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**A COMPARATIVE STUDY OF THE PERFORMANCE OF
ENGLISH AND XHOSA SPEAKING CHILDREN ON THE
WECHSLER INTELLIGENCE SCALE FOR CHILDREN-REVISED (WISC-R)**

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ABSTRACT

The purpose of this study was to compare the WISC-R subtest score scatter patterns and obtain preliminary normative data on the WISC-R Adjunctive tests (Digit Span Forward; Digit Span Backward; Digit Supraspan; Coding Immediate Recall and Coding Delayed Recall) on a non-clinical population of South African English (n=15) and Xhosa (n=12) speaking, standard six children, studying in English medium schools. Tests were administered to 27 subjects, both male (n=19) and female (n=8), with a mean age of 14.1 years (range = 13.3-15.3). The results show that White English speaking children outperform Black Xhosa speaking children on Verbal, Performance and Full Scale IQs and all subtests, but that these differences tended to disappear when Full Scale IQ and school grade average were controlled for. No subtest score scatter was present for either group although more specific test items appeared to be more difficult for Xhosa speaking subjects and may have contributed to generally lowered scores. Results suggest that caution must be employed in assigning Xhosa speaking South African children to absolute IQ categories. However, the WISC-R has validity for diagnostic use on both White English speaking and Black Xhosa speaking South African children as there was no evidence of a significant Verbal IQ/Performance IQ discrepancy, or significant low subtest scatter for either group. Normative tables are presented for the use of WISC-R Adjunctive tests.

1. INTRODUCTION

The availability of normative data on psychological tests across the full spectrum of the South African population is extremely limited. Research suggests that a number of variables, one of which is cultural background, influences a person's test performance and thus existing normative data on a test may not necessarily be appropriate when used in population groups other than the original normative population (Anastasi, 1976). This problem is evident in neuropsychological assessment where the clinician often finds him/herself making inferences using normative data based on population groups for which the standardisation of normative data exists. At the present time there is a paucity of published research investigating the application of neuropsychological tests with South African children and is an area which requires urgent attention by South African researchers (Viljoen, Levett, Tredoux, & Anderson, 1994).

The aim of this thesis is to address this issue by comparing the performance of English speaking and Xhosa speaking, standard six children, in the age group thirteen to fifteen years, on the composite and subtest scaled scores of the Wechsler Intelligence Scale for Children - Revised (WISC-R). In addition, the research sets out to compare the performance of these two groups on a set of adjunctive WISC-R tests which enhance the neuropsychological diagnostic efficacy of this standard IQ test: the assessment of the Digits Forward Span and Digits Backward Span as two independent tests of the Digit Span subtest; the extension of the Digit Span subtest into a Digits Supraspan; and the extension of the Coding subtest into Coding Immediate Recall and Coding Delayed Recall. The Introduction to this report will thus be dealt with in two main sections: (i) The Wechsler Intelligence Scale for Children - Revised (WISC-R), and (ii) The WISC-R Adjunctive Tests.

1.1 WECHSLER INTELLIGENCE SCALE FOR CHILDREN - REVISED (WISC-R)

1.1.1. The Historical Development of the WISC-R

The Wechsler Intelligence Scale for Children (WISC) was developed in 1949 by Wechsler as a downward extension of the adult intelligence test, the Wechsler-Bellevue Intelligence Scale (1939). This was done by adding easier items to the beginning of each subtest of the original adult scale thus making it more suitable for children and then standardising it on a child population group (Sheashore, 1950).

In 1974 the WISC was revised by Wechsler and became known as The Wechsler Intelligence Scale for Children - Revised (WISC-R). Changes which were made include the modernisation of old items and the replacement of items that some test users considered to be ambiguous, obsolete, or unfair to minority groups. Seventy-two percent of the original WISC items were retained in the WISC-R, either intact (64%) or with substantial modification (8%). The main difference, though, between the WISC-R and the original WISC was that the sample of the WISC-R included a range of population groups (White, Black, American Indian, Asian, Puerto Rican, and Mexican Americans), whereas the original WISC was standardised on a White only population group. The WISC-R was standardised on a varied group of children of both sexes, ranging in age from 6.5 years to 16.5 years. It covered four geographic regions and a range of socioeconomic classes, living in both urban and rural areas.

1.1.2. Psychometric Properties of the WISC-R

The WISC-R (Wechsler, 1974) is an individually administered measure of verbal and nonverbal abilities, composed of ten regularly administered subtests (i.e. Information, Similarities, Comprehension, Vocabulary, Arithmetic, Picture Completion, Picture Arrangement, Block Design, Object Assembly and Coding) and two optional subtests (i.e.

Digit Span and Mazes) all of which have a mean of 10 and a standard deviation of 3. These subtests have been organised into Verbal and Performance Scales which are then combined to yield a Full Scale IQ, with all three scales having a normative mean of 100 and a standard deviation of 15 (Sattler, 1992). The Verbal Scale comprises of the Information, Similarities, Comprehension, Arithmetic, Vocabulary and Digit Span subtests and the Performance Scale comprises the Picture Completion, Picture Arrangement, Block Design, Object Assembly, Coding and Mazes subtests. The WISC-R has become one of the most widely used intelligence tests for children, which may be due to its excellent standardisation procedures, reliability and comprehensive manual which provides good administration procedures and test materials (ibid).

1.1.3. Clinical use of the WISC-R

In clinical practice the WISC-R aids the clinician in a number of areas. Analysis of composite scores aids in the evaluation of a child's present level of functioning and in the identification of children who are not coping in mainstream classrooms and who are thus possibly in need of special educational programmes. Analysis of the scatter pattern of subtest scores aids in the identification of brain damage which may have been acquired at birth or due to a head injury sustained in an accident. These analyses are possible through the use of deficit pattern analysis. That is, an analysis of the pattern of low test scores to identify the site of cerebral damage (Walsh, 1987). Lezak (1995) states that intellectual functions are expressed consistently and cerebral damage sustained to a specific area may often be pinpointed by a corresponding change in the expression of a specific function. Thus organic deterioration typically appears in patterns of syndrome related impairment, with some functions remaining intact relative to other functions (Lezak, 1995; Shuttleworth-Jordan, 1991).

Research on the WISC-R reveals that a number of different subtest score patterns can aid in the identification of specific neuropsychological impairment and/or developmental disorders.

These include: (a) the ACID pattern (that is, a pattern of low scores on the Arithmetic, Comprehension, Information and Digit Span) being found in children with learning disabilities (Sandoval, Sassenrath, & Penalosa, 1988) and Attention Deficit Hyperactivity Disorder (A.D.H.D.) (Loge, Staton, & Beatty, 1990), (b) a pattern of low scores on Digit Span, Coding and Arithmetic, relative to the mean Verbal IQ and Performance IQ scores, aiding in the identification of left and right hemisphere lesions (Aram & Ekelman, 1986); (c) low scores on Digit Span and Coding, together with a poor Draw-A-Person score being common among subjects with epilepsy (Gaggero, Cirrincione, Zanutte & de-Negri, 1992); (d) low scores on Arithmetic, Vocabulary, and Information being found in mentally retarded subjects (Forceville, Dekker, Aldenkamp, & Alpherts, 1992); (e) reading disabled children scoring significantly low on the Digit Span subtest (Rugel, 1974); (f) and a specific pattern existing for children with learning problems (Grossman & Galvin, 1989).

Due to the clinical value of the subtest score scatters of the WISC-R being able to aid in the possible identification of neuropsychological and developmental disorders, it is important to ascertain whether there are identifiable patterns of high/low clusters among normal children due to differences caused by ethnicity ³ or socio-cultural ⁴ factors. If present, such differences could lead to the false identification of pathology should the patterns of deficit overlap with any of the pathological dysfunctional patterns identified above.

A vast amount of research exists on the Wechsler Intelligence Batteries which compares the scores of different racial or ethnic groups, although relatively few of these relate to the South African population specifically. This literature can be broadly divided into the following areas: (a) Research which has compared the mean composite scores (i.e. Full Scale, Verbal Scale and Performance Scale) of different population groups (Naglieri, 1986; Reynolds & Jensen, 1980; Vance, Hankins & Brown, 1988); (b) Factor structure research which attempts to ascertain whether the three factors identified as being measured by the WISC-R (namely, Verbal Comprehension, Perceptual Organisation, and Freedom from Distractibility) can be identified in different population groups (Jensen & Reynolds, 1982 & 1983; Kaufman, 1973; Reschly, 1978; Silverstein, 1973; Taylor & Richards, 1991); (c) research which has

identified subtest-score scatter patterns within different population groups (Jensen & Reynolds, 1981; Kaufman, McLean, & Reynolds, 1988; Naglieri, 1986; Reynolds & Jensen, 1983; Reynolds, 1988; Taylor & Richard, 1991; Vance, Hankins & McGee, 1979) and (d) research which has identified item bias/difficulty, or the lack of it, within individual subtests in the WISC-R (Bersoff, 1981; Clearly & Hilton, 1968; Conboy, McFarland, & Boll, 1986; Dean, 1977; Flaughner, 1978; Grossman & Galvin, 1989; Naglieri, 1986; Reschly, 1978 & 1981; Reschly & Sabers, 1979; Reynolds & Hartlage, 1979; Ross-Reynolds & Reschly, 1983; Sandoval, 1979; Sattler, 1988, 1991, 1992; Williams, 1970, 1971). A review of the literature will thus be done according to these broad categories.

1.1.4. Comparison of mean composite scores among different population groups.

Research comparing the performance of different ethnic groups on composite Verbal, Performance and Full Scale scores on the WISC-R reveals inconsistent findings. The WISC-R standardisation sample (Wechsler, 1974) reports differential performance among different population groups with White children (FSIQ = 102) obtaining Full Scale IQ scores approximately one standard deviation higher than Black children (FSIQ = 86). Naglieri (1986) also found that White children scored higher than Black children on all three composite scores, although the differences did not reach significance. This difference, of Whites outperforming their Black counterparts on all three scales, was also found with the standardisation sample on the Wechsler Adult Intelligence Scale -Revised (WAIS-R) (Kaufman, McLean, & Reynolds, 1988). Other studies have reported that only one of the scales has been higher for White subjects when compared to Black subjects, that is, either the Verbal Scale (Kaufman, 1973) or Performance Scale (Reynolds & Jensen, 1983) was significantly higher for White children compared to Black children .

However, this finding is not consistent as some researchers have found no significant difference between Black and White children on the three composite scores (Vance et al., 1988). Research has also reported that Black male children score significantly higher on the

Verbal Scale than their White counterparts (Vance et al., 1979). However, analysis of Vance et al. (1979; 1988) studies reveals that in both studies the mean composite IQ scores for both Black and White subjects were very low (i.e. at least one standard deviation below the norm) and that in one of the studies the subjects had been referred for psychological assessment due to learning disabilities, mild mental handicaps or classroom behaviour problems.

Thus it seems that although some studies have found no difference between Black and White subjects on all three composite scores, or found Black subjects performing better on the Verbal Scale than White subjects, these studies have generally used subjects with composite scores at least one standard deviation below the norm and/or subjects who have been referred for psychological assessment. Studies which have found White subjects outperforming Black subjects on either Verbal or Performance scales or on all three composite scores, have tended to use "normal" subjects found in mainstream classrooms.

1.1.5. Factor structure studies of the WISC-R

Factor Structure research attempts to ascertain that the WISC-R measures the same abilities in children of different ethnic groups. As with the above research, this research has yielded conflicting results with some research suggesting that different population groups have similar cognitive abilities (Kaufman, 1973; Silverstein, 1973) and other research suggesting that different population groups show different cognitive strengths and weaknesses (Jensen & Reynolds, 1982; 1983; Taylor & Richards, 1991).

Factor Structure research identifies three main factors being measured by the WISC and WISC-R, namely Verbal Comprehension measured by the Information, Similarities, Comprehension, and Vocabulary subtests; Perceptual Organisation as measured by the Picture Completion, Picture Arrangement, Block Design, and Object Assembly subtests and Freedom from Distractibility as measured by the Arithmetic, Coding and Digit Span subtests. Verbal Comprehension measures verbal knowledge and understanding obtained informally and

through formal education. It reflects the application of verbal skills to new situations and appears to measure a variable common to the Verbal Scale (Sattler, 1992). Perceptual Organisation reflects one's ability to interpret and organise visually perceived material within a time limit and appears to measure a variable common to the Performance Scale. Freedom from Distractibility is the ability to concentrate or remain attentive and may also involve numerical ability and short term memory (ibid).

Silverstein's (1973) factor structure research, using the original WISC found that children from three different ethnic groups (i.e. Anglo, Black and Chicano) performed similarly on Verbal Comprehension and Perceptual Organisation, suggesting that the WISC measures the same abilities in Anglo, Black and Chicano children. Kaufman (1973) using the original WISC-R standardisation sample, verified that the above three factors exist for all race groups at all age levels. Reschly (1978) found that four different ethnic groups (i.e. Anglo-Americans, Chicanos, Native-American Papagos and Black Americans) scored similar to each other on two of the three factor structures, namely, Verbal Comprehension and Perceptual Organisation, but that the Freedom from Distractibility factor was problematic with Black and Native-American Papagos.

Jensen and Reynolds (1982; 1983) found that the Black children, in the original standardisation sample, when matched with their White counterparts on Full Scale IQ, had their highest level of performance on the Freedom from Distractibility factor and Whites performed best on the Perceptual Organisation factor. Similarly, Taylor and Richard's (1991) research shows that children from different ethnic backgrounds perform differently on these three factors, suggesting that different ethnic groups (Black, White, and Hispanic) have different cognitive strengths and weaknesses. Their research shows that Black children scored highest on the Verbal Comprehension factor, suggesting that Black children perform better on verbal tasks; the Hispanic children scored highest on the Perceptual Organisation and Freedom from Distractibility factors, suggesting that Hispanic children perform better on visual-spatial tasks; and the White children perform better on tasks requiring abstract thinking and knowledge of facts.

Thus, when Black and White subjects are compared on the WISC-R using factor structure research, either no difference between the two groups has been found or Black subjects are reported to have performed better than White subjects on the Freedom from Distractibility factor (Jensen & Reynolds, 1982; 1983) or the Verbal Comprehension factor (Taylor & Richards, 1991).

1.1.6. Subtest-score scatter patterns within different population groups.

It has been argued that not only does culture determine what should be learned and thus that different individuals in different cultures will develop different patterns of abilities, but that individuals reared in one culture and exposed to a system of education from another culture may develop patterns of abilities quite different from those obtained in either culture (Crawford-Nutt, 1977).

Scatter pattern research using the WISC-R, has not as yet been able to consistently report that different population groups perform significantly better or worse on specific WISC-R subtests. Jensen and Reynolds (1981; 1983), using the national standardisation sample of the WISC-R, found that White subjects outperformed Black subjects on Object Assembly, Comprehension and Mazes and that Black subjects outperformed White subjects on Arithmetic and Digit Span. Naglieri (1986) found that, on the WISC-R, White children tend to significantly outperform Black children on Block Design, Object Assembly and Similarities. Vance et al., (1979) found that when Black and White children were matched on Full Scale IQ, Black children scored significantly higher on Information and Similarities and White children scored significantly higher than Black children on Coding. Taylor and Richard (1991) researched four different ethnic groups and found that Hispanic children scored highest on Picture Completion, Block Design and Object Assembly, that White children scored highest on Information and Similarities and that the Black children scored highest on Vocabulary.

Research on the WAIS-R, using the standardisation sample, found that White subjects significantly outperformed Black subjects on all 11 subtests, except Picture Arrangement which, although not significant, showed a trend of Whites outperforming Blacks. Most significant differences were found on Block Design and Vocabulary where White subjects did significantly better (more than one standard deviation) than Black subjects across all age groups ranging from 16-74 years (Kaufman et al., 1988).

In sum, it seems that firstly, White subjects have usually performed higher than Black subjects on Comprehension, Object Assembly, Block Design and Mazes and that in all the studies Black subjects have never outperformed White subjects on any of these subtests. Secondly, that Black subjects have tended to do better than White subjects on Arithmetic and Digit Span and that White subjects have never outperformed Black subjects on these two subtests. Thirdly, that both Black and White subjects have, in different studies, performed better than the other on Similarities, Information and Vocabulary. Thus White subjects usually do better on subtests which constitute the Performance Scale and Black subjects usually do better on subtests which constitute the Verbal Scale.

1.1.7. Item Difficulty/Bias

Sattler (1992) argues that children from different cultural backgrounds respond very differently in clinical situations to the idea of being tested or evaluated. Williams (1971) argues that the minority¹ child's experience of concepts and vocabulary are different from the majority child's and that a number of items on the WISC-R are unfairly difficult for children experiencing a common minority culture. Because of this difference in experience it is argued that the pattern of responses for minority children is significantly different to that of the majority children (Sandoval, 1979).

Item bias is a complex concept and there is no universal agreement as to how it should be measured (Flaugher, 1978; Sattler, 1988). The present study will adopt the definition used

by Clearly and Hilton (1968).

"An item on a test is said to be biased for members of a particular group if, on that item, the members of the group obtain an average score which differs from the average score of other groups by more or less than expected from performance on other items of the same test"

(Clearly & Hilton, 1968, p61).

Allegations of item bias which have been levied against the WISC-R have often been based on subjective judgements concerning specific items (Bersoff, 1981) or a priori assumptions concerning the White, middle class orientation of the test (Ross-Reynolds & Reschly, 1983). However, research shows that it is necessary to use empirical results rather than subjective judgements in decisions about bias in tests (Reschley, 1981; Sattler, 1991).

A review of the Item Bias/Item Difficulty research, as with the above research, has revealed inconsistent findings. Some research suggests that the WISC-R is valid and reliable on children of a number of different population groups including: Mexican-American children; Anglo-American, Black, Native-American Papagos and Chicanos (Conboy et al., 1986; Dean, 1977; Grossman & Galvin, 1989; Naglieri, 1986; Reschly, 1978; Reschly & Sabers, 1979; Reynolds & Hartlage, 1979; Ross-Reynolds & Reschly, 1983; Sandoval, Zimmerman, & Woo-Sam, 1983). Whereas other research studies have found general differences between population groups (Sandoval, 1979) or specific items which are biased against specific population groups (Sattler, 1991).

Sandoval's (1979) study of Anglo-American, Black, and Mexican-American children and Sandoval et al. (1983) study on Anglo-American, Black, Chicano and Bermudian children found that these groups of children did not perform at the same level on the various subtests of the WISC-R although they all responded to the test in the same general way, showing no clear pattern of item difficulty. However, Sattler (1991) found specific items being more difficult for Black than White children. These include three items in both Comprehension

(Items 2, 7, 11) and Information (Items 14, 15, 16) subtests.

In sum Item Bias research has either found no specific item difficulty for Black and White children, or when item difficulty is found it has been mainly against Black children rather than against White children.

1.1.8. Evaluation of previous research

The vast amount of research abroad, on the WISC-R, has yielded inconsistent results. However, comparative research tends to reveal a trend in favour of Whites outperforming Blacks on the Full Scale IQ score with insignificant differences between Whites and Blacks on specific subtests or individual items within subtests. This suggests that, within South Africa, the WISC-R will be a valid measure on both White English and Black Xhosa speaking population groups, but that the White English speaking population group may perform better on the test than the Black Xhosa speaking population group. However, it is important to recognise that within South Africa there is a different constellation of race groups and that, due to the political situation children belonging to a race group other than White were often more extremely disadvantaged than perhaps Black Americans in the United States of America. This disadvantage in educational opportunities may have had an influence on the development of certain abilities, some of which are measured by intelligence tests such as the WISC-R. It is thus necessary to take the research done in other countries one step further by obtaining norms on South African children of different population groups on the WISC-R composite and subtest scores. This constitutes the most objective and rigorous method of evaluating whether the WISC-R is a valid and reliable measure of intelligence on a South African population, and whether some items are biased and can be changed or whether the whole test is completely invalid and new tests should be devised. However, few studies have been done to ascertain the validity and reliability of the WISC-R on the different population groups within South Africa.

It appears

The only South African study on the WISC-R was researched by Murdoch, Fleming, Skuy, Painter, Schmidt, and Schutte (1994) which revealed that Black South African children performed significantly lower on all WISC-R subtests than the North American normative sample. However, this study has serious methodological problems which prevent generalisation. For example, it is difficult to ascertain the reason for the significantly lower scores for the Black South African children as some children in the sample had failed a standard, some had sustained head injuries, and it is not known whether these Black children were in English medium schools and/or whether they were proficient in the English language to be able to understand the test instructions and questions, all of which could have lowered IQ scores and produced unique scatter patterns for individual subjects.

Thus, at present, psychological test results on the Wechsler Intelligence Scale for Children - Revised (WISC-R) on South African children are reliant on American based norms as this test has not been standardised on South African children. It is necessary to question whether this American devised test is culturally relevant to South Africans and whether its normative data is valid in the multiracial and multilingual South African setting. Without the availability of South African specific normative data, clinicians may be in danger of interpreting low scores as being indicative of pathology or low intellectual level which may result in a child being inappropriately assessed and labelled as low functioning and/or inappropriately placed in a special class or special school for low functioning children. However, low scores may in fact represent pathology and thus clinicians need to be cautious when attributing low scores to cultural factors alone (Shuttleworth-Jordan, 1994).

Nell (1994) and Shuttleworth-Jordan (1995) argue that the lack of normative data of a population on a particular test is not sufficient reason for the abandonment of that test and that rather its relevance should be evaluated, minor changes made and norms developed, instead of creating new intelligence tests especially devised on a South African child population. Thus rather than developing more idiosyncratic South African Intelligence tests one must investigate the cultural bias on the up-to-date versions of the Wechsler tests, adjust the highly specific culture bound items, and achieve South African standardisation (ibid).

Shuttleworth-Jordan (1995) having done research on a South African university population, using the South African Wechsler Adult Intelligence Scale (SAWAIS), states that the international standard tests may be much more resilient in the face of cultural factors than is being acknowledged. This resilience must now be assessed using the WISC-R.

If one extrapolates from South African research which has evaluated the validity of other American based Neuropsychological tests on the South African population, one finds that on a broad level the American tests are valid for use on South Africans, although minor adjustments do need to be made. For example, researchers have found that the Bender Visual Motor Gestalt Test scores are culturally influenced and thus, although valid on a South African population, the American based normative tables need to be revised/recreated before the test can be used on a South African population (Horn, 1983; Reinecke, 1984; Viljoen et al., 1994).

The establishment of race and age related data on the WISC-R would be far less time consuming and cost-effective than designing multiple new tests. Moreover, such a procedure would simplify the clinician's task in terms of establishing expertise in the use of a single universally employed test, rather than a number of separate tests for separate races. Additionally, as Nell (1994) states, it would not preclude South African clinicians from participation in comparative worldwide research as the development of new South African tests would. Thus, one of the main advantages of using the WISC-R over specifically devised South African tests is its international relevance and broad research base for understanding the implications of the scatter patterns. The provision of a preliminary WISC-R data base of scatter patterns for standard six, English and Xhosa speaking South African thirteen to fifteen year old children will immediately make the WISC-R more accessible for clinical use on this age and educational group of South African children. In addition, the findings will provide the important broader indication of whether or not it is feasible for the WISC-R test to be pursued for use on South African children of all age groups in the race groups examined. Research in this area is vital to ascertain whether the WISC-R is culturally biased against some population groups in South Africa.

1.2 WISC-R ADJUNCTIVE TESTS

The WISC-R Adjunctive tests which were included in the battery as extensions of existing subtests include: (a) the Digit Span Forward and Digit Span Backward being assessed as two independent tests of the Digit Span subtest; (b) the Digit Supraspan; (c) Coding Immediate and Delayed Recall.

These tests have been added to the original Wechsler tests to strengthen their use as neuropsychological instruments which can aid in the initial detection of brain damage (Joy, Fein, & Kaplan, 1992a; Joy, Kaplan & Fein, 1992b; Shuttleworth-Jordan, 1991; 1992; 1995; Kaplan, 1995²; Shuttleworth-Jordan & Bode, 1995). For example, Digits Backward as a separate score assesses working memory which is extremely sensitive to brain damage and thus can detect early organic impairment. This, of course, could not be assessed when Digits Forward and Digits Backward were assessed as a combined Digit Span score. Secondly, Digits Supraspan assesses one's ability to learn new information, a function which is highly sensitive to the non-specific effects of diffuse cerebral damage. Thirdly, Coding Immediate and Coding Delayed Recall add a much needed memory component to the test without changing the structure of the test very much.

Previous researchers have described procedures for doing these adjunctive tests and have presented approximate age-related normative data on the WAIS-R (Joy, Fein & Kaplan; 1992a, Joy, Kaplan & Fein; 1992b); the South African Wechsler Adult Intelligence Scale (SAWAIS) (Shuttleworth-Jordan, 1992; Shuttleworth-Jordan & Bode, 1995) and the WISC-R, on both children abroad (Banken, 1985; Black, 1983; Gardner, 1981; Hoosain, 1979; Mishra, 1985) and on South African children (Avis, 1995; Murdoch et al., 1994). With regard to the South African research, Avis' (1994) research on six and seven year old children is useful as is Shuttleworth-Jordan's (1995) research on university students, using the South African Wechsler Adult Intelligence Scale (SAWAIS). However, this leaves a large gap in the adolescent age group. This gap in the literature is particularly significant in the

South African situation where the education system for Black and White children has been so vastly different during the Apartheid years, with White children obtaining privileged education and Black children obtaining disadvantaged education or no education at all. The present study aims to fill this gap.

1.2.1. The Separate Reporting of Digit Span Forward, Digit Span Backward and Digit Difference

Digit Span is a quickly and easily administered task that is employed in many different contexts to assist in assessing various aspects of cognitive functioning (Griffin & Heffernan, 1983). However, it has been argued that in order to obtain maximum clinical utility from this test, one needs to look at the two sub-components of this test, Digit Span Forward and Digit Span Backward, separately (Banken, 1985; Black, 1986; Gardner, 1981; Hoosain, 1979; Jensen & Figueroa, 1975; Lezak, 1995; Mishra, Ferguson, & King, 1985; Sattler, 1992; Saunders, 1959; Shuttleworth-Jordan, 1992).

The reasons for this are as follows: Firstly, Digits Forward and Digits Backward are differentially related tasks which involve somewhat different although not mutually exclusive mental activities and are affected differently by brain damage. Secondly, organic deterioration typically appears in patterns of syndrome related impairment, with some functions remaining intact relative to other functions. Composite scores, such as the Digit Span score obscures such patterns, and thus much data is lost in the composite score. Thirdly, Digits Backward evaluated separately would be able to assess working memory, which cannot be assessed if Digits Forward and Digits Backward are combined into one score. Fourthly, Digit Span has a relatively restricted range and does not correlate very highly with other measures of cognitive ability and thus it is more beneficial to deal with the data in raw score form than to convert it.

Digits Forward measures the efficiency of one's passive immediate attention span (Lezak, 1995; Shuttleworth-Jordan, 1991). It involves rote memory learning and sequential processing

(Sattler, 1992). It is effected by one's education level; it has a relatively stable capacity that is likely to be resistant to the effects of many dementing diseases (Lezak, 1995); tends to hold stable with advancing age (Shuttleworth-Jordan, 1991), and even though it often shows fall off during the first months following a head trauma or psychosurgery it usually returns to normal levels during subsequent years (Lezak, 1995).

The adult Digit Forward span commonly varies from 5 to 9 digits, with a normal range of 6, plus or minus one (Banken, 1985; Lezak, 1995). A score of less than 4 digits often suggesting that the adult is either organically impaired or mentally retarded (Griffin & Heffernan, 1983). However, Black (1986) researched brain damaged patients (left, right, bilateral lesions) and found, when compared with normal controls, no significant difference in Digits Forward scores among the patients, with subjects scoring approximately 6 digits forward.

Research on children suggests that the length of a string of digits which can be recalled increases from 2 to 8/9 between the ages of 2 and 16 (Gardner, 1981; Mishra et al., 1985) with learning disabled children scoring a mean of 5 digits forward (Black, 1983); and mentally retarded children scoring in the region of 4.6 on digits forward (Mishra et al., 1985).

Research has suggested that one's capacity for storage of digits in one's native language can be quite different from that in one's second language, despite years of instruction in the second language (Hoosain, 1979). Hoosain (1979) tested Chinese standard 6 children and university undergraduates and found that digits forward was significantly higher when given in the student's native language for both school children (8.9 digits forward) and university students (9.9 digits forward) than when repeating the digits in English (6 and 7.3 respectively), their second language and medium of instruction at school. South African research on university students found a mean of 7.67 for White South African university students and 6.88 for Black South African university students (Shuttleworth-Jordan, 1995). Reflecting a highly consistent trend of English speaking people performing at least one digit

higher than non-English speaking people on Digits Forward, when the test is performed in English. Avis (1994) found no difference between White and Black South African children aged 6 and 7 years, with a mean Digits Forward Span of 5.7.

Digits Backward is significantly more highly correlated to all three WAIS IQs (Full Scale IQ, Verbal IQ, Performance IQ) than is Digits Forward (Griffin & Heffernan, 1983), especially Verbal IQ (Gill & Schafer, 1968) and is able to differentiate subjects of different intelligence categories (Griffin & Heffernan, 1983; Lezak, 1995). This suggests that the ability to perform Digits Backward is more relevant to intellectual functioning than is the performance of Digits Forward (Black, 1983; Lezak, 1995).

As with Digits Forward, Digits Backward is influenced by education (Lezak, 1995). It requires immediate learning (Griffin & Heffernan, 1983), good concentration, planning ability and sequential processing (Sattler, 1992) and is a test of visual memory (Black, 1986; Gardner, 1981), being more strongly associated with visual-spatial or visual-constructional ability than with receptive language skills (Banken 1985; Hoosain, 1979). It tests working memory, a task which involves effortful mental double-tracking (Shuttleworth-Jordan, 1991), i.e. both memory and the reversing operations must proceed simultaneously. The ability to repeat digits backward is not only dependent on intact verbal short-term memory functioning and attention-concentration factors, but also may require both verbal and visual mediation. The nature of this task and its reliance on processes primarily resident in both the right and left hemispheres would, therefore, increase the probability of impaired performance with any type or locus of cerebral damage (Black, 1986).

Digits Backward is sensitive to brain damage and the more severe a lesion the lower the Digits Backward score. Patients with left hemisphere damage and visual field defects have shorter Digits Backward than those without such defects (Black, 1986). Digits Backward decreases with increasing age (Lezak, 1995) due to impairment in working memory (Shuttleworth-Jordan, 1991) and is very vulnerable to the kind of diffuse brain damage that occurs with many dementing processes and shows little improvement over time following

head trauma or psychosurgery (Lezak, 1995). In the absence of left hemisphere damage to which Digits Forward is sensitive, Digits Backward will tend to show increased fall-off relative to Digits Forward in patients with diffuse and right hemisphere damage (ibid). Botkin, Schmaltz, and Lamb (1977) suggest that digits backward is more dependent on the left hemisphere but it seems to depend on right hemisphere functions as well (Mishra et al., 1985). However, a limitation of using the Digit Backward score is its narrow range (Griffin & Heffernan, 1983; Lezak, 1995).

A Digits Backward raw score of 4/5 is within normal limits (Gardner, 1981; Lezak, 1995) and a score of 3 or less in an adult could indicate brain dysfunction (Lezak, 1995). Banken (1985) researched adults with 12 years education and suggests that a mean digits backward score of 5.7 is within the normal range. Griffin and Heffernan's (1983) research on an intellectually subnormal population who were psychiatrically and neurologically normal, found that, on the Wechsler Adult Intelligence Scale (WAIS), if a patient is functioning at above dull-normal range (IQ = 80 or better) he/she should be able to repeat at least three digits backward. Black (1983) found that learning disabled children score a mean Digits Backward score of 2.9; and Becker (1978) found mentally retarded children's mean digits backward score to be 2.35 (Mishra et al., 1985).

Hoosain (1979) found that Chinese school children and university undergraduates performed at approximately one digit less when taking the test in English, their second language, as opposed to Chinese, their first language. Digit backward scores in English were 4 and 6 for standard six and university undergraduates, respectively. Jensen and Figueroa (1975) found that Whites performed significantly better on Digits Backward than did Blacks of similar socio-economic backgrounds (Mishra et al., 1985). Similarly, research with South African university students found that White students performed better than Black students, by one digit, with White and Black students scoring 6.19 and 5.04 digits backward, respectively (Shuttleworth-Jordan, 1995). Similarly, Avis (1994) found that White children aged 6/7 performed approximately one digit better on Digits Backward than Black children, with a mean score of 3.17 and 2.64 respectively.

The Digits Difference score between Digits Forward and Digits Backward gives one an indication of working memory and thus can be a useful neuropsychological screening device (Shuttleworth-Jordan, 1991).

The normal raw score difference between Digits Forward and Digits Backward tends to range around 1.0, with a 3-point difference between them being an indicator of brain-damage (Lezak, 1995). Gardner (1981) suggests that, in children aged between five and sixteen years, a digits backward score of 3 or more points less than the digits forward score is significant and may indicate pathology. Black's (1983), research with learning disabled children, reports a relatively high incidence (35% of the sample) of large discrepancies (3+) between Digits Forward and Digits Backward. However, less than a three point discrepancy between digits forward and digits backward cannot rule out the possibility of brain damage as Black's (1986) research on brain-damaged adults found that some brain-damaged patients score less than a 3 point difference between digits forward and digits backward.

Research on South African university students reveals a Digits Difference scores of 1-2 for both Black and White students (Shuttleworth-Jordan, 1995). This suggests that regardless of whether a person is being tested in English as his/her first or second language, a digits difference score of more than 2, should alert the practitioner to possible problems with working memory (ibid). Avis (1994) found, with children aged six/seven years, a Digits Difference of 2.69 and 3 for White and Black children, respectively.

1.2.2. Digit Supraspan

Digit Supraspan measures new learning ability and recent memory. New learning ability is highly sensitive to the non-specific effects of diffuse cerebral damage (Shuttleworth-Jordan, 1991), and a deficit in recent memory is often the first presenting deficit in any pathology with raised intracranial pressure, and often the only deficit in closed head injury (Lezak, 1995; Lishman, 1978; Walsh, 1985).

However, the original Wechsler Intelligence tests, including the WISC-R, has no subtest/s which tap this new learning ability. A method for tapping new learning ability, called the Supraspan test, was developed by Zangwill (1943) and is a modification of the digits forward test which is automatically adjusted to the testee's immediate memory span. That is, the number of trials it takes to learn the numerical span above an individual's immediate memory span (Hamsher, Benton, & Digre, 1980; McFie, 1975). Research on the Supraspan test suggests that the administration of the Supraspan test as part of the Digit Span subtest adds an important verbal short term memory and new learning ability component to the test (Shuttleworth-Jordan, 1992). Advantages of using this method are firstly, that the individualised immediate memory span established on the Digits Forward test creates the automatic baseline of the test and secondly, it is merely an extension of the regular Digits Forward test which forms a standard part of many test batteries, including the WISC-R, and thus is a time economical way of achieving important additional neuropsychological information (Shuttleworth-Jordan, 1992).

The Supraspan task is sensitive to increasing age, education level, brain impairment and anticholinergic medication, and seems to show a greater degree of deficit in the presence of cerebral impairment than Digits Forward (Lezak, 1995; Hamsher et al., 1980). McFie (1975) notes that most normal subjects learn a supraspan series one above their immediate memory span in 2 to 3 repetitions. South African research suggests a Digit Supraspan score of 2-3 can be considered normal for both English and non-English university students (Shuttleworth-Jordan, 1995). This suggests that regardless of age between 18-70, and even when a patient is being tested in English as his/her second language, a score of more than 3 on Digit Supraspan should alert the practitioner to possible problems with verbal new learning ability (Shuttleworth-Jordan, 1995).

1.2.3. Coding Immediate and Delayed Recall

Coding taps the ability to learn an unfamiliar task and involves speed and accuracy of visual-

motor coordination, attentional skills, short-term memory, cognitive flexibility, motivation, psychomotor speed, visual acuity, and paper and pencil skills (Sattler, 1992). It is an information processing task involving discrimination and memory of visual pattern symbols (ibid); assesses short-term visual memory and visual perceptual ability (McManis, Figley, Richert, & Fabre, 1978). A low Coding score has been reported to identify a number of problems, for example, identifying children with delayed reading ability ((Holland, 1989); specific spelling retardation (Share, Silva, & Adler, 1987); Tourette's syndrome (Matthews, 1988); hearing problems (Braden, 1990) and possibly solvent abuse (Zur & Yule, 1990).

The Wechsler Intelligence Scales for both adults and children have been criticised for not including a immediate and short term memory component in the test. Research has attempted to rectify this by extending the existing Coding subtest on the WISC-R (Avis, 1994; Collear & Evans, 1982) and Digit Symbol Substitution subtest on the SAWAIS (Shuttleworth-Jordan & Bode, 1995; Joy et al., 1992).

Research on ethnic differences have not yielded any significant differences in recall scores. Collear and Evans (1982) found no significant mean difference among Black, White, Asian and Hispanic children, aged eight to twelve, on the Coding immediate incidental recall. Similarly, South African research (Avis, 1994) has reported no significant difference between English and Xhosa speaking children, aged 6/7 years, on the Coding A immediate and delayed recall tests.

The age of a child has been reported to have an affect on the Coding score (Kail, 1991) and Coding recall scores (Avis, 1994) as does the age of an adults have an affect on Digit Symbol Substitution scores (Shuttleworth-Jordan & Bode, 1995). South African research on adults, aged 20-39, using the Digit Symbol Substitution subtest of the SAWAIS suggests a mean immediate recall score of 7.30. Collear and Evans (1982) found a Coding immediate recall mean score of 5/6 for children aged eight to ten years and a mean of 6/7 for ages eleven and twelve. Murdoch et al. (1994) study on Black South African standard 6 pupils between the ages of 11 and 16 found a mean short term incidental recall score of 6.77 and

delayed recall score of 6.25. Avis' (1994) research with six/seven year old children reports a mean immediate recall and delayed recall score of 4.68 and 4.66 respectively. However, caution must be applied in comparing these studies as the administration of the recall tests, in these studies, is not identical.

It is thus evident that more research has been conducted on the South African population with regard to the WISC-R Adjunctive tests compared to the WISC-R subtests. However, as with research on the composite and subtest scaled scores, there is a paucity of research on the adolescent population group. Once again, the present study aims to fill this gap.

1.3. A STATEMENT OF THE AIMS OF THIS STUDY

Thus taking the above literature survey into consideration, it was decided to conduct a comparative study on the WISC-R mean composite, and subtest scaled scores and WISC-R adjunctive tests, on a population of English and Xhosa speaking children from one private and one government school in Grahamstown restricted to the age group of thirteen to fifteen years, and who were all in standard six, never having failed a standard. The study was designed (i) as a preliminary investigation into the validity of the WISC-R, and (ii) to provide initial normative data indications on these tests, on these two South African language groups, within the highly specific age and educational ranges of thirteen years and three months to fifteen years and three months, all in standard six. It was understood that the results would thus have generalizability limited only to this narrow age and educational range. However, it was expected that the results would provide broader indications for further investigation on other age, educational and language groups within South Africa.

2. METHODOLOGY

2.1 SUBJECTS

2.1.1 Demographic Data

Since this was a preliminary investigation it was decided that a restricted group of subjects would be used which controlled for education level. A total of 27 non-clinical South African Black Xhosa (n = 12) and White English (n = 15) speaking children (subsequently referred to as "Xhosa" and "English" speaking children or subjects, respectively), both male (n = 19) and female (n = 8) were matched on education level, and school attended. Children were selected from two Grahamstown schools, one private (n = 8) and one public school (n = 19), both instructing in the English medium. All children were in standard six at the time of testing, never having failed a standard. Only one Xhosa subject had not attended an English medium primary school before entering standard six. Age ranged from 13 years and 3 months (159 months) to 15 years and 3 months (183 months), with a mean age of 14 years and 1 month (169 months). There was no significant difference in ages between Xhosa and English speaking subjects.

The grade distribution, based on mid-year results, for English speaking children was: Grade A (n = 4), Grade B (n = 5), Grade C (n = 1), Grade D (n = 3), Grade E (n = 1), Grade F (n = 1) and for the Xhosa speaking children was: Grade A (n = 1), Grade B (n = 1), Grade C (n = 1), Grade D (n = 4), Grade E (n = 4), and Grade F (n = 1). The categories Grade A, B, C, D, E and F represent 80+%, 70-79%, 60-69%, 50-59%, 40-49%, and 30-39% respectively. The average grade for English speaking children was C, and Xhosa speaking children was D. The bottom cut-off percentage for each grade was allocated to each subject on the basis of their respective grade levels and a mean percentage was calculated for each group: the

English speaking group (mean = 63%, SD = 15.89, range = 30-80%); and Xhosa speaking group (mean = 50%, SD = 14.14, range = 30-80%).

Subjects were screened and children were excluded on the following grounds. No children were included in this study who had failed a standard, who were presently seeing a Psychologist or Psychiatrist, who were presently in remedial teaching or suffering from a learning disability, who were on medication or suffering from epilepsy or any other neurological disorder, who had previously sustained a head injury or been unconscious, or who had problems with eyesight or hearing.

2.1.2 Subject Selection Procedure

Four Grahamstown Schools using an English medium of instruction were approached by letter (Appendix I) to take part in this research project, in which it was stated that the children would be paid for their participation. Two of these four schools agreed to participate in the study. One school did not respond to the letter and the other school refused participation on the grounds of the headmaster stating that he did not have the authority to allow access to his pupils for psychological assessment research. Of the two schools who agreed to participate, one was a private school and one was a government school. Letters were sent to all parents of the standard six pupils requesting their permission for their children to take part in the study and stating that the children would be paid twenty-five rand for their participation (Appendix II), together with a Checklist Screening questionnaire (Appendix III) to be filled in by the parents and returned to the school. Only those children who were granted parental permission and returned a completed Checklist Screening Questionnaire were included in the subject pool. This pool of children was then further refined by the exclusion criteria described in section 2.1.1., paragraph 3. From this subject pool 27 subjects were randomly selected. All subjects who were selected agreed to participate in the study.

2.2 PROCEDURE

Separate time slots were arranged individually with each subject and the researcher, who was proficient in neuropsychological assessment. The researcher administered the WISC-R individually to each subject and scored all protocols. The entire battery, excluding the Vocabulary subtest, was given to each subject in a single sitting. The subtests were given in the following order: Information; Picture Completion; Similarities; Coding B; Coding Immediate Recall; Picture Arrangement; Arithmetic; Block Design; Coding Delayed Recall; Object Assembly; Comprehension; Digits Forward; Digit Supraspan; Digits Backward; Mazes. Approximately 70 to 90 minutes was required to establish rapport and administer the battery of tests to each child. At each school a testing room was chosen which was free from noise and interruptions. During the testing only the researcher and the subject were present. All subjects were paid twenty-five rand for their participation.

2.3 MEASURING INSTRUMENTS

2.3.1. Checklist Screening Questionnaire

A Checklist Screening Questionnaire (Appendix II) was sent to all parents asking whether their child had failed a standard, was seeing a Psychologist or Psychiatrist, was in remedial teaching or suffering from a learning disability, was on medication or suffering from epilepsy or any other neurological disorder, had previously sustained a head injury or been unconscious, or had problems with eyesight or hearing. Children with any of the above were not included in the sample pool.

2.3.2 Wechsler Intelligence Scale for Children - Revised (Wechsler, 1974)

The Wechsler Intelligence Scale for Children - Revised (WISC-R) was administered using the standard procedures as stated in the Manual (Wechsler, 1974).

In the WISC-R, eleven subtests were used. Verbal subtests include: Information, Similarities, Comprehension, Arithmetic, Digit Span. Performance subtests include: Picture Completion, Picture Arrangement, Mazes, Coding, Block Design and Object Assembly. The Verbal subtest, Vocabulary, was omitted as it is time consuming to administer and it is legitimate to use the other five verbal subtests in the calculation of I.Q. scores (Wechsler Manual, 1974).

The following Verbal subtest items were revised to enhance their relevance in the South African setting: Information (items 5, 20, 24, 27); Similarities (item 10); and Arithmetic (Appendix IV).

2.3.3. Digit Span Forward and Digit Span Backward

The Digit Span Forward and Digit Span Backward were examined as separate scores distinct from the Digit Span composite scaled score.

2.3.4 Digit Supraspan Test

The WISC-R Digit Supraspan Test was administered after the Digits Forward part of the Digit Span subtest, using the same instructions as those used by Shuttleworth-Jordan (1992). That is, the Digit Span test was administered in

the usual way and stopped at the point when the testee failed both items on a particular forward span. The Supraspan test then started with the second failed trial where the tester repeated this trial with the instructions "I will say that one again and see if you can get it this time". This first repetition counted as Supraspan Learning Trial 1. The span was repeated until the testee had repeated it correctly, or after eight consecutive failed trials. The score was the number of trials taken to learn the supraspan.

2.3.5. Modification of WISC-R Coding B Subtest

There were three changes in the administration of the Coding B subtest. Firstly, the protocol was a Black and White photocopy, not the blue and red colour coded form (see Appendix V). Secondly, the subject used a lead pencil, and not a red pencil, to complete the form. Thirdly, the instructions for the WISC-R Coding B Subtest were given as per instructions in the manual except that subjects were not told to stop after two minutes, but rather instructed that "When I say tick I want you to make a mark like this (demonstrated by researcher) in the block you are in and continue right to the end (the end of the test is pointed to)".

A number of different methods exist for the administration of the WISC-R Coding and SAWAIS Digit Symbol Substitution subtests with respect to the amount of practice given. For example, Shuttleworth-Jordan and Bode (1995) give one line less practice than Joy et al (1992) on the Digit Symbol Substitution subtest based on the rationale that older adults tire easily. With respect to children, Avis (1994) and the present study told subjects to complete the subtest until the end. The rationale for this was that it ensured that every subject had equal exposure to the symbols on the Coding subtest. It was hypothesised that this would give them an equal chance on the immediate and

delayed recall tests. Thus a subject would not be disadvantaged on the memory component of this subtest, if he/she performed poorly on the Coding subtest per se.

2.3.6. WISC-R Coding B Incidental Immediate and Delayed Recall Test

A separate A4 piece of paper was divided in two halves which each contained one row of nine blank boxes, numbered 1 - 9. One row for immediate Coding recall and the other for delayed Coding recall (Appendix VI). The instructions were worded in the identical form used in the research by Avis (1994), on 6-7 year old South African children.

The subjects received no warning at any stage that there would be an immediate or delayed Coding recall task. Immediately after administering the Coding B Subtest the Coding Immediate recall test was administered, with the following instructions: "I want you to fill in the things here (pointing to the row of numbers) with the same marks that you used just now. But this time, see how many of them you can remember of your own". Approximately thirty minutes later the Coding Delayed Recall test was administered, with the following instructions: "Remember the test you did where you had to fill in the things here (point to the row of numbers). Let us see how many you still remember" (ibid). For both recall tests the subject was not warned that there was a memory component.

2.4 STATISTICAL DATA ANALYSIS

2.4.1 Wechsler Intelligence Scale for Children - Revised standard scores

The WISC-R Full Scale, Verbal Scale and Performance Scale and the subscale scores for each of the eleven subtests used, were calculated for each subject according to the WISC-R manual instructions. All the analyses in this study are based on the age-standardised scaled scores.

2.4.2. Composite IQ Scores

A two-tailed t-test for independent samples was used to analyze the differences between English speaking children and Xhosa speaking children on Full Scale IQ, Verbal Scale and Performance Scale IQ. This was done for (i) all subjects; (ii) on a sub-sample of children matched on Full Scale IQ and (iii) on a sub-sample of children matched on mid-year grade average.

2.4.3. Verbal IQ versus Performance IQ within each group

No difference between Verbal IQ and Performance IQ for each subject was hypothesised and thus a two-tailed t-test for related samples was employed to test this hypothesis.

2.4.4. Subtest Scatter

In order to establish whether any tests were significantly lower for South African children as a whole, or specifically low in either the White or Black sample, a t-test for related samples was employed.

To establish whether there was significant variation between the subject's performance on each of the eleven different subtests of the WISC-R, two-tailed t-tests for related samples were used. a t-test for related samples was used instead of the Analysis of Variance (ANOVA) because of the t-test's sensitivity to individual variation, which the ANOVA lacks. As subtests were compared against each other a number of times the Bonferroni Multiple Comparison procedure was used to ensure that the overall level of significance was not higher than 5%. (i.e. t-tests were significant if $p < \frac{0.05}{10} = 0.0045$). Thus any t-value less than $+3.03$ or $+3.38$ for English-speaking or Xhosa-speaking children respectively, will have a p-value of less than 0.0045.

2.4.5. Digits Forward, Digits Backward, Digits Difference, and Digit Supraspan.

Statistical analysis of differences between English speaking children and Xhosa speaking children on Digits Forward, Digits Backward, Digits Difference, and Digit Supraspan was done using a two-tailed t-test for independent samples.

2.4.6. Coding Immediate Recall, and Coding Delayed Recall

Statistical analysis of differences between English speaking children and Xhosa speaking children on Coding Immediate Recall and Coding Delayed Recall was done using a two-tailed t-test for independent samples.

2.4.7. Item Difficulty

An analysis of the scores obtained by each sample was made item by item for each of the following subtests: Information, Similarities, Arithmetic, Comprehension, Block Design, Picture Completion, Picture Arrangement. For Comprehension, Block Design and Picture Arrangement subtests an item was considered passed if the child received any credit on the item, in contrast to

the manual scoring where the degree of a child's understanding or the speed of response is scored using a graded point system. This was done as the present study wanted to ascertain whether or not the children knew or did not know an answer and not the depth of their knowledge. Percentages passing each successive item were calculated.

3. RESULTS

3.1 COMPARISON OF ENGLISH VERSUS XHOSA SPEAKING CHILDREN ON THE WISC-R COMPOSITE SCORES, SUBTEST SCORES, AND SUBTEST SCORE SCATTER PATTERNS.

Table 1

Means, Standard Deviations, and t-scores for WISC-R Subtests and Scale Standard Scores

WISC-R	English (n = 15)		Xhosa (n = 12)		t
	Mean	SD	Mean	SD	
Verbal IQ	105.53	(10.88)	89.50	(8.53)	4.17***
Information	10.73	(2.09)	7.75	(1.86)	3.86***
Similarities	10.87	(1.19)	8.83	(2.33)	2.95**
Arithmetic	10.67	(3.04)	9.00	(3.33)	1.36
Comprehension	10.67	(1.95)	8.92	(1.38)	2.62*
Digit Span	11.80	(3.10)	7.30	(2.10)	4.27***
<u>Performance IQ</u>	113.13	(12.33)	89.25	(10.95)	10.84**
Picture Completion	11.80	(2.18)	8.75	(1.91)	3.81***
Picture Arrangement	10.20	(2.48)	9.00	(3.13)	1.11
Block Design	14.13	(2.83)	8.75	(2.53)	5.14***
Object Assembly	13.07	(3.43)	7.42	(2.84)	4.58***
Coding	10.27	(2.43)	8.58	(3.18)	1.57
Mazes	13.67	(3.56)	11.33	(4.66)	1.48
<u>Full Scale IQ</u>	109.67	(9.22)	88.42	(8.35)	6.20***

* p < 0.05
 ** p < 0.01
 *** p < 0.001

English speaking children scored significantly higher than the Xhosa-speaking children on Full Scale IQ ($t = 6.20$; $p < 0.001$), Verbal IQ ($t = 4.17$; $p < 0.001$), and Performance IQ ($t = 10.84$; $p < 0.001$). The English-speaking children had a mean Full Scale IQ of 109.67, a mean Verbal IQ of 105.53, and a mean Performance IQ of 113.13. The Xhosa-speaking children had a Full Scale IQ of 88.42, a mean Verbal IQ of 89.50, and a mean Performance IQ of 89.25.

The difference between the two groups scores were most apparent on the Information ($t = 3.86$; $p < 0.001$), Digit Span ($t = 4.27$; $p < 0.001$), Picture Completion ($t = 3.81$; $p < 0.001$), Block Design ($t = 5.14$; $p < 0.001$), and Object Assembly ($t = 4.58$; $p < 0.001$) subtests where English speaking children scored significantly higher than the Xhosa speaking children. To a lesser degree, but still significant, English speaking children scored higher than Xhosa speaking children on Similarities ($t = 2.95$; $p < 0.01$) and Comprehension ($t = 2.62$; $p < 0.05$). On the remainder of the subtests, that is, Arithmetic, Picture Arrangement, Coding and Mazes the difference between the two groups did not reach significance although there was a trend of English speaking children scoring higher than Xhosa speaking children.

Table 2

Means and Standard Deviations for 5 subjects matched on school performance on the WISC-R Subtest and Scale Standard Scores

WISC-R	English (n = 5)		Xhosa (n = 5)		t
	Mean	SD	Mean	SD	
<u>Verbal IQ</u>	102.8	(17.77)	89.6	(6.80)	1.55
Information	9.8	(3.03)	7.8	(2.04)	1.22
Similarities	10.4	(1.14)	10.0	(2.24)	0.36
Arithmetic	9.6	(4.04)	7.8	(2.39)	0.86
Comprehension	11.2	(3.12)	9.4	(1.52)	1.16
Digit Span	11.4	(4.39)	6.8	(1.10)	2.27
<u>Performance IQ</u>	109.0	(12.37)	89.8	(13.99)	2.30
Picture Completion	10.8	(2.59)	8.2	(1.64)	1.90
Picture Arrangement	9.6	(3.58)	10.8	(4.09)	0.49(-)
Block Design	13.2	(1.30)	7.8	(2.68)	4.05**
Object Assembly	12.2	(3.42)	6.4	(2.51)	3.06*
Coding	11.0	(2.00)	9.8	(4.21)	0.58
Mazes	11.0	(2.55)	8.4	(2.19)	1.73
<u>Full Scale IQ</u>	106	(13.44)	88.6	(10.99)	2.24

* p < 0.05
 ** p < 0.01
 *** p < 0.001

When subjects are matched on school performance, the Full Scale IQ, Verbal Scale and Performance Scale IQ score are no longer significantly different, although there is still a trend of English speaking children scoring higher than Xhosa speaking children on all three composite scores. The significant difference between the groups regarding individual subtest scores also declines, with significant differences evident only on the Block Design ($t = 4.05$; $p < 0.01$) and Object Assembly subtests ($t = 3.06$; $p < 0.05$). Although the trend, for all subtests except Picture Arrangement, is of English speaking children scoring higher than Xhosa speaking children.

Table 3

Means and Standard Deviations for **5 subject-pairs matched on Full Scale IQ** on the WISC-R Subtest

WISC-R	English (n = 4)		Xhosa (n = 4)		t
	Mean	SD	Mean	SD	
<u>Verbal IQ</u>	97.25	(9.91)	95.75	(8.66)	0.28
Information	8.75	(2.22)	9.25	(1.50)	0.04
Similarities	9.75	(0.50)	9.75	(2.50)	0
Arithmetic	9.00	(3.92)	10.50	(4.36)	0.51
Comprehension	9.50	(1.29)	9.25	(2.36)	0.19
Digit Span	11.00	(2.94)	8.00	(2.83)	1.47
<u>Performance IQ</u>	101.75	(12.18)	99.50	(7.68)	0.31
Picture Completion	10.00	(2.16)	10.00	(2.58)	0
Picture Arrangement	7.50	(2.52)	11.75	(3.86)	1.85
Block Design	12.00	(0.82)	9.25	(3.30)	1.62
Object Assembly	12.25	(4.03)	9.50	(2.38)	1.18
Coding	10.00	(2.16)	9.75	(4.79)	0.10
Mazes	11.00	(1.83)	12.50	(3.87)	0.70
<u>Full Scale IQ</u>	98.75	(5.32)	97.25	(3.86)	0.46

* p < 0.05
 ** p < 0.01
 *** p < 0.001

When subjects are matched on Full Scale IQ negligible differences occur with regard to mean subtest scores with none reaching statistical significance at any levels.

Table 4

WISC-R Verbal I.Q., Performance I.Q. and Full Scale I.Q. obtained by 15 English speaking South African children

Subject	Full Scale IQ	Verbal IQ	Perf. IQ	VIQ/PIQ Difference
1	126	133	112	21
2	121	112	128	16
3	121	111	129	18
4	117	109	121	12
5	113	102	124	22
6	112	103	121	18
7	111	102	120	18
8	109	106	112	6
9	108	97	120	23
10	107	117	95	22
11	105	102	108	6
12	103	90	120	30
13	103	111	95	16
14	97	98	96	2
15	92	90	96	6

Although there was a large difference between Verbal IQ and Performance IQ for a large number of subjects ($n = 10$), when the data was analyzed collectively this difference was not statistically significant ($t = -1.81$; $p < 0.05$). The data does however suggest a strong trend of Verbal IQ being lower than Performance IQ for English-speaking children.

Table 5

WISC-R Verbal I.Q., Performance I.Q. and Full Scale I.Q obtained by 12 Xhosa speaking South African children.

Subject	Full Scale	Verbal IQ	Perf. IQ	VIQ/PIQ Difference
1	101	96	106	10
2	100	107	91	16
3	95	86	106	20
4	93	94	95	1
5	89	92	87	5
6	89	92	88	4
7	89	87	93	6
8	85	98	74	24
9	84	82	87	5
10	84	81	90	9
11	81	80	86	6
12	71	79	68	11

Statistical analysis revealed no significant difference between Verbal IQ and Performance IQ for the Black sample ($t = 0.07$; $p < 0.05$). And no significant trend, in either direction, is noted.

Table 6

WISC-R subtest score scatter obtained by English speaking children

I		-0.26	0.09	0.17	-1.66	-1.62	0.89	-3.74	-2.07	0.61	-3.37
S			0.28	0.41	-1.31	-1.71	1.13	-4.54	-2.36	0.86	-3.15
A				0	-1.42	-1.09	0.44	-4.38	-1.85	0.42	-3.57
C					-1.65	-1.47	0.97	-3.75	-2.11	0.54	-3.11
DS						0	1.72	-2.02	-0.96	1.42	-1.57
PC							2.82	-3.07	-1.41	2.40	-1.83
PA								-4.24	-3.02	0.07	-2.97
BD									1.48	4.28	0.50
OA										2.28	-0.47
C											-3.47
M											
	I	S	A	C	DS	PC	PA	BD	OA	C	M

High subtest scatter for English-speaking children is noted on Block Design and Mazes. Block Design is significantly higher ($p < 0.0045$) than Information ($t = -3.74$), Similarities ($t = -4.54$), Arithmetic ($t = -4.38$), Comprehension ($t = -3.75$), Picture Completion ($t = -3.07$), Picture Arrangement ($t = -4.24$), Coding ($t = -4.28$). Mazes is significantly ($p < 0.0045$) higher than Information ($t = -3.37$), Similarities ($t = -3.15$), Arithmetic ($t = -3.57$), Comprehension ($t = -3.11$), and Coding ($t = -3.47$). No low subtest cluster is evident for English-speaking children.

KEY

- I - Information subtest
- S - Similarities subtest
- A - Arithmetic subtest
- C - Coding subtest
- DS - Digit Span subtest
- PC - Picture Completion subtest
- PA - Picture Arrangement subtest
- BD - Block Design subtest
- OA - Object Assembly subtest
- C - Coding subtest
- M - Mazes subtest

Table 7

WISC-R subtest score scatter obtained by Xhosa speaking children

I		-1.25	-1.14	-1.75	0.53	-1.24	-1.24	-0.87	0.35	-0.69	-2.36
S			-0.13	-0.12	1.70	0.09	-0.19	0.07	1.20	0.25	-1.58
A				0.07	1.77	0.32	0	0.24	1.41	0.23	-1.67
C					1.99	0.19	-0.10	0.15	1.30	0.37	-1.62
DS						-1.61	-1.28	-1.34	-0.09	-0.89	-2.85
PC							-0.21	0	1.92	0.13	-1.88
PA								0.17	1.14	0.56	-1.31
BD									2	0.13	-1.96
OA										-0.85	-2.93
C											-1.56
M											
	I	S	A	C	DS	PC	PA	BD	OA	C	M

No high or low subtest cluster is evident for Xhosa-speaking children at the corrected significance level (ie $p < 0.0045$). However, there is a tendency for Mazes to be the highest scoring subtest at the 5% level of significance ($p < 0.05$). At this level it is significantly higher than Information ($t = -2.36$), Digit Span ($t = -2.85$) and Object Assembly ($t = -2.93$).

3.2 Item bias/difficulty within subtests of the WISC-R for English and Xhosa speaking children.

Information (Graph 1)

The Information graph for both English-speaking and Xhosa-speaking subjects reveals markedly "saw tooth/jagged" profiles. Items which appear to be difficult for both groups, include the following: Item 16; 17; 19; 24; 25. No items were more difficult for English-

speaking than Xhosa-speaking children, on the Information subtest. However, some items did appear to be more difficult for the Xhosa-speaking children than the English-speaking children. These include the following: Item 12; 20; 21; 22. Ceiling effect for English-speaking children occurred at Item 29, but from Item 16 in Xhosa-speaking children, where less than 50% of the Xhosa-speaking children got these items right.

Similarities (Graph 2)

This subtest showed relatively smooth item progression for both groups. Differences between the two groups was not minimal. Both groups found item 15 disproportionately easy.

Arithmetic (Graph 3)

Relatively smooth curves for both groups is evident and no items appeared to be exceptionally difficult for any of the children.

Comprehension (Graph 4)

Xhosa-speaking children seemed to find item 10 and 16 disproportionately difficult.

Block Design (Graph 5)

Relatively smooth curves for both groups on this subtest. A sharp decline for items 10 and 11 for Xhosa-speaking children which did not occur with the English-speaking children.

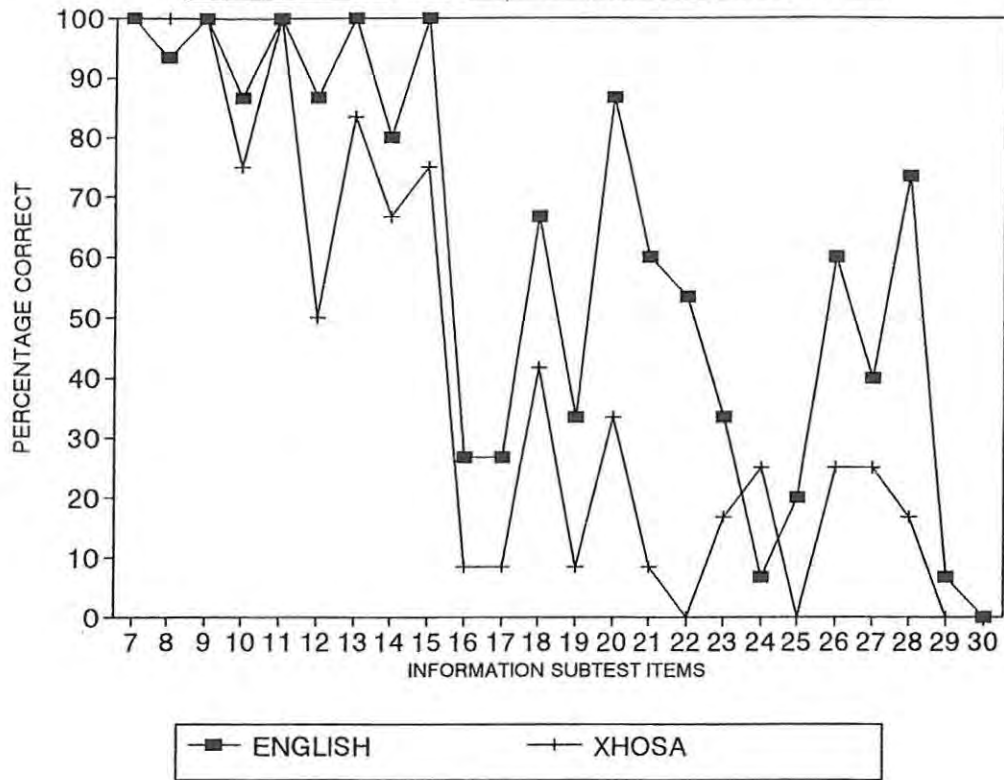
Picture Completion (Graph 6)

The Xhosa-speaking group found item 17 and 22 unusually difficulty. The English-speaking group had a relatively smooth curve except that item 24 was disproportionately easy.

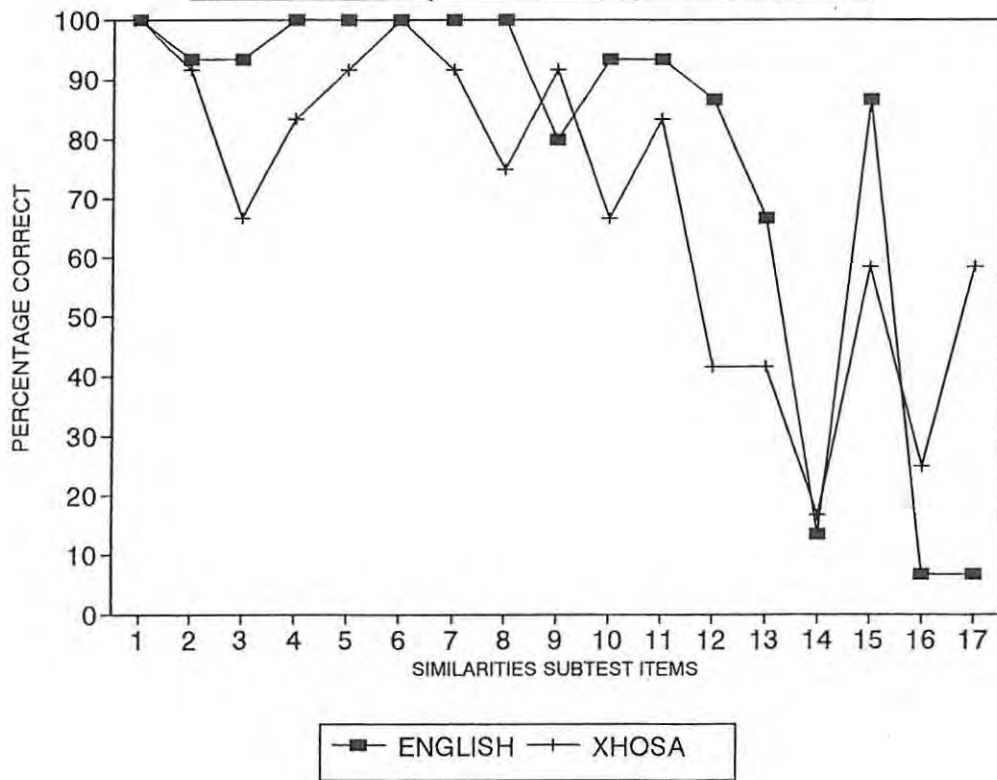
Picture Arrangement (Graph 7)

This subtest showed relatively smooth item progression for both groups. Item 7 was unexpectedly difficult for the Xhosa-speaking group.

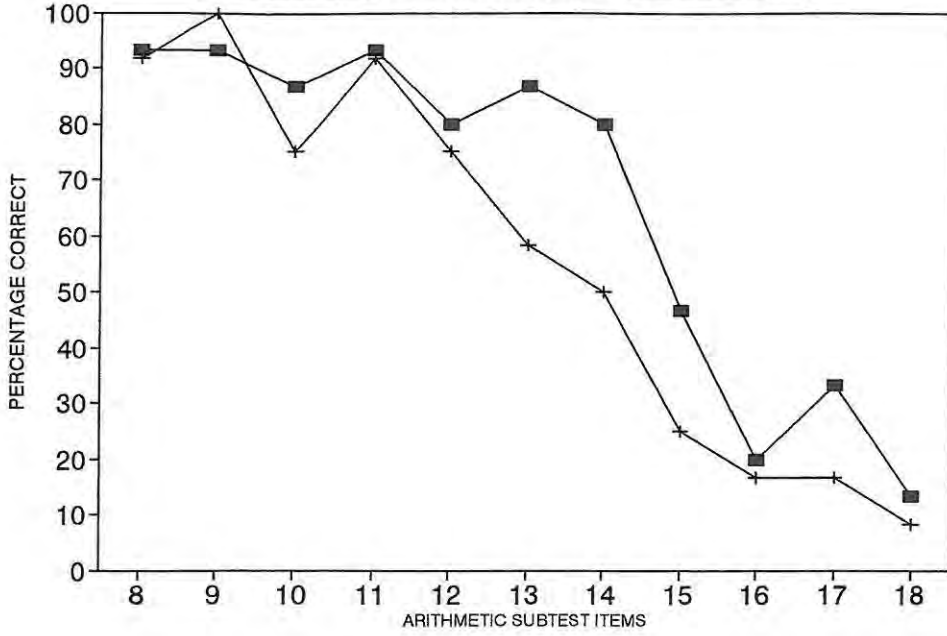
GRAPH 1: WISC-R INFORMATION SUBTEST



GRAPH 2: WISC-R SIMILARITIES SUBTEST

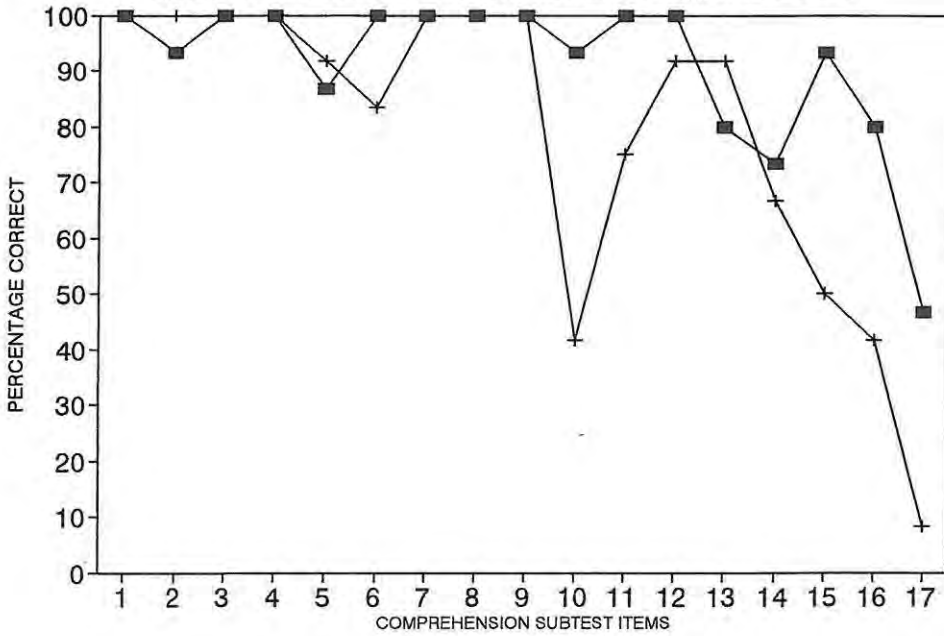


GRAPH 3: WISC-R ARITHMETIC SUBTEST



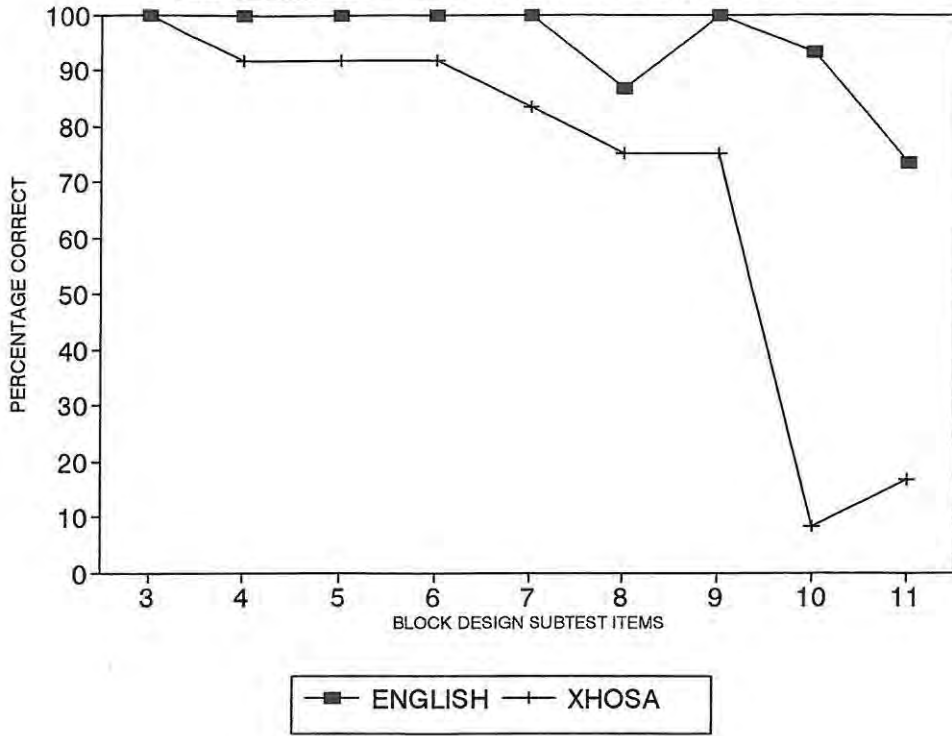
—■— ENGLISH —+— XHOSA

GRAPH 4: WISC-R COMPREHENSION SUBTEST

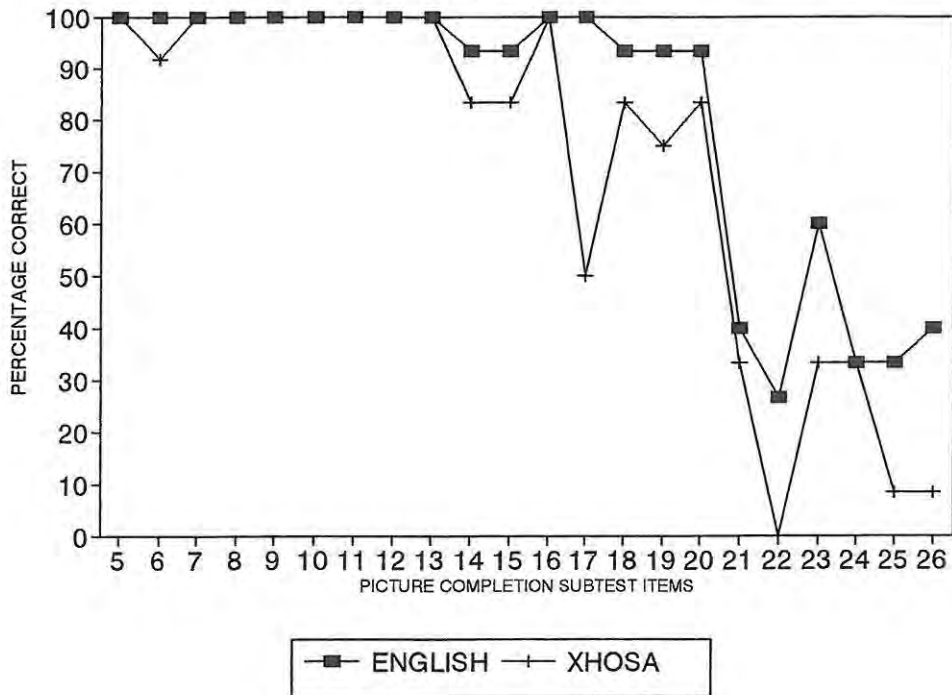


—■— ENGLISH —+— XHOSA

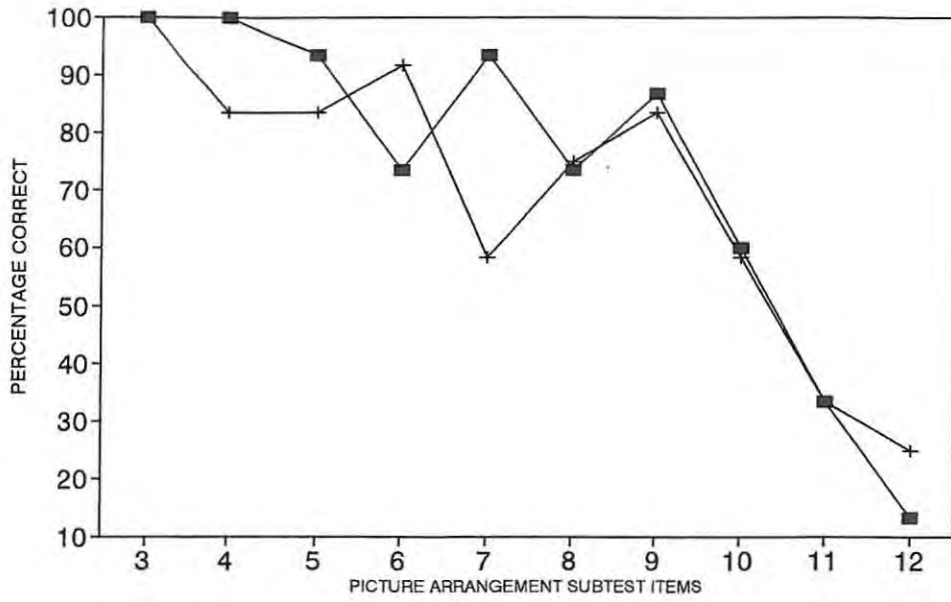
GRAPH 5: WISC-R BLOCK DESIGN SUBTEST



GRAPH 6: WISC-R PICTURE COMPLETION SUBTEST



**GRAPH 7: WISC-R PICTURE ARRANGEMENT
SUBTEST**



—■— ENGLISH —+— XHOSA

3.3. WISC-R DIGITS FORWARD, DIGITS BACKWARD, DIGITS DIFFERENCE AND DIGITS SUPRASPAN TESTS.

Table 8

WISC-R raw scores on Digits Forward, Digits Backward, Digits Difference, and Digits Supraspan obtained by English and Xhosa speaking children.

	English (SD)	Xhosa (SD)	t-scores
Digits Forward	6.87 (0.92)	5.33 (1.07)	4.01***
Digit Backward	5.53 (1.55)	4.17 (1.34)	2.40*
Digit Diff	1.33 (0.94)	1.33 (1.30)	0
Supraspan	3.27 (2.22)	1.75 (0.97)	2.20*

* p < 0.05
 ** p < 0.01
 *** p < 0.001

English-speaking children scored significantly higher (that is, performed better) than Xhosa-speaking children on Digits Forward ($t = 4.01$, $p < 0.001$) and Digits Backward ($t = 2.40$, $p < 0.05$) and significantly higher (that is, performed worse) on Digits Supraspan ($t = 2.20$, $p < 0.05$). There was no Digits Difference score between English and Xhosa-speaking children, both scoring a Digit Difference of 1.33.

Table 9

WISC-R raw scores on Digits Forward, Digits Backward, Digits Difference, and Digits Supraspan obtained by English and Xhosa speaking children **matched on school performance.**

	English n = 5 (SD)	Xhosa n = 5 (SD)	t-scores
Digits Forward	6.8 (1.30)	4.8 (0.45)	3.25*
Digit Backward	5.4 (2.30)	4.2 (0.84)	1.10
Digits Diff	1.4 (1.67)	0.6 (0.89)	0.95
Supraspan	2.8 (1.92)	1 (0)	2.10

* p < 0.05
 ** p < 0.01
 *** p < 0.001

When English and Xhosa-speaking children were matched on mid-year grades, the only significant difference was English-speaking children scoring higher than Xhosa-speaking children on Digits Forward ($t = 3.25$, $p < 0.05$), although this difference was less significant than when the whole sample was compared.

Table 10

WISC-R Coding Incidental Immediate and Coding Delayed Recall Tests obtained by English and Xhosa speaking children.

	English n = 12	Xhosa n = 9	t-scores
Imm. Recall	6.92 (2.02)	6.67 (2.40)	0.27
Delayed Recall	5.58 (2.81)	6.33 (2.35)	-0.65

* p < 0.05
 ** p < 0.01
 *** p < 0.001

There was no significant difference between the two groups on Coding Immediate recall or Coding delayed recall.

4. DISCUSSION, EVALUATION, CONCLUSIONS AND RECOMMENDATIONS

4.1. DISCUSSION

4.1.1. Comparison of mean composite scores among English and Xhosa speaking children

Results show that, when the sample is taken as a whole, there is a significant difference between the English and Xhosa speaking children on all three WISC-R composite scores (i.e. Verbal IQ, Performance IQ and Full Scale IQ), with the English speaking children's mean scores being more than one standard deviation, higher than the Xhosa speaking children's scores on the Full Scale IQ. English speaking children scored a mean Full Scale IQ, Verbal IQ and Performance IQ of 109.67, 105.53 and 113.13 respectively compared to the Xhosa speaking children who scored 88.42, 89.50 and 89.25 respectively.

These differences in composite scores between ethnic groups is consistent with differences found with the standardisation sample (Wechsler, 1974), where White children (FSIQ = 102) obtained Full Scale IQ scores approximately one standard deviation higher than Black children (FSIQ = 86). Naglieri (1986) found that, on the WISC-R, White children scored higher than Black children on all three composite scores, although the differences did not reach significance. This difference of, Whites outperforming their Black counterparts on all three scales, was also found with the standardisation sample on the Wechsler Adult Intelligence Scale -Revised (WAIS-R) (Kaufman et al., 1988). However, on the Wechsler Preschool and Primary Scale of Intelligence (WPPSI), White children only outperformed Black children on the Verbal Scale (Kaufman, 1973). Vance et al. (1988) found no significant difference in the three composite scores between White and Black children. However, their sample consists of subjects with lower composite scores (all falling within

the 85-90 intellectual range) than the present study, and their subjects were all children referred for psychological services due to possible learning disabilities, mild mental handicaps, and classroom behaviour problems: This suggests that the lower the composite IQ scores, the less variation seen between different ethnic groups.

However, in the present study, these differences in composite scores between the groups no longer reaches significance when subjects are matched on school performance, although the mean Full Scale IQ (106) and Performance IQ (109) for the English speaking children remains more than one standard deviation higher than the Xhosa speaking children's Full Scale (88.6) and Performance Scale (89.8) scores, and slightly below one standard deviation for the Verbal IQ. A possible reason for this difference between groups not reaching statistical significance may be due to the individual variation of scores within each group as within each group the grades ranged from A to E, together with the fact that the sample size was very small ($n = 5$).

Finally, when subjects are matched on Full Scale IQ there is no significant difference between the groups on Verbal or Performance IQ. It is important to note that matching the children on Full Scale IQ meant a selection of the English-speaking children from the bottom cluster in their group, with a selection of the Xhosa-speaking children who formed the top cluster in their group. That is, the "least intelligent" English speaking children were compared with the "most intelligent" Xhosa speaking children. Reynolds and Jensen (1983), using the WISC-R standardisation sample, also found that when subjects were matched on Full Scale IQ there was no significant Verbal Scale difference between Black and White Americans, but they did find that White children still performed significantly better than their Black counterparts on the Performance Scale. However, Vance et al., (1979) found that when subjects were matched on Full Scale IQ, Black male children scored significantly higher on the Verbal Scale than their White counterparts. However, possible reasons for incompatible findings with Vance et al. (1979) is the low Full Scale IQ of their sample (ie 50 - 81) which was two standard deviations below the mean. Additionally, the difference on Verbal Scale IQ between the Black and White children on the Vance et al. (1979) study is only three

points, which is a long way from one standard deviation and thus would not have been stated as a significant difference in the context of the present study.

As with the American standardised population normative data, the present data show White children's (English speaking in the present sample) composite scores to be approximately one standard deviation higher than Black children (Xhosa speaking in the present sample). This suggests that the American normative data can be seen, in very broad terms, to be fundamentally valid for use with both White English speaking and Black Xhosa-speaking South African children, to the extent that it is for Black and White American populations. At the same time, however, it highlights that the intelligence scales of the WISC-R are not equally applicable to different language or ethnic groups. Thus extreme caution should be employed in designating Black Xhosa speaking South African children obtaining composite scores of 80-89 in the "Low Average" intellectual range based on the WISC-R assessment (see Appendix VII), as both the standardisation sample and the present study suggest that this is the normal range for Black children. Additionally, it brings into question the Borderline and Mentally Deficient IQ ranges when assessing Black children.

4.1.2 Verbal IQ versus Performance IQ within each group

In the present study there is no significant difference between Verbal IQ and Performance IQ within either the English or Xhosa speaking groups. However, in the English speaking group, the data shows a strong trend for Verbal IQ to be lower than Performance IQ. No significant trend, in either direction, was found for the Xhosa speaking children. This does not support Vance et al. (1979) research on the WISC-R which found that Black children scored higher on the Verbal Scale than on the Performance Scale. Additionally, the present findings are contrary to the popular clinical belief that the Verbal subtests contain more item bias and thus are more difficult for Black South Africans. This suggests that a lower Verbal IQ than Performance for Black South Africans cannot be explained away as due to possible cultural bias of the WISC-R on the Verbal Scale and that a significant difference between the

Verbal and Performance IQs on Black Xhosa-speaking South Africans should alert the clinician to possible organic impairment. The unexpected finding of the Verbal Scale being lower than the Performance Scale for English-speaking children suggests that there are socio-cultural differences between American White children and South African White children and that some Verbal subtest items may be biased against White South African children. However, a difference of ten points or less between Verbal IQ and Performance IQ is not clinically significant (Sattler, 1992) and a difference of more than ten points is taken as an indication of organic pathology. The implication is that a low trend of Verbal IQ for White South African children should not be taken as an indication of organic pathology, that is, left hemisphere damage or specific verbal disabilities.

4.1.3 Analysis of WISC-R Subtest Score Scatter

Results show that, on all subtests, the mean of the English speaking children was higher than that of the Xhosa speaking children. Most significant differences were found on Information; Digit Span; Picture Completion; Block Design and Object Assembly, and to a lesser degree on Similarities and Comprehension. Qualitative analysis of the lower Digit Span scores of the Xhosa-speaking children reveals fluctuations within this subtest which suggests scores are lower due to concentration problems which are influenced by anxiety level. Thus the Xhosa-speaking children may have been more anxious during the testing situation, which may have been compounded by the fact that the clinician was White. Additionally, observation of test behaviour on this specific subtest, and on other subtests, showed a tendency of Xhosa-speaking children to give up more easily than their English-speaking counterparts.

When Xhosa and English speaking subjects were matched on school performance, only Block Design and Object Assembly remained significantly higher for the English speaking children over the Xhosa speaking children, but there was still a strong trend in favour of English speaking performing better on all other subtests, except Picture Arrangement where Xhosa speaking children were performing better than the English speaking children. Finally, when



subjects were matched on Full Scale IQ, negligible differences were present in subtest performance on all subtests.

Although previous research has found White children outperforming their Black counterparts on Block Design (Naglieri, 1986; Reynolds, 1988), and Object Assembly (Naglieri, 1986; Reynolds & Jensen, 1983) this finding has not been consistent and has not been limited to these two subtests. White children have also been found to outperform their Black counterparts on Coding (Vance et al., 1979), Comprehension and Mazes (Reynolds & Jensen, 1983), Similarities (Naglieri, 1986), and Information (Taylor & Richards, 1991).

In the present study Xhosa speaking children did not significantly outperform English speaking children on any subtests, although when matched on school performance and Full Scale IQ, there was a tendency for them to do better on Picture Arrangement although this did not reach significant levels. Previous research has reported Black children doing significantly better than White children on Information and Similarities (Vance et al., 1979), Arithmetic and Digit Span (Jensen & Reynolds, 1981; 1983), and Vocabulary (Taylor & Richards, 1991). This tendency for better performance among American Blacks surpassing Whites compared to South African Blacks versus Whites may be due to the fact that Black South Africans have been socio-culturally much more deprived relative to White South Africans than in America. Additionally, American Black children may have "caught up" to their White counterparts due to the "acculturation" process (Sattler, 1992), which possibly still needs to occur among Black South African children.

The significant difference between the English and Xhosa speaking subjects' performance on Block Design and Object Assembly suggest that English-speaking South African children may find these subtests easier than their Xhosa-speaking counterparts, but it does not suggest why this might be so.

Within each group, subtest score scatter shows a greater variability of scores among the English speaking children as opposed to the Xhosa speaking children whose scores are more

evenly spread. High subtest scatter scores reveal high scores on Mazes and Block Design for English-speaking children and a high score on Mazes for Xhosa-speaking children. This suggests that when testing an English or Xhosa speaking child, a high score obtained on Mazes, and or Block Design for the English speaking child, may not necessarily reflect an intellectual strength relative to other subtest scores on the WISC-R. Additionally, low scores on these subtests should be seen as significant in a child's profile, given the ease with which the present sample completed these subtests.

No subtest was significantly lower than the other subtests for either the English or Xhosa-speaking children. This further suggests that significantly lower subtest scores on an individual's profile should alert the clinician to specific difficulties and should not be explained away as due to cultural bias in the test and may well be genuine indicators of pathology.

4.1.4 Item difficulty on some subtests of the Wechsler Intelligence Scale for Children - Revised (WISC-R)

Graphic representation of the subtests reveals more item difficulty on verbal subtests than on performance subtests for both English and Xhosa-speaking children. The Information subtest profiles, for both the English-speaking and Xhosa-speaking subjects, are "jagged" in appearance, suggesting that some items were disproportionately difficult for both groups. These include the following: Item 16; 17; 19; 24; 25. Of these items, item 17 ("From what country did America become independent in 1776") and item 19 ("Name the two countries that border the United States") can all be seen as culturally unfair to South African children and would thus explain the low percentages correct. Low scores on item 16 ("Who invented the electric light bulb"), item 24 ("How tall is the average South African man") and item 25 ("What is a barometer") may have been disproportionately low because of socio-cultural differences between South African and American children, that is, poorer general knowledge, and possibly differences in school curriculum.

Additionally, some items (12; 20; 21; 22) appeared to be more difficult for the Xhosa-speaking children than for the English-speaking children. Again the poor performance on item 12 ("Who discovered America"); item 21 ("In what continent is Chile") could be explained in terms of its cultural-specificity to America and not relevant in the South African context. Low scores on item 20 ("How many grams make a kilogram") and item 22 ("What is the main material used to make glass") may be due to school curriculum differences and poorer general knowledge of Black South African children compared to Black American children. The ceiling effect for English-speaking children occurred at Item 29, but from Item 16 in Xhosa-speaking children, where less than 50% of the Xhosa-speaking children got these items right. Thus Xhosa-speaking children found items 16-30 difficult. Similarly, Ross-Reynolds and Reschly (1983) found Native American Papagos had difficulty with Items 15-24 on the Information subtest. Their study included four cultural groups (Anglo, Black, Chicano, Native American Papago) aged between 6.3 -15.9 years, where no item bias was found for Anglo-American children and negligible bias against Black and Chicanos children.

The amount of knowledge children possess may depend on their natural endowment, the extent of their education (formal and informal), and their cultural opportunities (Sattler, 1992). The Information subtest samples the knowledge that average children with average opportunities should be able to acquire through normal home and school experiences. Difficulties on those items which are not clearly culture-specific to American society may thus perhaps be explained in terms of Xhosa-speaking children having more limited exposure in the home environment, which has a greater possibility of being more poverty-stricken than their English-speaking counterparts in South Africa.

On Similarities there was a relatively smooth item progression for both groups. Both groups found item 14 ("In what way are Liberty and Justice alike") disproportionately difficult. Ross-Reynolds and Reschly's (1983) also reported that item 14 difficult for the Native-American Papagos, who also had difficulties on items 10-13. In the present study, Xhosa speaking children found item 3 ("In what way are a shirt and a hat alike") disproportionately difficult.

On the Arithmetic subtest no items appeared to be disproportionately difficult for any of the children. Ceiling effect was reached at item 14 for both English and Xhosa speaking children. Ross-Reynolds and Reschly (1983) found that Native-American Papagos found items 6, 7, 13, 17 difficult on the Arithmetic subtest.

On the Comprehension subtest, Item 10 ("Why do we have to put stamps on letters?"), and Item 16 ("Why is cotton often used in making cloth?"), caused difficulty for Xhosa-speaking children. On item 16 qualitative analysis revealed a confusion amongst Xhosa-speaking children whereby they understood the concept of cloth, as a tablecloth. Native-American Papagos also found item 16 on the Comprehension subtest difficult (Ross-Reynolds & Reschly, 1983). Items which have often been cited as culturally biased, for example item 6 (the FIGHT item) showed a high percentage of children getting this item right (100% English speaking and 83% Xhosa speaking). Similarly, Sandoval (1979) found that item 6 ("the FIGHT item") was of similar difficulty for both Black and White children. Sattler (1991) found that the FIGHT item was answered correctly by 62% of Black and 65% of White children. Sattler (1991) found items 2, 7 and 11 to be more difficult for Black than White children on the Comprehension subtest, which was not found in the present study.

On Block Design, Picture Completion and Picture Arrangement the profiles show relatively smooth curves for both groups suggesting that most items are "culture fair". The Xhosa speaking children did, however, find item 17 (watch strap) on Picture Completion and item 7 (Artist) on Picture Arrangement disproportionately more difficult.

Thus it seems that the Xhosa speaking found more items difficult than the English subjects. However, these items which the Xhosa subjects found difficult are less significant the more difficult the item is per se in the subtest, because the Xhosa subjects had lower school grades and lower Full Scale IQ scores than the White subjects. Thus the items which require most attention and in need of revision are the "easy" items which the South African subjects found disproportionately difficult. These include items on the Information subtest (items 16, 17, &

*These items were found
of cultural bias*

19) for both Xhosa speaking and English speaking South African children and items on Information (items 12, 21, 22); Similarities (item 3); Comprehension (item 10); Picture Completion (item 17); Picture Arrangement (item 7) for Xhosa speaking subjects.

4.1.5 WISC-R Digits Forward, Digits Backward and Digits Difference

English speaking children scored significantly higher (at least one digit) than Xhosa speaking children on both Digits Forward and Digits Backward. English speaking children scoring a mean Digit Forward score of 6.87 and Xhosa speaking children scored a mean of 5.33. This falls within Miller's (1956) 5 to 9 point adult range, and the 2 to 8/9 point range for children between the ages of 2 and 16 years (Mishra et al., 1985). Thus, in the present study, both the English and Xhosa speaking children fall within the normal range of 6 (+-1) suggested by Banken (1985) and Lezak (1995), with the English speaking children being on the high point of the range and the Xhosa speaking children being on the low point of the range. Neither English nor Xhosa speaking children's mean scores were below 4, suggesting that a score of less than 4 digits may alert the clinician to the child being either organically impaired or mentally retarded (Jensen & Figueroa, 1975; Matarazzo, 1972). This suggests that the 6 (+-) range stated by Lezak (1995) and Banken (1985) for adults to be considered normal, are also applicable for children of at least a standard six education. That a digits forward score of less than 4 digits may be indicative of brain damage or mental retardation in children as well as adults, and that this is true for English speaking children as well as Xhosa speaking children when the test is administered in their second language.

The trend of Xhosa speaking children performing one digit lower than English speaking children is consistent with the trend found by Shuttleworth-Jordan (1995) on South African university students. Shuttleworth-Jordan (1995) reports a mean Digit Forward score of between 7.67 for White South African university students and between 6.88 for Black South African university students. Reflecting a highly consistent trend of English speaking people in South Africa to perform one digit higher than non-English speaking people on Digits

Forward. These norms in Shuttleworth (1995) study are higher than that of the present study but age and education level could account for this discrepancy. Avis (1994) found no difference between White and Black South African children aged 6 and 7 years, with a mean Digits Forward Span of 5.7. It is evident however, as also pointed out by Shuttleworth-Jordan (1994), and in relation to Banken's (1985) brain damage cut off points, that this difference around one integer between Black and White subjects is not of great clinical significance in terms of organic pathology. This is particularly so in view of the fact that anxiety is thought to have contributed to lowered scores for the Black subjects in the present study. Finally, it is understandable that the Xhosa speaking subjects are lower than English speaking subjects from a language perspective. Research has suggested that one's capacity for storage of digits in one's native language can be quite different from that in one's second language, despite years of instruction in the second language (Hoosain, 1979). Hoosain (1979) tested Chinese standard 6 and university undergraduates and found that digits forward was significantly higher when given in the student's native language for both school children (8.9 digits forward) and university students (9.9 digits forward) than when repeating the digits in English (6 and 7.3 respectively), their second language and medium of instruction at school.

In the present study the Digit Backwards score for English and Xhosa speaking children was 5.53 and 4.17, respectively. For both English and Xhosa speaking children the Digits Backward mean score falls within the normal limits of 4/5 points (Banken, 1985; Lezak, 1995) and thus suggests that for children as well as adults, both Xhosa speaking and English speaking, English first or second language, a score of 3 or less may be indicative of brain dysfunction (Lezak, 1995), or a learning disability (Black, 1983). This is an extremely important finding in the neuropsychological clinical setting.

The present finding supports the research done by Jensen and Figueroa (1975) who found that Whites performed significantly better on Digits Backward than did Blacks of similar socio-economic backgrounds (Mishra et al., 1985). Hoosain (1979) found that Chinese school students and university undergraduates performed at approximately one digit less when taking

the test in English, their second language, as opposed to Chinese, their first language. Digit backward scores in English were 4 and 6 for standard six and university undergraduates, respectively. Similarly, Avis' (1994) study on South African children aged 6/7 found that English speaking children performed approximately one digit better on Digits Backward than Xhosa speaking children, with a mean score of 3.17 and 2.64 respectively. Finally, Shuttleworth-Jordan's (1995) research on South African university students showed a similar performance of White students performing better than Black students, by one digit, with White students scoring a mean of 6.19 and Black students scoring a mean of 5.04 (Shuttleworth-Jordan, 1995).

Taken together all the South African research on Digits Backward, which is summarised in Table 11 below, suggests that at any age level English first language people tend to perform at one digit higher than English second language people on the Digits Backward task. Additionally, it suggests that the Digit Backward span increases with age and education level.

The Digits Difference score, for both English and Xhosa speaking children, was approximately 1. This is consistent with the normal raw score difference between Digits Forward and Digits Backward of 1.0 reported by Costa (1975). Additionally, it supports the suggestion that the 3-point difference between Digits Forward and Digits Backward suggests brain-damaged (Gardner, 1981; 1985; Lezak, 1995), possible problems with working memory (Shuttleworth-Jordan, 1991; 1994), or a possible learning disability (Black, 1983).

This supports research on South African university students by Shuttleworth-Jordan (1995) who found a Digits Difference of 1-2 for both Black and White students. Although, Avis (1994) found a Digits Difference of 2.69 and 3 for English and Xhosa speaking children aged 6/7 respectively, which is not clinically significant.

A summary of all the South African data on the Digits Difference test, including that of the present study, appears in Table 11 below.

4.1.6 WISC-R Digit Supraspan Test

On the Digit Supraspan test English and Xhosa speaking children scored 2.86 and 1.75 respectively. This is consistent with other research findings, that is, that most unimpaired subjects learn such a supraspan series one above their immediate memory span in 2 to 3 repetitions. (McFie, 1975; Shuttleworth-Jordan, 1995). Additionally, it supports the contention that a score of more than 3 on Digit Supraspan should alert the practitioner to possible problems with verbal new learning ability (Shuttleworth-Jordan, 1991). In the present study, English speaking subjects took approximately one extra trial compared to Xhosa speaking subjects. However, a qualitative analysis of the high Supraspan trials among English speaking subjects revealed a high Digit Supraspan was almost always paired with a high Digit Forward score (7/8), which does not necessarily suggest verbal new learning ability. Thus the results of this study make it particularly evident that the Supraspan score needs to be evaluated in conjunction with the Digits Forward score and not in isolation from it.

The data from all the South African normative studies on Digits Forwards, Digits Backward, Digits Difference and Digits Supraspan are presented together in collated form in Table 11 below.

Table 11

Digit span forwards, backwards, difference and supraspan:
Normative data from South African studies

	Digits Forward	Digits Backward	Digits Diff.	Digits Supraspan
(Present study)				
English (white)				
n	15	15	15	15
Mean	6.87	5.53	1.33	3.27
SD	0.92	1.55	0.94	2.22
Xhosa (black)				
n	12	12	12	12
Mean	5.33	4.17	1.33	1.75
SD	1.07	1.34	1.30	0.97
<hr/>				
(Avis, 1994)				
English				
n	42	42	42	42
Mean	5.74	3.17	2.57	7.33
SD	1.01	0.82	1.23	6.30
Xhosa				
n	14	14	14	14
Mean	5.64	2.64	3.00	9.07
SD	1.01	0.63	0.96	6.64
<hr/>				
(Shuttleworth-Jordan, 1995)				
English language				
n	61	61	61	57
Mean	7.67	6.19	1.48	2.37
SD	1.0	1.26	1.3	1.59
African language				
n	50	50	50	49
Mean	6.88	5.04	1.84	2.84
SD	1.1	1.19	1.31	2.11

4.1.7 WISC-R Coding Incidental Immediate and Delayed Recall Test

The present study reveals no significant difference between English speaking and Xhosa speaking Coding Immediate Recall and Delayed Recall scores. This supports American research done by Collear and Evans (1982) who found no significant mean difference among Black, White, Asian and Hispanic children, aged eight to twelve, on the Coding immediate incidental recall; and South African research done by Avis (1994) who reported no significant difference between English and Xhosa speaking South African children, aged 6/7 years, on the Coding immediate and delayed recall tests..

The present study reveals a mean Coding Immediate recall score of 6.92 and 6.67 for English and Xhosa speaking children, respectively and a mean Delayed Recall score of 5.58 and 6.33. This is consistent with Collear and Evans (1982) research on children aged 11 to 12 who suggest an immediate recall score of 6-7, and Murdoch et al., (1994) research on Black South African standard 6 pupils between the ages of 11 and 16 who suggest a mean short term incidental recall score of 6.77 and delayed recall score of 6.25.

The above research findings on an age group ranging from 11-16, together with research on the South African Wechsler Adult Intelligence Scale (SAWAIS) Digit Symbol Substitution subtest on university students aged 18 - 25 years (Shuttleworth-Jordan & Bode, 1995), and research on the WISC-R Coding A subtest (Avis, 1994), suggests that one's immediate recall span increases age. Avis (1994) reported an immediate recall span of 4.6 for 6/7 year old children; the present research study together with Collear and Evans (1982) and Murdoch et al. (1994) suggests an immediate recall span of 6-7 for children aged 11-16 years; and Shuttleworth-Jordan & Bode (1995) suggest an immediate recall span of 7.30 for adults aged 20-39. This comparison, however, must be considered in light of the fact that the administration procedures used for this subtest differed in each of the studies cited. For example, Avis (1994) used the Coding A subtest, which consists of 5 symbols, as opposed to 9 in the Coding B subtest used in the present study. This means that in Avis' (1994) study the subjects recall rate was very high. In Murdoch et al's (1994) study the Coding Immediate

recall was measured 3 minutes after completion of the Coding B subtest, which may have artificially depressed the recall scores. Finally, in Shuttleworth-Jordan and Bode's (1995) study the adult Digit Symbol Substitution subtest (SAWAIS version) was administered differently to the child Coding subtest administered in the present study. In the Digit Symbol Substitution subtest subjects completed a sample of 8 blank squares and then given 90 seconds in which to complete 67 blank squares. In the present study, on the Coding subtest, the subjects completed 8 sample blank squares, and then completed the 93 blanks to the end.

The results of the present study suggest a fall off of one digit from Immediate to Delayed Recall is normal. This does not support South African research, with children aged 6/7 years, which suggests a lower mean score (4.6) but no fall off from immediate to delayed recall. A discrepancy between the present study and Avis' (1994) may be due to the amount of symbols being recalled as a lot smaller in her younger sample. A summary of all the South African data on the Digit Symbol and Coding Immediate and Delayed Recall tests appear in Table 12 below.

Table 12
Immediate Recall and Delayed Recall on the Coding and Digit Symbol
 Substitution subtests: Normative data of South African studies

	Coding Immediate Recall	Coding Delayed Recall	*
(Present study)			
<u>English</u>			
n	12	12	
Mean	6.92	5.58	
SD	2.02	2.81	
<u>Xhosa</u>			
n	9	9	
Mean	6.67	6.33	
SD	2.40	2.35	

(Avis, 1994) ⁵			
<u>English</u>			
n	42	42	
Mean	4.74	4.67	
SD	0.50	0.65	
<u>Xhosa</u>			
n	14	14	
Mean	4.50	4.64	
SD	0.76	0.63	

(Murdoch, 1994)			
<u>Black</u>			
n	47	47	
Mean	6.77 ⁶	6.25	
SD	2.07	2.34	

(Shuttleworth-Jordan, 1995) ⁷			
<u>English Language</u>			
n	28	-	
Mean	7.32	-	
SD	1.68	-	
<u>African Language</u>			
n	17	-	
Mean	6.59	-	
SD	2.4	-	

* Known as Digit Symbol Incidental and Delayed recall on the SAWAIS

4.1.8 Overall Conclusions on the WISC-R and Adjunctive Test findings

A number of possible hypotheses can be raised in order to explain the general overall trend for significantly lower WISC-R and adjunctive test scores on the Xhosa versus English speaking groups. Firstly, it is possible that this could indicate that the Xhosa speaking group do in fact represent a lower IQ group, which may be the case given the lower level of grades in that group. However, when the grades were matched the difference, although smaller, still remained. When the two groups were then matched on Full Scale IQ, these differences disappeared which could support a hypothesis of lower IQ in this group. However, without a separate indicator of IQ, this is difficult to substantiate. Another possible cause is cultural deprivation in the Xhosa group or that the WISC-R is not culturally relevant on this population group. However, item difficulty analysis reveals few items which are disproportionately difficult for the Xhosa-speaking children only. It seems that the reason for score differences between the two groups will only become apparent with further research in this area. South African children of different language groups are presently at different levels of intellectual advancement due to gross inequality in home environment and educational opportunities which both influence one's intellectual level. Once this gap closes and children of different language groups are afforded the same opportunities it is hypothesised that the scores on intelligence tests will diminish, but only continued research can answer this question.

4.2. Clinical Implications of the Study

The following specific clinical implications of the study have been identified:

- a) In broad terms the WISC-R can be seen to have as much relative validity for English-speaking and Xhosa-speaking South African children as it does for White and Black American children in that in the American standardisation sample, Black children scored at least one standard deviation below their White counterparts, which was also evident in the present study. Thus extreme caution should therefore be employed in assigning a Xhosa-speaking child to an absolute IQ category such as "Low Average, Borderline, Mild Mental Retardation, Moderate Mental Retardation, or Severe Mental Retardation, on the basis of the WISC-R assessment.
- b) A low Verbal IQ versus Performance IQ in Xhosa speaking South African children should not be explained away as cultural bias of the WISC-R. Rather, a significant difference between the Verbal and Performance IQs on Xhosa speaking South Africans should alert the clinician to possible learning difficulties or organic impairment in need of further investigation. However, a tendency for lower Verbal IQ relative to Performance IQ on English speaking South African children may in part be due to cultural bias with respect to American samples, and should only be taken as an indicator of pathology if clearly significant differences, that is, more than ten points (Sattler, 1992) occur.
- c) High subtest scatter scores reveal high scores for English-speaking children on Block Design and Mazes and high scores on Mazes for Xhosa-speaking children. This suggests that when testing a child, high scores obtained on these subtests may not necessarily reflect an intellectual strength relative to other subtest scores on the WISC-R.

- d) No low subtest cluster was evident in either the English or Xhosa-speaking profile. This suggests that significantly lower subtest scores on an individual profile of either an English or Xhosa-speaking South African child should alert the clinician to possible deficits as measured by the specific subtest and cannot be explained away as due to cultural bias of the WISC-R for South African children. This suggests that the WISC-R has validity for both Xhosa and English speaking South African children as a diagnostic instrument neuropsychologically. This is because the focus of brain damage assessment is on intra-individual test patterns rather than on absolute test values.
- e) Xhosa speaking South African children may find Block Design and Object Assembly more difficult than their English-speaking counterparts.
- f) Items which may be difficult for both English and Xhosa speaking children may include the following: Information (item 16, 17, 19), Similarities (item 3). Items which may be difficult for Xhosa-speaking children alone include: Information (12; 21; 22), Comprehension (10), Picture Completion (17) and Picture Arrangement (item 7).
- g) English speaking children tend to score at least one digit higher than Xhosa speaking children on both Digits Forward and Digits Backward. A digits forward score of 6 for English-speaking children and 5 for Xhosa speaking children and a digits backward score of 6 for English and 5 for Xhosa speaking children can be considered the normal range for South African children with a standard six education.
- h) Neither English nor Xhosa speaking means were below 4 digits forward or 3 digits backward suggesting that a score of less than 4 digits forward or 3 digits backward in a South African standard six child should alert the clinician to possible organic impairment.

- i) The Digits Difference score, for both English and Xhosa speaking children, was approximately 1, supporting the suggestion that the 3-point difference between Digits Forward and Digits Backward suggests brain-damage, possible problems with working memory, or a possible learning disability.

- j) These results support the finding that most unimpaired subjects should learn a supraspan series one above their immediate memory span in 2 to 3 repetitions. Additionally, it supports the contention that a score of more than 3 on Digit Supraspan could alert the clinician to possible problems with verbal new learning ability.

- k) The present study reveals a mean Coding Immediate recall score for English and Xhosa speaking children of 6/7 and a mean Delayed Recall score of 6 and supports an increasing immediate recall span with increasing age.

- l) The results of the present study suggest a fall off of one digit from Coding Immediate to Delayed Recall is normal.

In summary, the present study provides a starting point into research on the validity of the Wechsler Intelligence Scale for Children - Revised (WISC-R) on South African children. It provides a preliminary WISC-R data base of scatter patterns for English and Xhosa speaking South African twelve to fifteen year old children, making it more accessible for clinical use on this age group in South Africa. Additionally, the findings provide an indication that the WISC-R can be used on White English speaking South African children aged twelve to fifteen but that caution must be employed in the interpretation of subtest and composite scores for Black, Xhosa speaking South African children. Finally, the present study provides preliminary normative data, albeit on a small sample size, on individual subtest scores for Xhosa and English speaking children. In general terms the findings indicate that specific test items are difficult for South Africans and especially for Xhosa speaking South Africans and contribute to the low scores of the Xhosa speaking group.

4.3 EVALUATION OF THE STUDY

The present study has a number of shortcomings which need to be considered when examining the findings.

- a) The sample size is small and thus this study should only be seen as a preliminary investigation aimed at providing a springboard for further research on a broader scale. Thus, the normative data needs to be seen as tentative and in need of further investigation. This small sample size is especially restricting in the analyses of the samples which were matched on Full Scale IQ and mid-year grade averages.
- b) The subjects attended schools only within Grahamstown and thus generalisation to other areas of South Africa is questionable.
- c) Subjects were not matched on school performance and a skewed performance in the sample was noted. That is, within the A to D aggregate range, the English speaking children obtained more A and B aggregates and the Xhosa speaking children obtained more C and D aggregates.
- d) When subjects were matched on school performance they were matched on grades ranging from A to E, which together with the small sample size ($n = 5$) within each group, resulted in extreme variation in scores within each group.
- e) No separate measure of intelligence was used on which subjects could have been matched in sample selection.
- f) Only one clinician was involved in administration and scoring of all protocols, which may have introduced some form of bias. Additionally, the tester was White and English speaking which may have acted as a barrier for the Black, Xhosa speaking children.

4.4 RECOMMENDATIONS

The findings of this study must be seen as a pilot study into this field of research and as a springboard for further research on a broader scale. The following recommendations are made:

- a) It is recommended that future research draws its sample from a larger pool, as a large pool of subjects is needed to match children of different language groups on Full Scale IQ. This will provide a more accurate picture of scatter pattern differences between different language groups.
- b) Future research needs to be done on other standards, for example, standard eight or nine pupils, who have all been in the same school for at least three to four years. It is possible that the magnitude of difference between Xhosa speaking and English speaking pupils in standard nine on the Wechsler Intelligence Scale for Children - Revised (WISC-R) subtests will be less than found in the present study, as pupils would have obtained the same quality of education over a longer period of time. The present study was aimed at standard six pupils, which in South Africa, represents the start of one's high school education. Pupils often enter High School from different Primary Schools where the quality of education can vary greatly.
- c) Future studies should identify the number of years that Black, Xhosa speaking children have been exposed to White, English urbanised education, and take this into account as an important variable on which to match subjects, or to interpret the findings.
- d) With increasing equality of education for Xhosa and English speaking children in South Africa it is necessary to continue to evaluate the validity of the WISC-R on the Xhosa speaking, Black South African population. As results of this research suggest that the WISC-R is a valid measure on the White, English speaking population, who

would have received an education equitable to their American counterparts. However, the Xhosa speaking children obtained significantly lower scores on all subtests. It is hypothesised that this difference may become less significant as Black, Xhosa speaking South African children are afforded the opportunity of obtaining a better education.

- e) Future research should also include other population and/or language groups in South Africa, for example, Indian, Coloured, Afrikaans, other African languages like South Sotho, Zulu, etc. The present study used only English speaking White children and Xhosa speaking Black children, thus attempting not to mix race and language group effects.
- f) Future studies should match pupils on school aggregate and use a separate relatively "culture fair" measure of intelligence, for example the Draw-A-Person Test, or Ravens Progressive Matrices Test so as to control for, or to examine the influence of IQ on the findings.
- g) Future studies may include a Black, Xhosa speaking clinician to administer the WISC-R in English to the Xhosa speaking subjects. This would eliminate any possible cultural barriers which the Xhosa children may have felt with the White, English speaking clinician.
- h) The individual WISC-R profiles of this study should be maintained on a data base to be combined with future research in this area. Once a large data base of profiles on South African children of different ethnic and language groups exists, it will become possible to draw on this data base to match children of different language groups more closely on Full Scale IQ in order to obtain a clearer picture of subtest scatter pattern differences, if any do exist.

4.5 CONCLUSION

The study provides a preliminary WISC-R data base of scatter patterns and preliminary normative data on the Adjunctive tests, albeit on a small sample size. The WISC-R and Adjunctive tests have validity for diagnostic use on both White English speaking and Black Xhosa speaking South African children. This is because of finding no significant Verbal IQ/Performance IQ discrepancy, or significant low subtest scatter for either group, which the differential presentations of organic pathologies invariably produce.

5. NOTES

1. "Minority" in the literature usually refers to the smaller population groups whose cultural values etc are not completely recognised and practised by the society at large. Within the South African context the "minority" is comprised of the population groups who are, in quantity, a much larger group but still the group whose values, and beliefs are not recognised and practised by society at large, for example, the Xhosa speaking population group.
2. Kaplan, E. (1995). Adaptation of the WISC-III as a Neuropsychological Instrument. Paper presented at the West Coast Neuropsychology Conference. San Diego, California. This article is referred to in the present study to acknowledge its existence. Unfortunately, due to time constraints on the submission of this dissertation, a copy of this paper could not be acquired in time.
3. "Ethnicity" refers to racial differences which may in themselves be considered to cause changes in cognitive test performance (Shuttleworth-Jordan, 1995, p 5).
4. "Socio-cultural" differences include factors such as incommensurate preschool socialization experiences, primary language, current language usage, levels of education, socioeconomic status, and test sophistication (Shuttleworth-Jordan, 1995, p 5)
Incorrectly referenced
5. In Avis' (1994) the Coding subtest was Coding A, which consists of 5 symbols, as opposed to 9 in the Coding B subtest used in the present study. Thus subjects completed 5 sample blank shapes, followed by 45 blank shapes.
6. In Shuttleworth-Jordan and Bode's (1995) study the adult Digit Symbol Substitution subtest (SAWAIS version) was administered differently to the child Coding subtest administered in the present study. In the Digit Symbol Substitution subtest subjects

completed a sample of 8 blank squares and then given 90 seconds in which to complete 67 blank squares. In the present study, on the Coding subtest, the subjects completed 8 sample blank squares, and then completed the 93 blanks to the end (with the score within the two minute time limit being noted).

7. Murdoch et al (1994) Coding Immediate recall was measured 3 minutes after completion of the Coding B subtest.

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APPENDICES

APPENDIX I

LETTER SENT TO SCHOOL HEADMASTERS

LETTER SENT TO SCHOOL HEADMASTERS

Dear,

PSYCHOLOGICAL ASSESSMENT RESEARCH

Rhodes Psychology Clinic is presently involved in research on children in the area of Intelligence Testing.

The research project that is proposed is an examination of the pattern of performance of South African children on the WISC-R (Weschler Intelligence Scale for Children - Revised). This test material is similar to the group intelligence testing done at schools to obtain the child's I.Q.

The motivation for this research is the lack of normative data on the Psychological Tests which are used on South African children. It has thus become necessary for psychologists to rely on American-based norms, which is not ideal, but has up until now been accepted practice. However, the validity of psychological assessment on South African children has been brought into question. Thus if a child from your school sustains a head injury in an accident the lack of culturally relevant norms is problematic with respect to making a valid diagnosis. This has serious implications for treatment, and for acquiring just compensation in the legal setting.

The age group of children which this research is aimed at is thirteen to fourteen years of age, and thus would concern your standard seven pupils. A representative sample of the predominant race groups would be involved. The test, which takes 90 minutes, would be administered on a one-to-one basis with a Trainee Psychologist. Each child will be paid R25 for their participation in the study.

We hope that will be one of the Grahamstown schools which will participate in this research project which will be of long-term benefit to South African children. I look forward to contacting you to set up an appointment at your earliest convenience in order to discuss this project further.

Yours sincerely,

Carey Runciman
(Trainee Psychologist)

APPENDIX II
LETTER SENT TO PARENTS

LETTER SENT TO PARENTS

Dear Parent,

..... (school) has agreed to take part in a research project aimed at validating American based Intelligence Tests for South African children. The need for this research is crucial especially in attempting to obtain legal compensation for children who have sustained head injuries in motor vehicle or sport-related accidents. Presently families are often being refused compensation as our Psychological tests have not been validated on South African children.

We request permission for your child to take part in this very relevant testing procedure. This testing will be administered during school hours by a Psychologist. The testing will take approximately 90 minutes to administer and each child shall be paid R25 for their participation. As soon as a suitable number of the parental consent forms have been received, a proportion of children will be randomly selected to participate in the testing.

As with group Intelligence testing, which the school routinely performs on children, the results obtained are confidential. Individual test results will thus not be released to parents unless this is considered to be clinically relevant, and in the child's best interests.

Please fill in the attached form and return it to the school by the We thank you in anticipation and look forward to your child's participation in this project.

Yours sincerely,

Carey Runciman
(Rhodes Psychology Clinic)

APPENDIX III
CHECKLIST SCREENING QUESTIONNAIRE

Please return to the school by the 25th July 1994

NAME OF PUPIL:

MARK WITH AN (X) THAT WHICH IS APPLICABLE TO YOUR CHILD:

Has failed a standard at school	
Is presently seeing a Psychologist/Psychiatrist	
Is undergoing remedial teaching	
Is suffering from a learning disability	
Is on medication for any reason Please specify: Medication:	
Reason for medication:	
Has Epilepsy	
Has any other neurological disorder Please specify:	
Has previously sustained a head injury involving loss of consciousness and/or hospitalisation	
Has any problems involving his eyesight Please specify:	
Has any problems involving his hearing Please specify:	

I,, the parent of
..... (child's name)
grant permission for him to partake in your above mentioned
study. I am aware that these results are confidential and will
not be made available to the child or myself as parent.

Signature of parent: Date:

APPENDIX IV

WISC-R SUBTEST ITEMS ALTERED TO
INCREASE SOUTH AFRICAN RELEVANCE

WISC-R SUBTEST ITEMS ALTERED TO INCREASE SOUTH AFRICAN RELEVANCE

Information Subtest

5. How many pennies make a nickle
HOW MANY CENTS MAKE A RAND
20. How many pounds make a ton?
HOW MANY GRAMS MAKE A KILOGRAM
24. How tall is the average American man?
HOW TALL IS THE AVERAGE SOUTH AFRICAN MAN?
27. How far is it from New York to Los Angeles
HOW FAR IS IT FROM JOHANNESBURG TO CAPE TOWN.

Similarities Subtest

10. Pound - yard
KILOGRAM - METRE

Arithmetic Subtest

In all items change pennies/pounds to cents and rands respectively.

APPENDIX V
CODING B ANSWER SHEET

1	2	3	4	5	6	7	8	9
÷)	+	⊢	7	√	(÷	⊢

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

APPENDIX VI

CODING IMMEDIATE AND DELAYED RECALL ANSWER SHEET

1	2	3	4	5	6	7	8	9

1	2	3	4	5	6	7	8	9

APPENDIX VII
CLASSIFICATION RATINGS FOR IQ ON WECHSLER SCALES

CLASSIFICATION RATINGS FOR IQ ON WECHSLER SCALES

IQ	CLASSIFICATION
130 and above	Very Superior
120 - 129	Superior
110 - 119	High Average
90 - 109	Average
80 - 89	Low Average
70 - 79	Borderline
69 and below	Mentally Deficient

Wechsler (1974)

APPENDIX VIII
WISC-R SUBTEST SCORE SCATTER

WISC-R subtest score scatter obtained by 15 English speaking children

Subject	I	S	A	C	DS	PC	PA	BD	OA	C	M
1	14	12	15	16	19	10	11	15	11	12	15
2	11	13	13	11	12	15	8	18	14	14	17
3	11	11	16	9	12	12	11	19	18	10	19
4	14	10	9	11	14	14	13	13	13	12	11
5	10	11	11	10	10	11	11	19	19	7	14
6	11	11	10	12	9	14	14	14	11	12	9
7	12	11	10	10	9	15	11	14	10	14	19
8	10	13	9	10	13	12	13	12	14	8	11
9	9	10	10	9	10	13	10	17	16	8	12
10	12	12	13	11	16	10	11	11	8	7	15
11	12	10	8	13	9	11	10	12	13	10	19
12	8	10	4	9	11	13	11	12	18	10	9
13	11	10	13	10	15	10	7	11	10	9	13
14	10	10	8	11	10	9	7	12	12	8	10
15	6	9	11	8	8	8	5	13	9	13	12

WISC-R subtest score scatter obtained by 12 Xhosa speaking children

Subject	I	S	A	C	DS	PC	PA	BD	OA	C	M
1	8	13	7	11	8	9	14	9	8	15	11
2	10	9	16	9	12	11	8	10	11	4	12
3	8	7	12	6	6	13	9	13	12	8	18
4	11	10	7	11	6	7	16	5	7	12	9
5	8	9	12	9	6	10	7	11	8	6	9
6	6	11	7	8	8	9	10	9	7	11	8
7	5	8	12	10	9	8	9	10	6	8	11
8	10	11	10	9	9	8	7	5	5	6	17
9	6	9	7	9	4	9	9	9	6	10	5
10	7	8	5	8	8	7	5	10	11	8	19
11	8	4	7	9	6	8	7	9	6	10	12
12	6	7	6	8	6	6	7	5	2	5	5

APPENDIX IX

DIGITS FORWARD, DIGITS BACKWARD, DIGITS DIFFERENCE
AND DIGITS SUPRASPAN RAW SCORES

WISC-R Digits Forward, Digits Backward, Digits Difference, and
Digits Supraspan obtained by 15 English speaking children.

Subject	Digits Forward	Digits Backward	Digits Diff	Digits Supraspan
1	9	9	0	6
2	6	6	0	2
3	7	5	2	4
4	7	7	0	2
5	7	5	2	3
6	7	3	4	2
7	6	5	1	1
8	8	7	1	2
9	6	4	2	2
10	8	6	2	9
11	7	4	3	6
12	6	6	0	2
13	7	7	0	4
14	6	5	1	1
15	6	4	2	3

WISC-R Digits Forward, Digits Backward, Digits Difference,
and Digits Supraspan obtained by 12 Xhosa speaking children.

Subject	Digits Forward	Digits Backward	Digits Diff	Digits Supraspan
1	5	5	0	1
2	7	7	0	3
3	5	3	2	1
4	5	3	2	1
5	5	4	1	1
6	5	5	0	1
7	7	3	4	3
8	5	6	1	2
9	4	3	1	1
10	7	4	3	3
11	5	3	2	3
12	4	4	0	1

APPENDIX X

CODING IMMEDIATE AND DELAYED RECALL RAW SCORES

WISC-R Coding subtest; Coding Incidental Immediate and
Coding Delayed Recall Tests obtained by 15 English speaking children.

Subject	Coding	Coding Immediate Recall	Coding Delayed Recall
1	12	2	1
2	14	8	8
3	10	8	8
4	12	9	9
5	7	7	7
6	12	7	7
7	14	8	4
8	8	8	8
9	8	7	5
10	7	8	8
11	10	6	5
12	10	8	2
13	9	8	8
14	8	4	2
15	13	3	3

WISC-R Coding subtest; Coding Incidental Immediate and
Coding Delayed Recall Tests obtained by 12 Xhosa speaking children.

Subject	Coding	Coding Immediate Recall	Coding Delayed Recall
1	15	9	9
2	4	7	7
3	8	9	9
4	12	3	3
5	6	8	6
6	11	7	8
7	8	7	7
8	6	8	9
9	10	8	8
10	8	1	1
11	10	8	6
12	5	5	5

