concept, similar to Anastasi's (1982) notion of test sophistication, which is related to socio-economic, educational and cultural factors, which combine to aid and orientate the test-taker to the demands of western psychometric tests. The results of the present study appear to confirm Nell's (1999) notion of test-wiseness. The African language participants of this study, who received private/model C schooling, have benefited from influences, which would make them more test-wise and which therefore allowed them to outperform their non-test-wise fellows who received DET schooling. The influences which are taken to have led to this test-wise status, among these particular participants, are higher socio-economic status (being able to afford private/model C schooling), better quality education (private/model C schooling) and acculturation (through attendance at these traditional schools). In the comparison of these groups, (the total private/model C and DET comparison in Table 12 p. 51), with educational level and years of education attained virtually equivalent, and with the groups stratified for gender and age, this advantage amounted to 22 mean Full Scale IQ points. It is difficult to account for these differences apart from the test-wise factors named above. The strong implication of this finding is that individuals who take western designed cognitive tests will require their test-wise status to be assessed for their results to be placed into any meaningful context.

5.5 Implications of the Present Research

The findings of the present research will now be discussed with specific reference to their implications in relation to cross-cultural research, the current HSRC standardisation of the WAIS-III and IQ and neuropsychological assessment using the WAIS-III.

5.5.1 Cross-Cultural Research

It has been argued that previous research which showed racial or cultural differences on IQ tests was effected by intervening variables (Helms, 1992), which included socio-economic status (Ardila, 1995). These comparisons are often made between white individuals from relatively privileged backgrounds, and ethnic minorities who are from lower socio-economic groups. The findings of the present study, which show a strong relationship between SES and WAIS-II Full Scale IQ, support the notion that such comparisons are spurious. Therefore any study wishing to compare individuals of different racial or cultural groups would have to, as at least a minimum measure, control for the SES of the participants. The findings of this study thus place in doubt all previous cross-cultural studies, which did not control for SES as an intervening variable.

Previous studies of cultural or racial differences have also often not adequately controlled for education factors (Ardila, 1995). The results of this study indicate how widely results can vary with differing levels and quality of education. In this study African language individuals with a private/model C school matric had mean IQ scores which were greater than the African language DET graduate group by 5 mean Full Scale IQ points. Thus despite being older and having attained four years more mean education, the DET education group was a third of a standard deviation lower. By comparison the two graduate groups (DET and private/model C) differed by a massive 19.5 Full Scale IQ points in favour of the private/model C schooled group.

What the results of this study suggest is that it is not 'race' that determines an individual's abilities, but rather the broader environment in which the individual is embedded. Those African individuals in this study who benefited from private/model C education, despite being tested in a second language, scored in line with the American education related WAIS-R standardisation norms. Any study, which wishes to show 'racial' or cultural differences, must control not only for SES and education attained, but also for the quality of that education. This is the very critique which has recently been levelled at the HSRC standardisation of the WAIS-III (Nell, 1999).

5.5.2 The HSRC Standardisation of the WAIS-III

The HSRC standardisation process seeks to identify individuals from various language groups and from various education levels. However the equivalence of the education received by these different groups has been questioned (Nell, 1999). The HSRC also did not seek to ascertain the SES level of the participants used in the South African WAIS-III standardisation process. There is thus no way to determine if the study is using primarily higher, lower, or a balanced cross-sectional set of participants in terms of SES. The standardisation and the experimental groups should have been stratified for social status, which Crawford, Gray and Allan (1995) found necessary when trying to test the American WAIS-R norms against a British sample. These stratifications are even more necessary in a country with such diverse socio-economic groups as are in place in South Africa.

The results of this study support Nell's (1999) criticism and suggests that the HRSC standardisation may be seriously flawed, especially with regard to the experimental groups. It is assumed that the HSRC, on the basis of these experimental studies, will make recommendations regarding the use of the WAIS-III with non-English speaking individuals. The validity of these recommendations is thus called into question by the results of this study.

The exact implications of the decision not to record SES or quality of education factors are not however apparent. It may result in a greater caution being advocated than is required, if the majority of those tested are from low SES or poor educational backgrounds, or too little caution being advocated, if the majority are from a higher SES or good quality education backgrounds. In essence this study places doubt over the utility of these experimental studies and the recommendations which will result therefrom.

5.5.3 Implications for IQ Assessment

The uses of IQ in contemporary society is usually restricted to educational environments, disability assessments and neuropsychological assessment. These former uses will be discussed in this sub-section while the latter will be discussed in detail below (section 5.5.4 p. 81).

In educational settings IQ is often used to ascertain whether an individual is performing to his or her full potential. It is also used to determine whether special schooling may be required for the individual. The findings of this research suggest that deficits may be a result of the schooling itself and that the school may need to modify its teaching methods to cope with individuals who are not performing rather than labelling their potential. The assessment of 'potential' is therefore a theoretically contentious construct, especially as IQ, as shown in the present study, is significantly a result of environmental factors, rather than pure 'innate' talent. Obviously this caution should not be taken to extremes, as certain individuals, due to neurological factors, and described as mentally retarded, will never perform within the normal range on cognitive tests, regardless of environmental factors.

The assessment of at least moderate mental retardation in the South African context results in the individual being classified as "disabled" and qualifies them for a disability grant and possibly

sheltered employment. The accurate assessment of mental retardation thus has implications for both the individual and the state. With the results of the present study in mind, the use of the WAIS-III to measure IQ with individuals from low SES backgrounds, who received poor schooling, and who may be from different language and cultural groups, must be questioned. One of the DET *graduates* in the present study scored a Full Scale IQ of 79, which would fall into what is often described as 'borderline mental functioning' being only 9 points above what the *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition* (DSM-IV) would classify as Mild Mental Retardation (317) (American Psychiatric Association, 1994 p.40). The possibility that serious assessment error may result from insensitive use of this instrument is thus vividly apparent. Incorrectly labelling individuals as mentally retarded could have multiple implications, both for the welfare of the individual and for the state that would then have to provide for this 'disabled' individual.

5.5.4 Implications for Neuropsychological Assessment

All previous versions of the Wechsler tests were utilised for neuropsychological assessment (Lezak, 1995), while the WAIS-III has even greater neuropsychological applicability (Kaufman & Lichtenberger, 1999). This includes the various factorial Indexes, the inclusion of three new tests and the use of learning in the reverse rules on almost all subtests. It therefore follows that the WAIS-III will become extensively used in the assessment of neuropsychological disorders.

As was noted in the literature review, SES (Amante, Van Houten, Grieve, Bader & Margules, 1977; Nichols & Anderson, 1974; Wachs et al., 1996) and education (Finlayson, Johnson & Reitan, 1977; Adams, Boake & Crain, 1982) have been found to be intervening variables in the assessment of neuropsychological disorders, particularly amongst the aged (Anthony, Heaton & Lehman, 1980; Bachman & Logan, 1977; Manly et al., 1998a; Marcopulos, McLain & Giuliano,

1997; Paolo & Ryan, 1980). This study confirms these results, here with relatively young participants. Both quality and level of education received, and the SES, of the individual must be carefully considered when interpreting neuropsychological test results. While this is true in an international context, it is even more of a concern in South Africa, where apartheid has left legacies, which impact, deeply in the areas of socio-economics and education. Individuals in South Africa, regardless of their ethnic backgrounds, may originate from very diverse situations and these diversities, particularly with regards socio-economics and education highlighted in this study, cannot be ignored in neuropsychological assessment.

The use of western psychometric instruments in the South African context has come under various forms of criticism (Nell, 1994), as well as pragmatic support (Shuttleworth-Jordan, 1996). Shuttleworth-Jordan, drawing on a limited number of empirical findings, concluded that an "attitude of nihilism" was unjustified with respect to western psychometric instruments being applied to non-western individuals. Clinicians were urged to take into account education and acculturation factors before deciding against using these tests. The essence of Shuttleworth-Jordan's argument is that, although western psychometric instruments have the potential to bias non-western test-takers, these tests produce non-biased results with certain well educated and acculturated non-western individuals.

The results of this study provide strong support for Shuttleworth-Jordan's (1996) preliminary findings and associated arguments, as those African individuals from private/model C school backgrounds performed well enough to be compared with the American education appropriate norms. Obviously those individuals from non-western cultural groups, from poor socio-economic backgrounds, who have received a poor quality of education, need to be addressed with the appropriate caution with regards to the same instruments, as the results of this study also indicate.

The results of the present study thus support both necessary caution in the South African context with respect to western psychometric instruments (Nell, 1994, 1999), and pragmatic clinical application with appropriate individuals (Shuttleworth-Jordan, 1996).

5.6 Conclusions

The following conclusions may be drawn from the present research:

i) That higher socio-economic status is positively related to WAIS-III Full Scale IQ performance, even within a restricted sample, which confirms international studies with a South African sample.

ii) That level of education is positively related to WAIS-III performance, with the verbal subtests being most sensitive to this variable.

iii) That quality of education has highly significant effects on performance on the WAIS-III; with poor quality of education having a negative effect on performance, in that deficits persist in individuals from poor educational backgrounds even after attaining tertiary qualifications; whereas a high quality of education has a positive influence on performance, to the extent that cultural differences disappear when non-western individuals benefit therefrom.

iv) That there is empirical support for Nell's (1999) notion of test-wiseness, as a composite of socio-economic, education and acculturation factors, effecting performance on the WAIS-III.

v) That in the South African context use of neuropsychological assessment has to be sensitive to the impact of socio-economic and educational variables, but that this should not lead to the abandonment of western psychometric instruments as they remain valuable clinical tools when appropriately applied (Shuttleworth-Jordan, 1996).

5.7 Evaluation of the Present Research

The methodological strengths of this study include:

1) The participants in the present study were carefully stratified for potentially influential variables. This included gender, age and educational level attained. Thus it was possible to isolate more clearly the effects of the relevant variables being measured, particularly quality of education.
2) The socio-economic questionnaire used in the present study was more extensive and comprehensive than other measures used in the literature to measure this complex variable.
3) The present study used highly qualified and trained testers, who were under constant supervision during the testing process. The testing arrangements, which included the place and conditions of testing, as well as appropriate breaks from testing, were also conducive to optimal performance by the participants.

This study had the following methodological weaknesses:

1) The number of participants in each quality and level of education group were relatively small. This was unavoidable given the scope of the present study. However the WAIS-III, as the latest in a series of Wechsler tests, is a robust instrument (Kaufman & Lichtenberger, 1999), which has been extensively standardised and validated (Wechsler, 1997). The distribution and standard deviations obtained in this study, on the subtests as well as the various Indexes and IQs, were very close to those which were obtained in the American standardisation of the WAIS-III, considering the age and education of the participants. The WAIS-III is thus a highly reliable instrument which provides reassurance with respect to the scores obtained despite the small sample used in the present study. A small sample may have the effect of masking certain results, rather than highlighting the extensive significant results which were in fact found in the present study.

2) The socio-economic status analysis may have been effected by the use of a relatively educationally restricted sample. Results obtained were however still significant suggesting that had a more educationally representative sample been used, results would have been even more significant.

3) The analysis of socio-economic status separate from the education variable was somewhat artificial as it may be argued that the same participants who fell into the high SES categories, also fell into the private/model C school categories. It can however be argued that it would be almost impossible to find individuals from low SES backgrounds who then benefited from expensive private/model C schooling, and that this collapsing of categories is in a practical sense unavoidable.

4) The socio-economic questionnaire used in the present study requires independent validation. However construct validity was to a certain extent confirmed in terms of the overall socio-economic status categories derived and the relation of individual items making up the questionnaire to WAIS-III Full Scale IQ.

5) This study used the American version of the WAIS-III as well as the scaled scores from the American standardisation process. Many of the items on individual subtests, particularly Information, Comprehension and Vocabulary have items which are distinctly American, and the HSRC may replace many of these items once its standardisation process is complete. This bias however extended to all participants in the study, although it may have effected the African first language participants to a greater extent than English first language participants. As noted in the methodology, these replacement items were administered to all participants, which will allow the re-scoring and evaluation of this potential weakness at a later date.

5.8 Recommendations for Future Research

The following is recommended for future research into the effects of socio-economic status on IQ test performance:

1) Research should be carried out to produce a socio-economic scale, which can reliably divide participants into various socio-economic groups in relation to the general population. This will greatly aid in the analysis of the performance on all individuals who may potentially be used in future research.
2) Future research should attempt to obtain participants from more diverse educational backgrounds than was the case in the present study. This would allow for more subtle analysis of the various SES variables across the various SES groups.

The following is recommended for research into the effects of education on IQ test performance:

1) Future research should attempt to test a larger participant sample to overcome any possible bias that may be attributed to the small sample used in this study. Future research could consider adding participants to the present sample to improve this shortcoming.
2) The possibility of testing a group of participants who are at a particular educational level, who can be re-tested in the future after accounting for different educational exposure, would be most fruitful. Longitudinal research overcomes the critique that intelligence may be inherent in participants and that this is what is found on cross-sectional research.
3) As noted above, the present protocols used in this research could be re-scored once the HSRC standardisation is complete, due to the fact that the possible replacement items were collected along with the standard WAIS-III items. A comparison of results would then be possible. This comparison would reveal whether the HSRC standardisation has overcome some of the biases, which are inherent in the current American norms and version of the WAIS-III, which were used in the present study.

Chapter 6: References

Adams, R. L., Boake, C., & Crain, C. (1982). Bias in a neuropsychological test classification related to education, age, and ethnicity. *Journal of Consulting and Clinical Psychology, 50* (1), 143-145.

Amante, D., Van Houten, V. W., Grieve, J. H., Bader, C. A., & Margules, P. H. (1977). Neuropsychological deficit, ethnicity, and socioeconomic status. *Journal of Consulting and Clinical Psychology, 45* (4), 524-535.

American Psychiatric Association. (1994*). Diagnostic and statistical manual of mental disorders. Fourth Edition*. Washington: Author.

Anastasi, A. (1982). *Psychological testing* (5th edition). New York: Macmillan.

Anthony, W. Z., Heaton, R. K., & Lehman, R. A. W. (1980). An attempt to cross-validate two acturial systems for neuropsychological test interpretation. *Journal of Consulting and Clinical Psychology, 48*, 317-326.

Ardila, A. (1995). Directions of research in cross-cultural neuropsychology. *Journal of clinical and Experimental Neuropsychology, 17* (1), 143-150.

Avenant, T. J. (1988). *The establishment of an individual intelligence scale for adult South Africans. Report on an exploratory study conducted with the WAIS-R on a sample of blacks* (Report P-91). Pretoria: Human Science Research Council.

Barona, A., Reynolds, C., & Chastian, R. (1984). A demographically based index of premorbid intelligence for the WAIS-R. *Journal of Consulting and Clinical Psychology, 52*, 885-887.

Carroll, (1982). The measurement of intelligence. In R. J. Sternberg (Ed.) *Handbook of Human Intelligence* (pp. 29-122). Cambridge: Cambridge University Press.

Carvajal, H. & Pauls, K. K. (1995). Relationships among graduate record examination scores, Wechsler Adult Intelligence Scale-Revised IQ's, and undergraduate grade point average. *College Student Journal*, *29* (4), 414-416.

Ceci, S. J. (1991). How much does schooling influence general intelligence and its cognitive components? A reassessment of the evidence. *Developmental Psychology*, *27* (5), 703-722.

Claassen, N. C. W. (1985). *Socio-economic deprivation questionnaire* (Document 2387). Pretoria: Human Science Research Council.

Claassen, N. C. W. (1997). Cultural differences, politics and test bias in South Africa. *European Review of Applied Psychology*, *47*, 297-307.

Claassen, N. C. W. (1998). *Research plan for standardising the Wechsler Intelligence Scale (WAIS-III) for South Africa*. Unpublished HSRC report/working document.

Compton, D. M., Bachman, L. D., & Logan, J. A. (1997). Aging and intellectual ability in young, middle-aged, and educated adults: preliminary results from a sample of college faculty. *Psychological Reports*, *81*, 79-90.

Crawford, J. R., Gray, C. D., & Allan, K. M. (1995). The WAIS-R (UK): basic psychometric properties in an adult UK sample. *British Journal of Clinical Psychology*, *34*, 237-250.

Crawford, J. R., & Allan, K. M. (1997). Estimating premorbid WAIS-R IQ with demographic variables: regression equations derived from a UK sample. *The Clinical Neuropsychologist*, *11* (2), 192-197.

Culcross, R. R., & Lakshmanan, A. (1998). Comparison of WAIS and WAIS-R scores among bright adults aged 20-34. *Psychological Reports*, *82*, 922.

Eells, K. (1951). Summary of the field of study. In K. Eells, A. Davis, R. J. Havighurst, V. E. Herrick & R. Tyler. (1951). *Intelligence and Cultural Differences* (pp. 51-80). Chicago: The University of Chicago Press.

Eysenck, H. J. (1971). *Race, intelligence and education*. London: M. Temple Smith.

Fienberg, S. E., & Resnick, D. P. (1997). Reexaminig *The Bell Curve*. In B. Devlin, S. E. Fienberg, D. P. Resnick & K. Roeder (Eds.) (1997). *Intelligence, Genes and Success: Scientists respond to The Bell Curve* (pp. 3-18). New York: Copernicus.

Finlayson, M. A. J., Johnson, K. A., & Reitan, R. M. (1977). Relationship of level of education to neuropsychological measures in brain-damaged and non-brain-damaged adults. *Journal of Consulting and Clinical Psychology, 45* (4), 536-542.

Flynn, J. R. (1987). Massive IQ gains in 14 countries: what IQ tests really measure. *Psychological Bulletin, 101*, 171-191.

Flynn, J. R. (1998). WAIS-III and WISC-III gains in the United States from 1972 to 1995: how to compensate for obsolete norms. *Perceptual and Motor Skills, 86*, 1231-1239.

Harnqvist, K. (1968). Relative changes in intelligence from 13 to 18. *Scandinavian Journal of Psychology, 9*, 50-82.

Helms, J. E. (1992). Why is there no study of cultural equivalence in standardized cognitive ability testing. *American Psychologist, 47* (9), 1083-1101.

Herrick, V. E. (1951). What is already known about the relation of the IQ to cultural background? in K. Eells, A. Davis, R. J. Havighurst, V. E. Herrick & R. Tyler. (1951). *Intelligence and Cultural Differences* (pp. 10-15). Chicago: The University of Chicago Press.

Herrnstein, R. J., & Murray, C. (1994). *The bell curve: intelligence and class in American life*. New York: Free Press.

Horn, J. L., & Cattell, R. B. (1966) Refinement and test of theory of fluid and crystallized intelligence. *Journal of Educational Psychology, 57*, 253-270.

Husen, T., & Tuijnman, A. (1991). The contribution of formal schooling to the increase in intellectual capital. *Educational Researcher, 20*, 17-25.

Huysamen, G. K. (1996). *Psychological measurement: an introduction with South African examples*. Pretoria: J.L. Schaik Academic.

Insua, A. M. (1983). WAIS-R factor structures in two cultures. *Journal of Cross-Cultural Psychology, 14* (4), 427-438.

James, T., & Dalton, R. (1993). Modification of the WAIS-R information sub-test for use with an Irish population. *Irish Journal of Psychology, 14* (4), 589-595.

Jensen, A. R. (1969). How much can we boost IQ and scholastic achievement? *Harvard Educational Review, 39*, 1-123.

Kallaway, P. (1984). *Apartheid and education: the education of black South Africans*. Johannesburg: Ravan Press.

Kamin, L. J. (1974). *The science and politics of I.Q*. New York: John Wiley & Sons.

Kamin, L. J. (1995). Lies, damned lies and statistics. In R. Jacoby & N. Glauberman (Eds.) (1995) *The bell curve debate*. (pp. 81-105). New York: Times Books.

Kaufman, A. S. (1973). The relationship of WPPSI IQs to SES and other background variables. *Journal of Clinical Psychology, 29*, 354-357.

Kaufman, A. S., & Lichtenberger, E. O. (1999). *Essentials of WAIS-III assessment*. New York: John Wiley & Sons, Inc.

Kaufman, A. S., McLean, J. E., & Reynolds, C. R. (1988). Sex, residence, region, and education differences on the 11 WAIS-R subtests. *Journal of Clinical Psychology, 44* (2), 231-248.

Kendall, I. M., Verster, M. A., & Mollendorf, J. W. (1988). Test performance of blacks in Southern Africa. In S. H. Irvine & J. W. Berry (Eds.), *Human abilities in cultural context* (pp. 299-339). Cambridge: Cambridge University Press.

Kline, P. (1993). *The handbook of psychological testing*. Routledge: London.

Krull, K. R., Scott, J. G., & Sherer, M. (1995). Estimation of premorbid intelligence from combined performance and demographic variables. *The Clinical Neuropsychologist, 9* (1), 83-88.

Lezak, M. D. (1995). *Neuropsychological assessment - 3rd Edition*. New York: Oxford.

Lund, T., & Thrane, V. C. (1982). Schooling and intelligence: a methodological and longitudinal study. *Scandinavian Journal of Psychology, 24*, 161-173.

Lynn, R., & Cooper, C. (1994). A secular decline in the strength of Spearman's g in Japan. *Current Psychology: Development-Learning-Personality-Social, 13* (1), 3-9.

Manly, J. J., Jacobs, D. M., Sano, M., Bell, K., Merchant, C. A., Small, S. A., & Stern, Y. (1998a). Cognitive test performance among nondemented elderly African Americans and whites. *Neurology, 50*, 1238-1245.

Manly, J. J., Miller, S. W., Heaton, R. K., Byrd, D., Reilly, J., Velasquez, R. J., Saccuzzo, D. P., Grant, I., and The HIV Neurobehavioral Research Center (HNRC) Group. (1998b). The effect of African-American acculturation on neuropsychological test performance in normal and HIV-positive individuals. *Journal of the International Neuropsychological Society, 4*, 291-302.

Marcopulos, B. A., McLain, C. A., & Giuliano, A. J. (1997). Cognitive impairment or inadequate norms? A study of healthy, rural, older adults with limited education. *The Clinical Neuropsychologist, 11* (2), 111-131.

Matarazzo, J. D., & Herman, D. O. (1984). Relationship of education and IQ in the WAIS-R standardization sample. *Journal of Consulting and Clinical Psychology, 52* (4), 631-634.

Mitrushina, M. N., Boone, K. B., & D'Elia, L. F. (1999). *Handbook of Normative Data for Neuropsychological Assessment*. Oxford: Oxford University Press.

Nell, V. (1994). Interpretation and misinterpretation of the South African Wechsler-Bellevue Adult Intelligence Scale: a history and a prospectus. *South African Journal of Psychology, 24* (2), 100-109.

Nell, V. (1999). Standardising the WAIS-III and WMS-III for South Africa: legislative, psychometric, and policy issues. *South African Journal of Psychology, 29* (3), 128-137.

Nichols, P. L., & Anderson, V. E. (1974). Intellectual performance, race, and socioeconomic status. *Social Biology, 20*, 367-374.

Ogden, J. A., & McFarlane-Nathan, G. (1997). Cultural bias in the neuropsychological assessment of young Maori men. *New Zealand Journal of Psychology, 26* (2), 2-12.

Paolo, A. M., & Ryan, J .J. (1994). Factor structure of the WAIS-R by educational level: an examination of elderly persons. *Archives of Clinical Neuropsychology, 9* (3), 259-264.

Paolo, A. M., Ryan, J. J., Ward, L C., & Hilmer, C. D. (1996). Different WAIS-R short forms and their relation to ethnicity. *Personal and Individual Differences, 6*, 851-856.

Petrie, K., Dibble, C., Long-Taylor, M., & Ruth, G. (1986). A New Zealand subtest for the WAIS-R. *New Zealand Journal of Psychology, 15*, 23-26.

Pieters, H. C., & Louw, D. A. (1987). Die Suid-Afrikaanse Wechsler-Intelligensieskaal vir Volwassenes: 'n kritiese perspektief. *South African Journal of Psychology, 17*, 145-149.

Rapport, L. J., Brines, D. B., Axelrod, B. N., & Theisen, M E. (1997). Full scale IQ as mediator of practice effects: the rich get richer. *The Clinical Neuropsychologist, 11* (4), 375-380.

Shuttleworth-Jordan, A. B., & Bode, S. G. (1995). Use of the SAWAIS digit symbol test of incidental recall. *South African Journal of Psychology, 25* (1), 53-57.

Shuttleworth-Jordan, A. B. (1995). Against mutton masquerading as lamb: additional commentary on the interpretation and misinterpretation of the SAWAIS. *South African Journal of Psychology, 25* (4), 244-246.

Shuttleworth-Jordan, A. B. (1996). On not reinventing the wheel: a clinical perspective on culturally relevant test usage in South Africa. *South African Journal of Psychology, 26* (2), 96-102.

Sternberg, R. J., & Salter, W. (1982). Conceptions of intelligence. In R. J. Sternberg (Ed.) *Handbook of Human Intelligence* (pp. 3-28). Cambridge: Cambridge University Press.

Verster, J. M., & Prinsloo, R. J. (1988). The diminishing test performance gap between English speakers and Afrikaans speakers in South Africa. In S. H. Irvine & J. W. Berry (Eds.), *Human abilities in cultural context* (pp. 534-560). Cambridge: Cambridge University Press.

Wachs, T. D., McCabe, G., Moussa, W., Yunis, F., Kirksey, A., Galal, O., Harrison, G., & Jerome, N. (1996). Cognitive performance of Egyptian adults as a function of nutritional intake and sociodemographic factors. *Intelligence, 22*, 129-154.

Wechsler, D. (1997). *The Wechsler Adult Intelligence Scale - 3rd Edition: Technical manual.* San Antonio: The Psychological Corporation.

Winship, C., & Korenman, S. (1997). Does staying in school make you smarter? The effect of education on IQ in *The Bell Curve*. In B. Devlin, S. E. Fienberg, D. P. Resnick & K. Roeder (Eds.) (1997). *Intelligence, Genes and Success: Scientists respond to The Bell Curve* (pp. 215-234). New York: Copernicus.

Wolfle, L. M. (1980). The enduring effects of education on verbal skills. *Sociology of Education, 53*, 104-114.

Zindi, F. (1994). Differences in psychometric performance. *The Psychologist, 7*, 549-552.

APPENDIX A: 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 B: Informed Consent Form

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

APPENDIX C: Demographic Data Sheet

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): _____

_____

_____

_____

_____

_____

_____

APPENDIX D: Socio-Economic Questionnaire

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	☐	☐	☐	☐

APPENDIX E: Language Proficiency Test

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.

APPENDIX F: WAIS-III Answer and Response Booklets

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)	

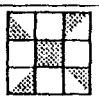
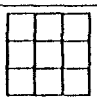
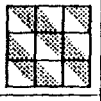
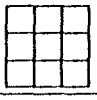
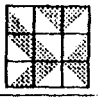
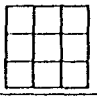
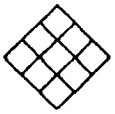
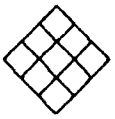
5. Block Design

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)

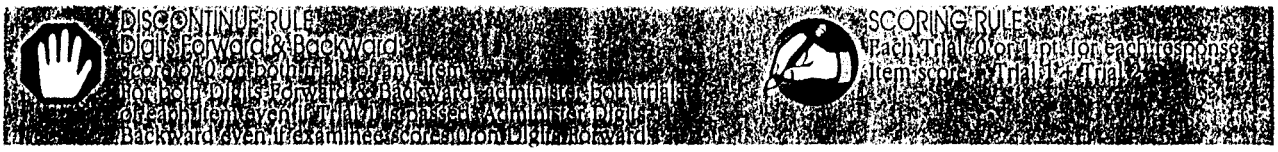
7. Matrix Reasoning

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)
1.	Saturday	
2.	Age	
3.	Ball	
4.	Months	
START 5.	Thermometer	
6.	Sunrise	
7.	Weeks	

Item	Response	Score (0 or 1)
8.	Hamlet	
9.	Brazil	
10.	MLK, Jr.	
11.	Civil War President	
12.	Cleopatra	
13.	Italy	
14.	Relativity	

9. Information *(continued)*

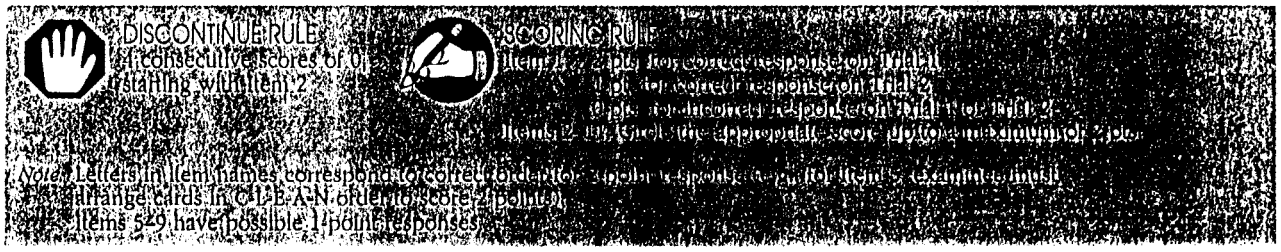
Item	Response	Score (0 or 1)	Item	Response	Score (0 or 1)
15.	Olympics		22.	Vessels	
16.	Sahara Desert		23.	Catherine	
17.	Genesis		24.	Continents	
18.	Sistine Chapel		25..	Curie	
19.	Gandhi		26.	World Population	
20.	Koran		27.	Speed of Light	
21.	Water		28.	Faust	

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		

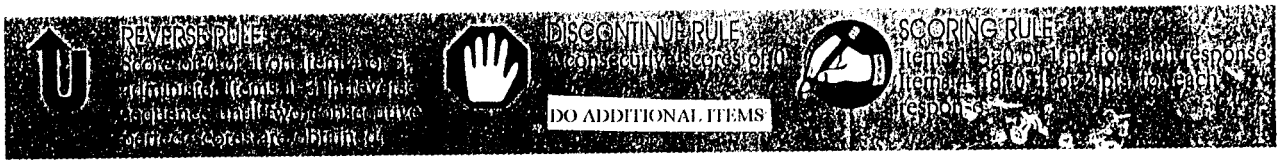
10. Picture Arrangement



Item (2 pts.)	Item (1 pt.)	Time Limit	Response Order	Completion Time in Seconds	Score (Circle One)
START 1. CAP Trial 1	[redacted]	30"			0 1 2
Trial 2		30"			
2. BAKE	[redacted]	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	[redacted]	120"			0 2
11. SHARK		120"			0 2

Total Raw Score (Maximum = 22) [redacted]

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 pt. 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 weighting and circle the appropriate score.

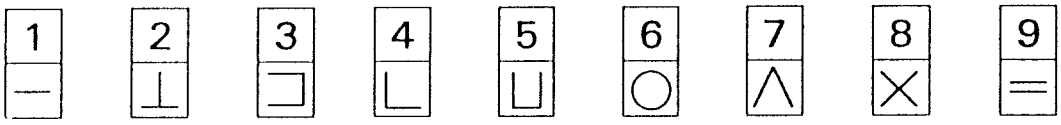
START

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)

Total Raw Score (Maximum = 52)

* Round half scores up.

Digit Symbol - Coding



Sample Items

2	1	3	7	2	4	8	2	1	3	2	1	4	2	3	5	2	3	1	4

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

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

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

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

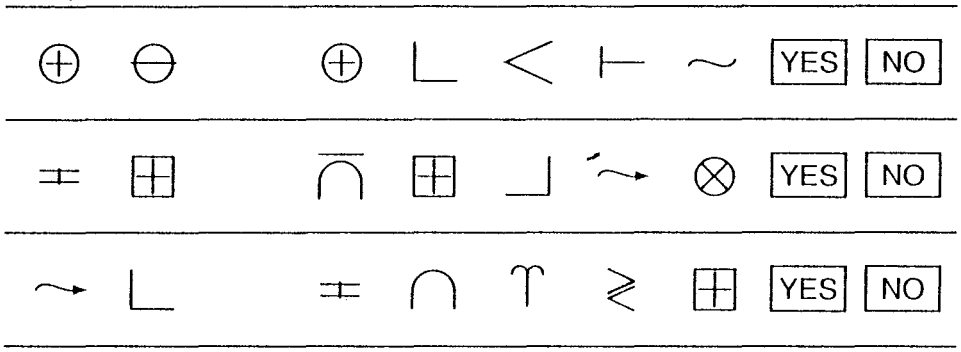
5	1	8	2	9	4	6	3	7

8	5	6	3	1	9	4	7	2

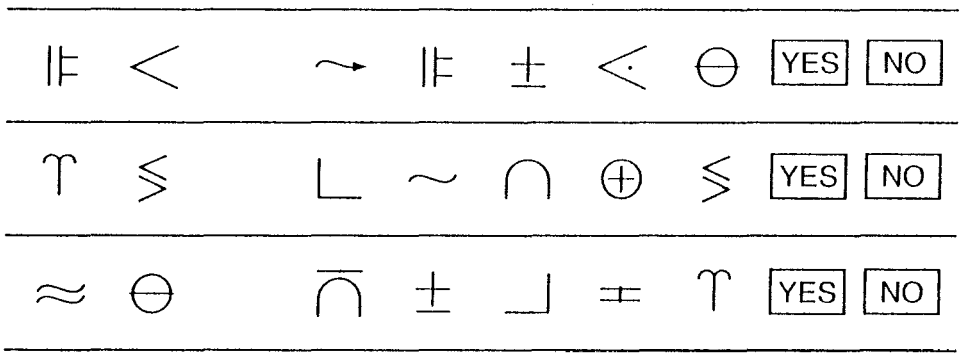
Free Recall

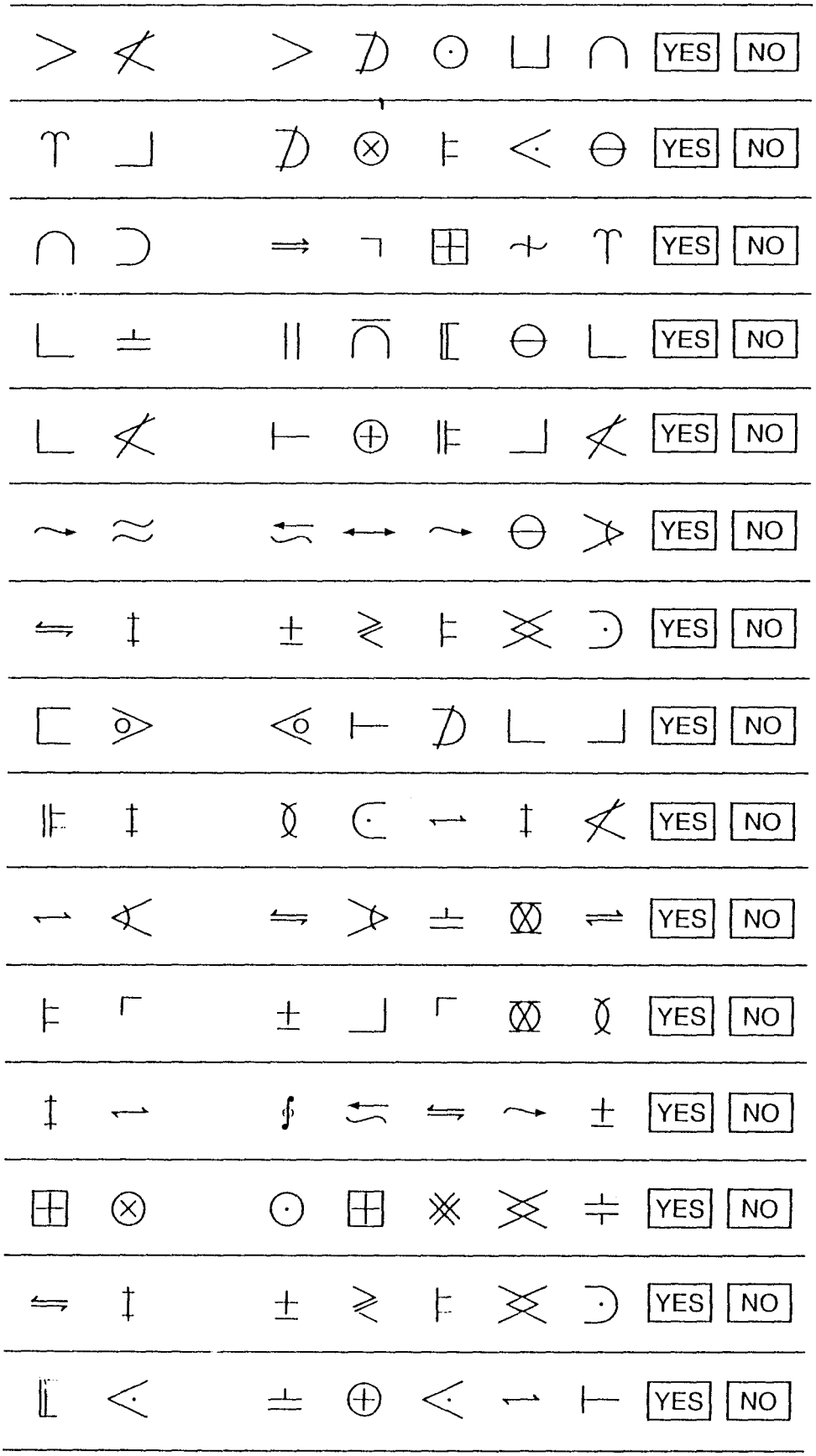
Symbol Search

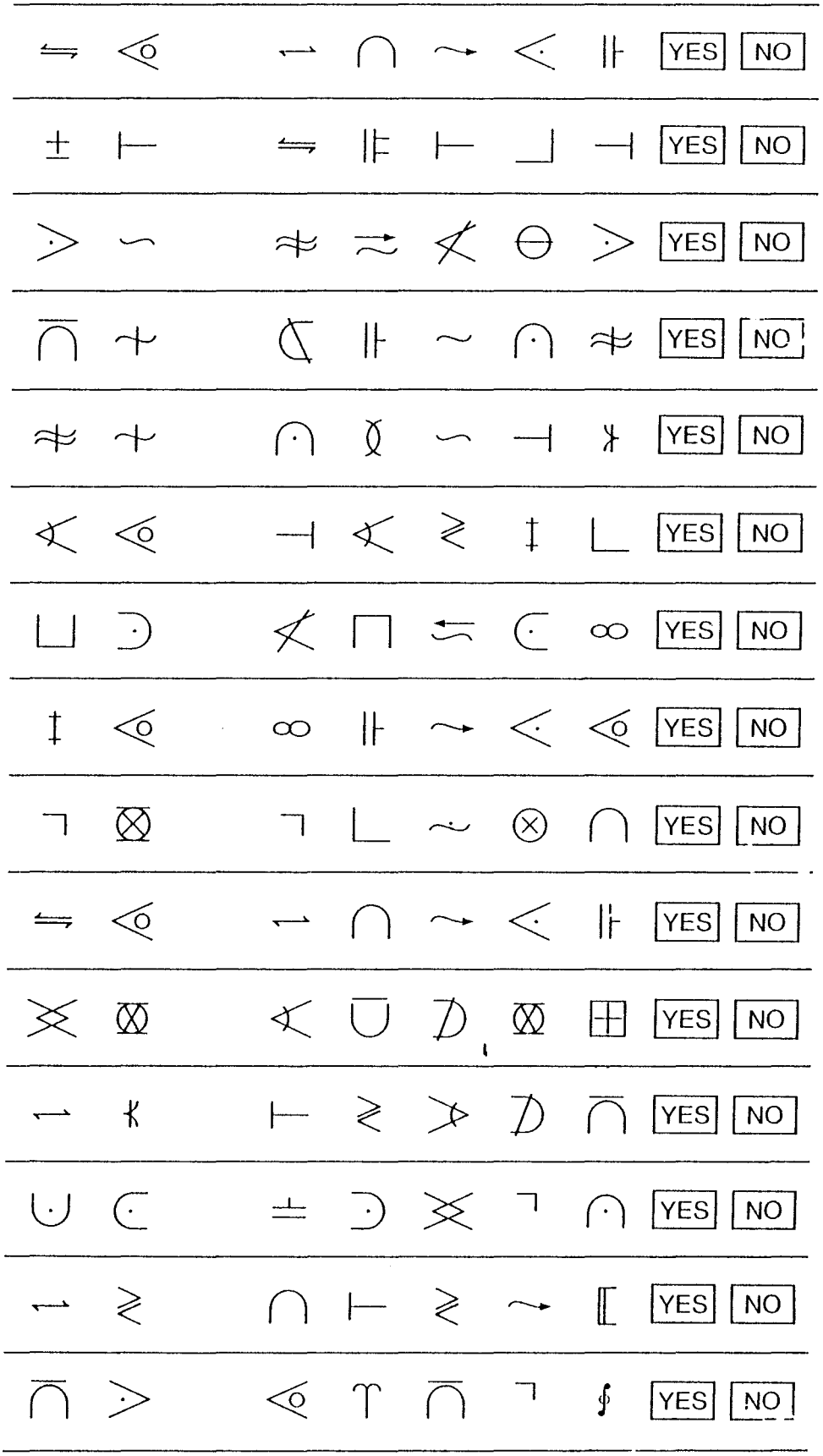
Sample Items



Practice Items




YES
NO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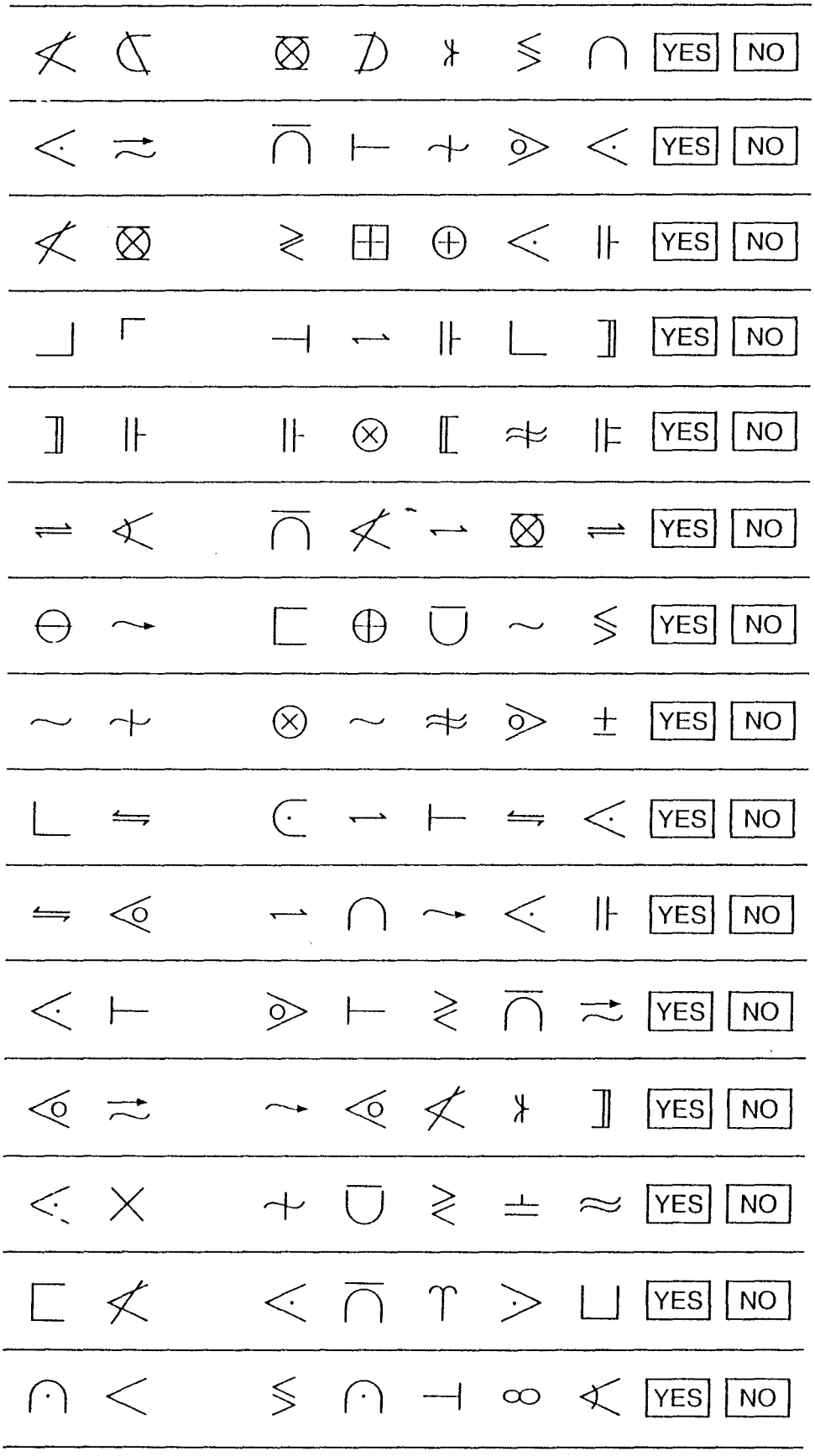
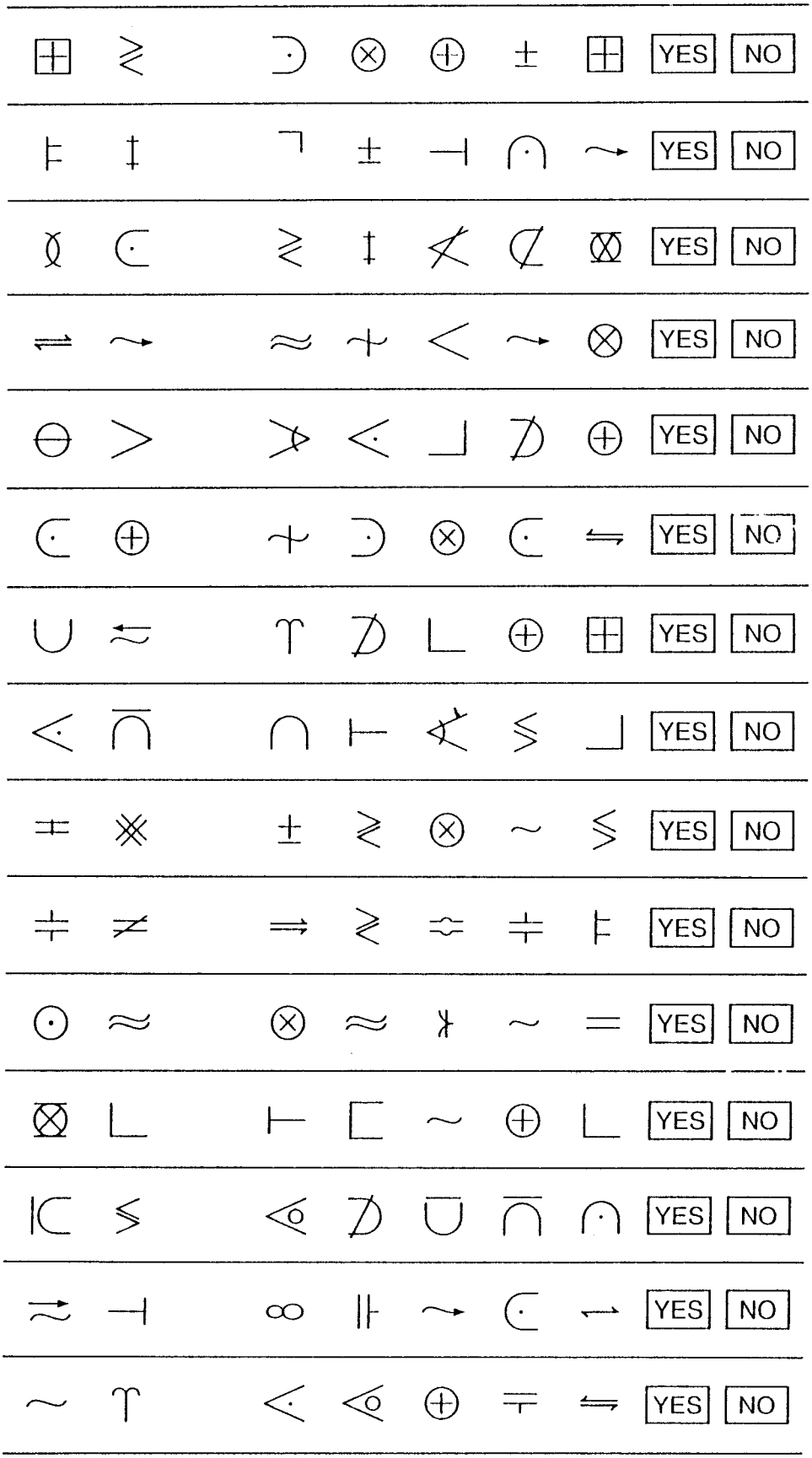

YES
NO


YES
NO

Symbol Copy

Samples

APPENDIX G: WAIS-III Administration Instructions

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 H: 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: _____

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