

Cross-cultural differences in IQ test performance: Extension of an existing normative database on WAIS-III test performance.

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It has been such a privilege to be able to do this work, and I hope that the findings will not only provide information for Clinical and diagnostic purposes, but will also inform further ways in which education can be improved in disadvantaged schools in South Africa. There is a quote by Judge Mahomed in Desmond Tutu's book "No future without forgiveness" (1999, p. 55) that I feel is pertinent to this research:

'The families of those whose fundamental human rights were invaded by torture and abuse are not the only victims who have endured 'untold suffering and injustice' in consequence of the crass inhumanity of apartheid which so many have had to endure for so long. *Generations of children born and yet to be born will suffer the consequences of poverty, of malnutrition, of homelessness, of illiteracy and disempowerment generated and sustained by the institutions of apartheid and its manifest effects on life and living for so many.* The country has neither the resources nor the skills to reverse fully these massive wrongs. It will take many years of strong commitment, sensitivity and labour to 'reconstruct our society' so as to fulfil the legitimate dreams of new generations exposed to real opportunities for advancement denied to preceding generations initially by the execution of apartheid itself and for a long time after its formal demise, by its relentless consequences.'

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ABSTRACT

Prior research (Shuttleworth-Edwards et al., 2004) presented preliminary normative data for the Wechsler Adult Intelligence Scale – III (WAIS-III) for Southern Africa, stratified according to gender (female vs. male), language (black African vs. white English), level of education (matric/12+ years of education vs. Graduate/15+ years of education) and quality of education (disadvantaged – Department of Education and Training vs. advantaged - Private/Model C). IQ scores for black African language and white English Southern Africans were comparable with the United States of America (USA) standardization when level and quality of education were equitable. ('White English' is the term used to denote those of European descent whose first language is English). A limitation of the research was the lack of control for language for most of the black groups and particularly in the Private/Model C Graduate group, where sixty percent of the participants originated from Zimbabwe. These represented a particularly elite group whose education was equitable to that of the white participants throughout their education (i.e. at primary, secondary and tertiary level). In order to rectify the lack of homogeneity of language, all non- Xhosa first language participants were excluded from the black sample and sixteen additional Xhosa first language participants were tested on the WAIS-III. Data analyses found no significant differences between the original and new groups, except in the comparison between Mixed African language Private/Model C Graduates and the Xhosa first language Private/Model C Graduate/15+ years of education, where there was a lowering of WAIS-III subtest, index and IQ scores in the newly constituted group. This lowering in test performance is explained in that the new Xhosa first language 15+ years of education group was a less advantaged group than the original Mixed African Language Private/Model C Graduate group, as the new group generally had less advantaged primary school education and had generally studied less at a tertiary level. Overall, these results demonstrate an incremental increase in WAIS-III test performance for sample groups on a continuum of quality of education from least to most advantaged education. This was true for both verbal and non-verbal subtests.

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Chapter 1 INTRODUCTION

Recent international cross cultural research and literature reviews have suggested that quality of education plays an important role in the cognitive test results of non-westernized groups (i.e. any group not of western middle class origin) (Lezak, Howieson & Loring, 2004; Manly, Byrd, Touradji, Sanchez & Stern, 2004; Manly, Jacobs, Touradji, Small & Stern, 2002; Nell, 1999; Shuttleworth-Edwards et al., 2004). In the South African context, as a legacy of the colonial era and apartheid, most black South Africans received poor quality education, although there were some black South Africans who received privileged education at Private schools during the 1980s. After 1991, when apartheid ended, many more black South Africans received high quality education via enrollment at Model C schools (formerly the school system available for whites only). Thus in the last two to three decades some black South Africans have been receiving education on a par with the high quality education received exclusively by white South Africans during apartheid. Consequently, black South Africans are a heterogeneous group in respect of quality of education, which is likely to result in a divergence of cognitive test performance within this group.

The Wechsler Adult Intelligence Scale – III (WAIS-III) has recently been standardized for the South African population by the Human Sciences Research Council (HSRC) (Claassen, Krynauw, Hotzhausen, & Mathe, 2001). The HSRC standardization included 250 people from each of four ethnic groups: black, coloured, indian, and white. As is common in the standardization of IQ tests, (Wechsler, 1981; 1997), the researchers took into account the participant's level of education (i.e. number of years of education completed), but they did not stratify for the effects of quality of education on WAIS-III test performance.

Nell (1999) criticised the HSRC standardization for not taking into account the effect of quality of education, as he believed that the variations in quality of education available to South Africans would affect IQ test performance. In response to this, a preliminary study was conducted at Rhodes University to investigate the effects of level *and* quality of education. The Shuttleworth-Edwards et al. (2004) study stratified participants according to gender (female versus male), first language (black African versus white English), level of education completed (Grade 12 versus Graduate), *and* quality of education (disadvantaged - Department of Education

& Training – DET - versus advantaged – Private/Model C). Grade 12 was defined as having completed primary and high school and obtaining a Matric certificate. Graduate was defined as 12 years of schooling and three or more of tertiary education. Stratification resulted in four black groups (DET grade 12, DET graduate, Private/Model C grade 12 and Private/Model C graduate) and two white groups (Private/Model C grade 12 and Private/Model C graduate). Shuttleworth-Edwards et al. (2004) drew a comparison between their data for grade 12 groups and the HSRC standardization data that was generally representative of the population. The grade 12 groups were more comparable to the HSRC data than the graduate groups, as the majority of the population is more likely to complete Grade 12 than a tertiary qualification. This comparison appears in Table 1 below.

Table 1. A comparison of WAIS-III Full Scale IQ (FSIQ) scores of the HSRC South African standardization (Claassen et al., 2001), stratified for race, and the FSIQ of the research by Shuttleworth-Edwards et al. (2004) stratified for language, level and quality of education.			
HSRC	South African Black 92.51		South African White 108.34
Shuttleworth-Edwards et al. (2004)	Black African first language DET Grade 12 74.40	Black African first language Private/Model C Grade 12 99.90	White English first language Private/Model C Grade 12 106.57

Table 1 demonstrates that the FSIQ of the HSRC standardization and the Shuttleworth-Edwards et al. (2004) data for white South African groups is very similar. The HSRC FSIQ is 108.34 and the Shuttleworth-Edwards et al. FSIQ is 106.57. However, the HSRC FSIQ for black South Africans (92.51) falls between the FSIQ scores obtained by Shuttleworth-Edwards et al. (2004) for the DET grade 12 (74.40) and Private/Model C grade 12 (99.90) groups. While the HSRC FSIQ is seven IQ points below the Private/Model C grade 12 score, it is significantly too high for the disadvantaged group. This strongly supports Nell’s (1999) critique of the HSRC standardization that quality of education has a profound effect on IQ test performance.

At the time that the data was collected for the Shuttleworth-Edwards et al. study (1998 – 1999), most of the graduates tested were studying at Rhodes University. This in an internationally recognized university and consequently the group was of a particularly high calibre. It was

difficult to find Xhosa first language graduates with advantaged, high quality education as apartheid had only ended about 4-5 years before. Consequently, only two of the African first language Private/Model C graduates were Xhosa first language, and it was necessary to include other black participants whose first language was other than Xhosa in order to make up the numbers in this group. Sixty percent of these participants were originally from Zimbabwe, a country that had the highest literacy rate of 90% in Africa in 2000 (Answers.com, 2005) and had a reputation during the 1980s and 1990s for excellent education. Eighty percent of this group (i.e. the African first language Private/Model C graduates) had attended advantaged schooling (i.e. both primary and high school at Private/Model C institutions), and 80% were in the process of completing post-graduate studies, making them a particularly elite group. Thus the inclusion of these non-Xhosa speaking participants would have the effect of making them an educationally very privileged group. In contrast, all the other African first language subgroups in the sample were comprised predominantly South African individuals, and included at least 80% Xhosa first language participants.

The purpose of this thesis was to refine the original data collection so that all the black African first language categories were homogeneous for Xhosa first language and to provide greater homogeneity in respect of educational advantage in the South African context.

Chapter 2 LITERATURE REVIEW

2.1 Cultural issues in cognitive testing

The field of intelligence testing and the understanding about intelligence and cognitive processes is a contentious one (Cronbach, 1975). The use of assessment tests has the power to heal and lead to increased insight, understanding and personal development (Anastasi & Urbina, 1997), but it can also be used to perpetuate racist beliefs and justify discrimination at worst (Nell, 1999), and lead to exclusion and restriction for some (Helms, 1992; Howe, 1997; McClelland, 1973). These issues led some IQ critics to state that intelligence tests are ‘irrelevant to non-white subcultures’ (Kaufman, 1994, p. 21). In the past, the debate around the use of assessment scores has become blurred between political and scientific issues (Neisser et al., 1995; Singham, 1995).

The Wechsler subtests test various different mental abilities, such as verbal, perceptual and numerical skills, abstract reasoning and processing speed that together reflect the individual’s over-all abilities (Wechsler Manual, 1997). The attainment scores and intelligence scales were regarded by Wechsler as a sample of the participant’s abilities, and that these abilities are not usually equally developed in “normal” individuals (Wechsler, 1997). Matlin (1983) argued that ethnic groups of people demonstrate no significant difference in the cognitive processes of memory, concept formation, problem solving and communication. Thus if simple cognitive operations are to be found across cultures, then intelligence can be measured using the same test across cultural groups (Ardila, 1995). The universalist position is that individuals from all ethnic groups respond in a similar way to the individual subtests on an IQ test, which yields similar factor analyses across ethnic groups. Evidence in support of this is the comparison between black, Mexican-American and white Verbal, Performance and FSIQ performance on the Wechsler Adult Intelligence Scale (WAIS) of nine subgroups of psychiatric patients (Overall & Levin, 1978). The researchers found that the magnitudes of the effects of education, ethnic group and sex were very similar in all the psychiatric groups (Overall & Levin, 1978). This pattern of universality was also found in comparisons between black and white incarcerated testees on the Wechsler Adult Intelligence Scale – Revised (WAIS-R) (Faulstich, McAnalty, Carey & Gresham, 1987). Results of both the one and two factor solutions suggested that similar underlying abilities were being measured in the Black and White groups. Both groups

demonstrated Verbal Comprehension and Perceptual Organization factors that generalized across the groups. Faulstich et al. (1987) concluded that their results suggest that the WAIS-R has construct validity for black and white forensic populations (p. 185). Further research found that black and white performance supported the construct validity of the WAIS-R, as the factor patterns were similar for both gender and race groups (Kaufman, McLean & Reynolds, 1991). Gregoire (2004) found that the factor structure of the USA WAIS-III recurred in the French adaptation. He found that the four-factor model matched the data better than the two and three factor solutions. His research confirms the universality of the factor structure of the WAIS-III. Tam (2004) found that young Chinese adults validated the use of the seven subtest short form of WAIS-III (Chinese).

Despite research that supports similarities in cognitive processing, and the finding that the factor structure of the Wechsler tests is very similar across cultures, it is accepted that cultural differences do affect performance on standardized tests (Helms, 1992). When tests are applied cross culturally, they frequently have to be modified and adapted. This was the case for Insua (1983), who applied the WAIS-R to Argentines, and found that four of the verbal subtests (i.e. Vocabulary, Information, Comprehension and Arithmetic) had to be modified. Results found that the factor structures for the American and Argentine samples were very similar, lending further support for the universalist position, however, despite adapting the four subtests, discrepancies between the Argentines and the USA performance remained on the Vocabulary, Arithmetic, Digit Symbol and Similarities subtests. Although the level and probably quality of the Argentine's education was lower than the USA group, Insua attributed the lowered performance on Digit Symbol to 'unknown' personality and cultural factors (Insua, 1983, p. 436). This was also found in the French WAIS-III administration, but to a lesser extent: five of the verbal subtests had to be altered substantially, but upon administration, the Arithmetic subtest did not align with the Working Memory factor. This suggests that personality and culture play a role in the participant's performance on an intelligence test.

The field of intelligence testing attempted to compensate for cultural differences initially by designing tests that were culture-free or culture-fair. An example is the Ravens Progressive Matrices which was thought to be a 'reliable indicator of general intelligence' (Jensen, 1980, in Carlson & Wiedl, 1992, p. 170) and would thus be able to assess pure intelligence. These

attempts have been criticized, as it is argued that the culture of the non-westernized group affects the approach and response of the testee to the test (Verma, 1988), and as learning occurs in a culture, intelligence tests are culture loaded in the favour of the test designer and his or her culture of origin (Kaufman, 1994). These arguments against the development of culture-free or culture-fair tests are supported by research indicating that cultural differences impact not only on verbal tests, but also on performance (i.e. non-verbal) tests (Ardila, 1995, Ostrosky-Solis, Ramirez & Ardila, 2004, Rosselli & Ardila, 2003). Soffer (1997) found that the FSIQ of Caucasian, Hispanic and African-American children in a psychiatric in-patient unit were about 20 points below the standardization sample on the Wechsler Intelligence Scale for Children (WISC-III); over and above this, the African-American children scored lower on Performance IQ scores.

Thus while all ethnic groups have the capacity to process information and to think, it has been found that different cultures, having different environmental influence, value particular skills (Ostrosky-Solis et al., 2004, Salvia & Ysseldyke, 1995), and cognitive abilities are shaped by the individual's exposure to and opportunities to play and refine his or her cognitive abilities. This was demonstrated in the comparison between white English children in the United Kingdom and black Zambian children in Zambia, who were asked to complete clay models, pen-paper tasks and wire modeling tasks. The English and Zambian children achieved equally on the clay modeling task, a material accessible to both groups of children, while the English children performed better on pen-paper tasks and the Zambian children performed better on the wire modeling task (Neisser et al., 1995, Serpell, 1994). Thus, the type of materials available will determine the activities that are engaged in and consequently the types of skills developed (Miller-Jones, 1989). In these ways, the individual's culture will influence the type of knowledge that is acquired, and this knowledge, activities and learnt behaviors will solidify into what is known of as crystallized knowledge (Kline, 2002).

The idea that each culture affects what is learnt and consequently performance on cognitive tests was one reason that the Black Intelligence Test of Cultural Homogeneity (BITCH) was developed (Sattler, 1992). It assesses knowledge of inner city black slang in the USA. Although it is culture-specific, it was found to have limited validity across the USA and could not predict future academic success as well as the Wechsler tests (Sattler, 1992). Pragmatically, it would

appear that developing such culture specific tests is an unrealistic ideal and not a feasible solution to the need for assessment in a multi-cultural world, where the current milieu of globalization results in rapid integration and convergence between individuals from different ethnic groups. Furthermore, from a neuropsychological perspective, assessment tests such as the WAIS-III can provide useful diagnostic information that can inform intervention and facilitate compensation (Claassen, et al., 2001). When used cautiously, taking into account cultural factors as well as both level *and* quality of education, such an American-based test can be beneficial when applied to black African first language individuals (Shuttleworth-Jordan, 1996; Shuttleworth-Edwards et al., 2004).

However, considerable research in the last 30 to 40 years has demonstrated that it is inappropriate to generalize normative data on standard cognitive tests (including the Wechsler tests) from one ethnic group to another, as this may result in diagnostic and placement errors (Ardila, 1995; Frisby, 1993; Manly et al., 1998; Skuy, Schutte, Fridjhon & O'Carroll, 2001; Soffer, 1997). As described in detail above, research has found that differences in test performance between ethnic groups have been found to reflect socio-cultural factors, rather than ethnic attributes and this has been extensively documented in the literature (Ardila, 1995; Byrd, Touradji, Tang & Manly, 2004; Claassen, 1997; Faulstich et al., 1987; Gasquoine, 2001; Gonzales & Roll, 1985; Sattler, 1992). Thus, as learning and intelligence is shaped by the culture or environment in which the individual lives and the opportunities and stimuli that are available to him or her, the use of western middle class tests on individuals from different cultural backgrounds is not a true reflection of "intelligence", but rather reflects the discrepancy between the western middle class "norm" and the individual's culture.

Commensurate with this, Gonzales & Roll, (1985) emphasized such early research as that by Mercer (1973), who found that the IQ of black and Chicano testees increased in direct proportion to the number of Anglo socio-cultural features they demonstrated. This suggests that the more an individual acquires the skills and exposure to a western middle class context, a process commonly referred to as "acculturation" the more his or her IQ score will increase (Ogden & McFarlane-Nathan, 1997, p. 4). Van de Vijver & Phalet (2004) use an analogy of a continuum of acculturation, ranging from no adjustment and marginalization to complete adjustment or assimilation to the other culture. They emphasize that each individual from a non-westernized

group will present with a unique range of experiences and skills in the process of becoming “westernized”. Therefore, the process of acculturation is not an either-or phenomenon, but rather one that acknowledges the uniqueness of the individual’s experience.

An important factor to be considered in the application of tests across cultures is the testee’s test wiseness. Testees who are exposed to western schooling systems and have a higher level of acculturation, develop the ability to respond to the test items by paying attention, concentrating, following directions and have a higher level of confidence, as well as specific skills, such as pencil use and copying (Nell, 1999). Nell further describes how test-taking skills are ‘absorbed’ instead of being taught, and result in the testee managing to balance the contradiction of speed and accuracy when responding to test items. Individuals from non-westernized cultures may believe that intelligence is reflected in cautious, careful work, which will impact on his or her response to the test items and consequently the test result. Thus, the literature suggests that individual test performance will be affected by the interaction between ethnic group and level of acculturation (Helms, 1992).

An example of this acculturation process occurred in the white Afrikaans population of South Africa over the period of half a century (Claassen, 1997). The white Afrikaans community originated from the Belgium, Dutch, French Huguenot and German immigrants (Verster & Prinsloo, 1988). They followed a Calvinistic doctrine and tended to cut their ties to their land of origin. In 1932, the Carnegie Commission stated that 300 000 whites in South Africa were ‘very poor’ and that 90% of those were Afrikaans speaking (Breitenbach, 1977). During the 1940s and 1950s, the white Afrikaans-speaking group was predominantly rural, impoverished, and poorly educated. In the 1950s, there existed significant differences between white Afrikaans and white English performance on the South African Wechsler Intelligence Scale (SAWAIS) (Biesheuvel & Liddicoat, 1959, in Verster & Prinsloo, 1988, and in Claassen). The data was re-examined with regard to the Verbal and Performance scales (Verster and Prinsloo, 1988) and the differences were generally consistent for both groups of subtests. However, over the last half-century, the white Afrikaans group has become increasingly urbanized, their level and quality of education has improved and they have become financially prosperous (Claassen). Results of intelligence testing has demonstrated a convergence of IQ scores from 1954 to 1984, where the difference between white Afrikaans and white English testees shifted from a 10 IQ point

difference to a 5 IQ point difference (Claassen). Taken together, this suggests that acculturation of the white Afrikaans group to a more westernized lifestyle has led to a convergence of IQ scores with the white English-speaking group.

Over the last 100 years, the process of urbanization has increased in the black population of South Africa. Initially, urbanization mainly affected black males directly, as the British imposed a land and hut tax, which forced black men to work on the mines (Breitenbach, 1977). This gradually eroded the strong rural ties to an extended family clan, and increasingly included black African women, who left the rural areas to find work and/or to be with their husbands. This has resulted in the increasing sense of heterogeneity of ethnic groups in South Africa, and to a wide range of acculturation.

The impact of acculturation was elegantly demonstrated in the comparison between the test scores of black rural Pedi and black urban Pedi adults (Kendall, 1980). Kendall's battery consisted of non-verbal tasks, as he was attempting to develop a "culture-fair" test of universal application. Many of the tasks were taken from Biesheuvel's General Ability Battery (GAB), and consisted of construction tasks, pattern and design copying, sorting of objects and symbols (Kendall, 1980). It was found that education, urbanization and age all contributed to the testee's performance, but education had the greatest impact, followed by urbanization. Some possible explanations for the poorer performance of the rural group is that the type of competencies or skills required to complete the tasks may be of little use to rural individuals and / or the type of individual who tends to move to the cities to find work may be more ambitious and more motivated (Kendall, Verster & Von Mollendorf, 1988). This effect of urbanization (or acculturation) on intelligence test scores was also found in the administration of the Griffiths Scales of Mental Development, where urbanized children performed significantly better than rural children (Rosen & Venter, 1988, in Paulsen, 1994). Accordingly, exposure to a more urban, western environment appears to influence IQ test results positively. Thus the field of neuropsychological assessment is a challenging arena as it is increasingly unusual to find one ethnic group that is separated and unaffected by other cultures and each ethnic group will vary as to the amount of exposure to other cultures.

Manly and her colleagues (1998, 2002, 2004) have done extensive research into the interaction between acculturation, neuropsychological test performance, and literacy level and quality of education. For example, Manly et al. (1998) investigated the relationship between acculturation through self-report, linguistic behaviour and neuropsychological test performance. Acculturation was measured using the African-American Acculturation Scale – short form (AAAC). This scale measures cultural experiences, including values, beliefs and practices as reflected in ‘music, arts, people, religious beliefs and practices, traditional foods, traditional childhood experiences, superstitions, interracial attitudes – cultural mistrust’ (p. 294). Results found that performance of healthy African-Americans on WAIS-R and Boston Naming Test was directly related to acculturation. The more the testee reported acculturation to the white English culture, the more his or her neuropsychological tests conformed to the normative data for white English Americans. Similarly, when HIV+ African-American and HIV+ white individual test performance was compared (Manly et al, 1998), it was found that ethnic differences became non-significant when acculturation was taken into account. The corollary of this finding is that those participants who tended to communicate using African-American “black” English tended to perform poorly on WAIS-R Information subtests and Trail Making Test (Part B). Thus, acculturation is directly related to improved neuropsychological test performance.

Further research by Manly et al. (2002) investigated neuropsychological performance on elderly groups of African-American and white individuals. They found that number of years of education (i.e. level of education) was a poor predictor of neuropsychological test performance in African-American elders. They explained that elderly African-American individuals were educated during the first half of the twentieth century, when black and white learners were segregated and there was an unequal distribution of funds to African-American schools, which resulted in African-American children receiving a lower quality of education. These researchers used the Reading Recognition subtest from the Wide Range Achievement Test – Version 3 (WRAT-3) to assess literacy level. When literacy level was taken into account, the effect of race on test performance became non-significant except for two tests (category fluency and a drawing measure). In further research, Byrd et al. (2004) found significant differences between African-American, Hispanic and white elderly individuals on cancellation test performance, but the use of the Reading Recognition subtest of WRAT-3 to equate the groups according to literacy level made all the performance differences non-significant. Manly et al. (2004) emphasized that the

use of reading level partly reflects quality of education and that the use of reading level is a more sensitive predictor of test performance than number of years of education for ethnic minorities. Thus, Manly and colleagues started investigating the interaction between test performance and acculturation, and their research evolved to explore the effects of reading level, which in part reflects quality of education. In conclusion, these researchers have effectively demonstrated that both increased acculturation and improved reading level (reflecting quality of education) reduce the ethnic differences between African-American and white test performance in most tests.

Van de Vijver & Phalet (2004) review methods in cognitive and personality assessment that incorporate acculturation into multicultural assessment with a view to reducing bias. They highlighted two methods that are appropriate to the field of cognitive testing, and particularly in respect of the Wechsler tests. The first is to use acculturation data such as length of stay in a country or the approach of Mercer (1979), which was to take into account socio-economic and ethnic background and then adjust or correct the score obtained on the test accordingly. Van de Vijver & Phalet (2004) however criticize Mercer's approach, as they state that Mercer merely had one correlation for African-American and one correlation for Mexican-American children and they feel that this failed to address the concept of acculturation as occurring on a continuum. In the second approach, Van de Vijver & Phalet (2004) cite the work of Cuellar (2000), who has devised a regression approach to correct the score according to the amount from which the testee deviates from the norm upon which the test is standardized. Thus the tester is able to predict how each testee would have performed were he or she from the group upon which the test was designed. Van de Vijver & Phalet (2004) conceptualize acculturation as occurring on a continuum, which endorses the point, raised earlier (pp 6-7), about the development of culture specific tests being an unrealistic goal. Rather making adjustments for testees on existing well-researched tests (such as the Wechsler tests) along a continuum of cultural sophistication appears to be the more pragmatic solution.

2.2 Level and quality of education

There is much research that supports the relationship between level of education (i.e. number of years completed) and improved performance on intelligence tests (see reviews in Lezak, et al., 2004; Shuttleworth-Edwards, Donnelly, Reid & Radloff, 2004). For example, the results of 880

WAIS-R participants were examined, and a direct relationship was found between FSIQ and years of education (Matarazzo & Herman, 1984); the scatter on three WAIS-R IQ scales were found to relate to level of education (McLean, Kaufman & Reynolds, 1989). In the South African context, statistically significant differences on a neuropsychological battery and the Wechsler Intelligence Scale for Children – Revised (WISC-R) was found in a group of black Soweto learners as a function of grade level (Skuy et al., 2001, p. 141). Research by Shuttleworth-Edwards et al. (2004) concurred for both black and white South Africans: graduates scored higher than those with a Grade 12 across all groups.

This has also been found in other tests of neuropsychological functioning. Verbal fluency of African-American, Chinese, Hispanic, Vietnamese, and white individuals was directly affected by education level and age (Kempler, Teng, Dick, Taussig & Davis, 1998), as is the performance of testees on the Rey-Osterrieth Complex Figure Test (Ardila & Rosselli, 2003 in Rosselli & Ardila, 2003). Education level is found to affect not only verbal skills, but also non-verbal skills; these include for example, ‘spatial memory, cancellation tasks and copying of simple line drawings’ (Lezak et al., 2004, p. 315). Typically, educational level is considered when tests are being standardized (Wechsler, 1981; 1997).

However, increasingly it is being ascertained that the level of education attained becomes a poor predictor of test performance in countries where there is not parity between the quality of education available to different race groups (For example, Manly et al., 2002; 2004; Shuttleworth-Edwards et al., 2004). As discussed above, educational level in non-westernized groups is a poor predictor of neuropsychological test performance. According to Manly et al. (2004), reading level is a better assessment of educational exposure and demonstrates the individual’s knowledge, strategies and skills reflecting quality of education than the number of years of education (i.e. level of education). Other research has found that different regions produce variations in quality of education. For example, Lezak (1995) draws attention to research such as Hanney (1992) who found that significant variations in test performance were evident in individuals from inner city versus small rural schools in the USA, as these two school systems vary according to the quality of education reflected in different types of skills and knowledge that are imparted.

As discussed above, recent cross cultural neuropsychological research in the USA that compared African-American and white 'elders' matched on years of education found significant discrepancies in test performance (Manly, et al., 2002; 2004), but when literacy level was used to compare the groups, all the other discrepancies became non-significant (Manly et al., 2002). Thus, some differences in test performance in the USA occurred in the past due to variations in the quality of education available to African-Americans versus whites, which has been determined using a measure of literacy level, and currently exists between inner city versus rural schools.

In South Africa, differences in quality of education have been a particularly marked phenomenon starting when the South African government passed legislation to ensure variations in quality of education according to race. In this context, there has been a legacy of inequity in the quality of education provided to different racial groups at primary and high school levels (Claassen et al., 2001). The Bantu Education Act of 1953 ensured Government control over education, and that there was separate, differentiated education for each racial group (Booyse, 1993, in du Toit, 1996). The apartheid regime lasted from 1948 to 1991. Its political policy and doctrine stated that different races were required to perform different 'levels' of work, and thus the majority of black South African learners were deprived of some academic subjects in favour of subjects such as gardening. The inequality of education was reflected in the manner in which teachers were trained, the salaries that were paid to different race groups (white teachers receiving an adequate salary, while black teachers were paid minimal salaries), the resources available to different schools, and the prescribed curriculum. Specifically, traditionally black South African schools were under-supplied with basic resources such as books and desks, and teachers were required to teach large classes.

The majority of black South Africans under apartheid were educated in schools run by the Department of Education and Training (DET), which acquired only 5-25% of the financial resources expended on white Afrikaans and white English first language pupils (Claassen, et al., 2001), despite representing more than 75% of South African population. White Afrikaans and white English first language pupils were educated in elite schools modeled on the British public school system, in Private/Model C institutions (Kallaway, 1984). Kallaway (1984) considered Private/Model C schooling to be of a superior level while DET schooling represented a lower

quality of education. As discussed earlier, this has implications for test performance, as quality of education has been found to impact on the individual's acquisition of crystallized knowledge. In South Africa, schools vary according to the teaching methods they employ. For example, high quality schools develop problem solving and facilitate developing different strategies for learning, while poor quality, disadvantaged schools focus on rote learning as a means to cover the syllabus (Grieve & Viljoen, 2000).

During the 1980s, Private schools in South Africa became increasingly multi-racial, and thus a few black African children were exposed to advantaged education. From 1991, Model C schools became multiracial and the former DET schools were no longer restricted as they had been during apartheid. Despite the change in legislation, former DET schools continue to be dogged by the legacy of apartheid. Although the DET system no longer exists, in essence, the problems remain. For example, in 1991, black schools in the Eastern Cape with a thousand students had 24 teachers while an equivalent Model C School had 59 teachers. Now, both types of schools have about 31 state paid teachers, but the Model C schools pay about 12 additional teachers privately (Van Der Berg, 2004). South African Democratic Teacher's Union deputy Provincial chairman of the Eastern Cape, Mzolele Mvara stated that the Eastern Cape is short of 22 000 teachers, and that the 68 000 teachers currently employed cannot cope (Cooper, 2004). According to Mvara, 80% of Eastern Cape schools do not have electricity or computers. Thus, more than ten years after apartheid has ended, there remain significant discrepancies between the quality of education available to black students. Former DET schools include what is colloquially termed "township schools", as well as rural and farm schools, and for the purposes of this study, all those schools that were formerly referred to as "DET" schools during apartheid will continue to be referred to as DET schools, as this term is synonymous with disadvantaged education.

A growing body of research reflects discrepancies in test performance as a result of quality of education in the South African context. For example, Shuttleworth-Edwards et al (2004) draw attention to the effects of quality of education on performance on the Wechsler tests in their review of research by Avenant (1988) and Shuttleworth-Jordan (1996). Avenant (1988) administered the SA-WAIS to 140 prison warders with 9 – 12 years of DET education and found significantly lowered IQ scores, yet all were working, intelligent adults (Nell, 2000). Additional

research by Avenant (1988) found that students from traditionally black Universities (Fort Hare, Zululand, North and Medical University of South Africa) scored a mean FSIQ of 77 on the SA-WAIS (recalculated in Nell, 1999 p. 132). However, preliminary research between black and white students at a traditionally white South African university (Shuttleworth-Jordan, 1996) found marginal differences between black and white participants on a number of SA-WAIS subtests. These research findings provide a strong indication that, in light of differential educational backgrounds, black African first language individuals are not a homogeneous group and consequently are likely to score at different levels on IQ testing using the WAIS-III. This indication was borne out by the Shuttleworth-Edwards et al. (2004) research on WAIS-III, where black African first language Private/Model C grade 12s and graduates who had had advantaged education performed comparably to the USA standardization and those who had had poor quality education (black African first language DET), demonstrated a significant lowering across all subtests.

Furthermore, in the South African context, the effects of quality of education have been found in the comparison of performance on other neuropsychological tests. Recently, Grieve & Viljoen (2000) administered the Austin Maze test to 30 Vendas University students. They found a lowering of performance yet other students from a privileged University achieved better results (Anderson & Shanahan, 1995 in Grieve & Viljoen, 2000). This discrepancy in performance was explained as a residual effect of disadvantaged education, where disadvantaged schools focus on rote learning (Grieve & Viljoen, 2000) rather than facilitating problem solving skills.

Thus in South Africa quality of education has been found to have a profound impact on IQ and neuropsychological test performance and as quality of education improves so does performance on tests. As discussed earlier, a similar pattern of convergence towards the western middle class normative data was found by Manly et al. (1998) in those who reported a higher level of acculturation and in further research where literacy was used to measure quality of education (Manly et al., 2002). This suggests that acculturation is related to high quality of education, and thus in the South African context (as Shuttleworth-Edwards et al., 2004, have done), simply taking into account the individual's quality of education via disparate educational institutions or environments provides information as to the individual's degree of assimilation to the western middle class culture. An added refinement in the estimation of quality of education would be to

calculate gradations of quality of education in line with Van de Vijver & Phalet's (2004) delineation of a continuum of acculturation. This could be achieved by taking into consideration the length of time in attendance at various educational institutions, for example a continuum of the gradation of quality of education could be achieved by noting either: (i) DET education throughout primary and high school; (ii) DET/township primary schooling and Private/Model C high school; (iii) Private/Model C education throughout primary and high school.

To the author's knowledge, this refinement has not yet appeared in the South African research on the effects of quality of education. The HSRC standardization took no account of quality of education. The Shuttleworth-Edwards et al. (2004) research formally addressed quality of education across only two broad dimensions – disadvantaged (DET) versus advantaged (Private/Model C), that were not refined in terms of primary versus high school exposure to disadvantaged versus advantaged education.

2.3 Language in the South African context

South Africa is a country of 43,647,656 citizens and 11 official languages. Nine of the official languages are Bantu languages that originate from the Niger-Congo language family. Linguists have divided and classified Bantu languages into Nguni (consisting of the Swazi, Tsonga, Xhosa and Zulu), Sotho (consisting of Northern Sotho, Pedi & Tswana), and Venda (Wikipedia, 2004). Recent comparison between Nguni, Sotho, Tsonga and Venda suggested that the Nguni languages express relative concords, while the other languages do not use relative concords to the same extent (Zeller, 2004). Thus although there are some similarities between the Bantu language groups, the Nguni, Sotho and Venda contain more similarities within their subgroups. There are about six million Xhosa-speaking South Africans (i.e. 14% of the South African population), and the highest numbers of Xhosa-speakers originate from and live in the Eastern Cape.

In the Shuttleworth-Edwards et al. (2004) research, the majority of the black participants in the sample were Xhosa speaking, however, due to a sampling difficulty (as discussed in the Introduction), the groups were not homogeneous for language, and thus, despite there being some similarities in the language structure for the Bantu language groups, there are still some

subtle linguistic and cultural differences which may impact on test performance. Furthermore, in the original research, some of the participants originated from Zimbabwe, and their first language was Shona. As this language is not generally spoken in South Africa, and in an attempt to reduce any subtle effects of variations in language and culture on test performance, it was therefore decided to collect data that was homogeneous for Xhosa-speaking participants.

2.4 The Wechsler Adult Intelligence Scales

The first Wechsler intelligence test was published in 1939. Since the Wechsler-Bellevue Intelligence Scale Form I was published, various editions and forms have been produced to assess adults, children and preschoolers. All the Wechsler intelligence tests consist of various subtests that together form the Full Scale IQ (FSIQ). These subtests are grouped into Verbal tasks (predominantly targeting language-related skills) and Performance tasks (predominantly focusing on visuo-perceptual non-verbal reasoning skills). Each new Wechsler IQ test includes new subtests that contribute to the FSIQ, but the basic structure of Verbal IQ (VIQ) and Performance IQ (PIQ) remains the same. Each new edition of the Wechsler has had updated norms, updated items and changes made to the scoring. As this thesis is focusing on the WAIS-III, the Wechsler Intelligence Scale for Children and the Wechsler Preschool and Primary Scale of Intelligence will not be further discussed.

After the first Wechsler-Bellevue Intelligence Scale Form I was produced in the USA in 1939 (Sattler, 1992), a second form, the Wechsler-Bellevue Intelligence Scale, Form II was introduced in 1946. Form I was revised in 1955 and in 1981, the Wechsler Adult Intelligence Scale – Revised (WAIS-R) was produced. Most recently, the WAIS-III was made available internationally in 1997. The WAIS-III included updated norms, an extended age range up to 89 years of age (the WAIS-R only had normative data up to 74 years), extension of differentiation between mild and moderate Mental Retardation, updated artwork and larger drawings to extend application to those with poor visual acuity, modification of items to reduce cultural bias and those with empirical bias, an addition of tasks that would provide information on fluid reasoning (e.g. Matrix Reasoning), decreased reliance on timed performance (e.g. Matrix Reasoning replaced Object Assembly as a Performance subtest that is used to derive the FSIQ score), four factor index scores are now derived from the subtests (Wechsler, 1997). The factor indexes

include VCI (Verbal Comprehension Index), POI (Perceptual Organization Index), WMI (Working Memory Index), and PSI (Processing Speed Index).

The WAIS-III has three new subtests: Matrix Reasoning, Letter-Number Sequencing and Symbol Search. The inclusion of the Matrix Reasoning subtest, an item very similar to the Ravens, can be understood as an attempt to make the test more culture fair. However, as indicated above, attempts to use nonverbal tests to determine intelligence have been criticized by cross cultural researchers (Rosselli & Ardila, 2003), who argue that test items that do not require language still frequently require problem solving typically taught in western middle class environments. Nevertheless, in a developing country such as South Africa, the WAIS-III has the added advantage of guided learning where the testee is given the practice items if he/she does not achieve the baseline (Nell, 2000, p. 173). This extended practice provides teaching to testees who are unfamiliar with the task, which should reduce one form of bias (i.e. method bias), as it allows for the testees to have some experience with the material (Van de Vijver & Phalet, 2004).

The WAIS-III has been tested on groups of individuals with diagnosed neurological disorders, Alcohol and related disorders, neuropsychiatric disorders, psycho educational and developmental disorders and hearing impairment. The Manual therefore provides expected means for WAIS-III IQ and index scores for these different population groups. Despite these developments, the concern remains that individuals from a non-Westernized middleclass background will not score as high as would be expected (Nell, 2000).

2.5 The Wechsler Adult Intelligence Scales in South Africa

In South Africa, the Wechsler-Bellevue Intelligence Scale was adapted and normed for white Afrikaans and white English South Africans from 1954 to 1969 and was re-named the South African Wechsler-Bellevue Adult Intelligence Scale (SA-WAIS) (Claassen et al., 2001). Until recently, the SA-WAIS was used extensively in South Africa, despite criticism of its out-dated questions and normative data (Shuttleworth-Jordan, 1995). The development and use of a more recent test was needed, and when the WAIS-III became available, it was decided to norm it for use in South Africa, as it is internationally relevant and neuropsychologically sensitive and reliable (Claassen et al., 2001). Norming was undertaken by the Human Sciences Research

Council (HSRC) on four South African groups: black, colored, indian and white in 1997 - 1998. It was administered in English, and all the participants either studied in English, or spoke English at work or at home. A few changes were made to the Arithmetic subtest. For example, dollars were converted to rands. Although educational level (number of school years completed) was considered for all ethnic groups, quality of education was not. Taking quality of education into consideration in the standardization process is not standard procedure (Wechsler, 1981; 1997), but this was criticized by Nell (1999) and Shuttleworth-Edwards et al. (2004), who suggested that the HSRC data for black South Africans was problematic, as it did not address the diversity in quality of education.

In response to this limitation in the HSRC standardization, research was conducted by Shuttleworth-Edwards et al. (2004) that aimed to investigate cross cultural influences on WAIS-III test performance for a South African sample (age range 19-30). Participants were stratified according to gender (female versus male), language (black African versus white English first language), level of education (grade 12 versus graduate) *and* quality of education (disadvantaged – DET versus advantaged - Private/Model C). The results indicated that scores for the black African and white English first language groups with advantaged education were comparable with the USA standardization, whereas scores for black African first language participants with disadvantaged education were significantly lower than this. According to the HSRC normative data, black South Africans scored a FSIQ score of 92.51 (Claassen et al., 2001), however, Shuttleworth-Edwards et al. (2004), revealed differences within the black African first language group for quality of education. Specifically, black DET Grade 12 achieved a FSIQ of 74.40, compared to black Private/Model C grade 12 who achieved a FSIQ of 99.90. As discussed in the Introduction, Table 1 shows that the HSRC standardization for black South Africans does not reflect the impact of quality of education, in that the IQ score was too high for those with disadvantaged (DET) education, and too low for those with advantaged (Private/Model C) education. As further noted in the Introduction, at the time when the Shuttleworth-Edwards et al. (2004) research was conducted (1998 – 1999), it was difficult to find black Xhosa first language participants with more than four years of consecutive privileged (Private/Model C) education, mostly due to the fact that South Africa became a democracy only four to five years before the research began, and also perhaps due to the higher degree of impoverishment in the Eastern Cape. Consequently, it was necessary to include speakers of other indigenous Southern African

languages in the privileged educational category, with resultant inconsistency in the number of Xhosa first language speaking individuals in the advantaged subgroup compared with the disadvantaged subgroup, which comprised entirely Xhosa first language participants.

Both the disadvantaged and advantaged grade 12 groups consisted of 90% Xhosa first language participants. Similarly, the disadvantaged graduate group consisted of 100% Xhosa first language participants. However, the advantaged graduate group comprised only 20% Xhosa first language participants (i.e. two of ten) and the rest of the group was made up of 60% Shona first language -speakers from Zimbabwe (i.e. six of ten), and 20% Tswana first language –speakers (i.e. two of ten). The black Private/Model C graduate group represented a particularly elite group, 80% of whom had experienced advantaged education during primary *and* high school that was commensurate with white schooling. Furthermore, 60% (i.e. the six Shona-speaking Zimbabweans) of this group received particularly advantaged education in Zimbabwe, which in the 1980s and 1990s was recognized for its high quality of education. In addition, 80% of this black Private/Model C graduates were post-graduate students at Rhodes University. In terms of the Van de Vijver & Phalet (2004) delineation of a continuum of acculturation, this group can be seen to represent an exceptionally high level of acculturation. Compared with the HSRC norming (Claassen et al., 2001), the Shuttleworth-Edwards et al. (2004) study represented a refinement in that it took quality of education into account. However, as indicated earlier (pp 16), gradations of quality of education in terms of how much advantaged or disadvantaged education was experienced at primary and high school levels within their two-pronged advantaged versus disadvantaged categories of quality of education, was not formally addressed in that study.

Thus, the aim for the current study was to refine the data obtained by Shuttleworth-Edwards et al. (2004), by recruiting additional Xhosa first language participants in order to create a sample in which there were an equal number of exclusively Xhosa first language participants with South African education in all the subgroups. In this way, it would be possible to replicate the former analyses for advantaged versus disadvantaged education, on a sample that was controlled for any subtle confounding effects due to linguistic difference in the African first language groups, and that was more representative in respect of quality of education. Furthermore, it was decided to undertake a more refined analysis of quality of education for black African first language

participants by noting whether disadvantaged or advantaged education was present for high school only, or throughout schooling and how this affected the newly acquired descriptive normative data.

Chapter 3 METHODOLOGY

3.1 Participants

The methodology for this study was the same as that employed in the Shuttleworth-Edwards et al. study (2004). In this way, it was possible to compare and/or combine the data obtained in the current study with the data obtained in the earlier study. In the previous study, a sampling matrix was devised in order to stratify for relevant variables. These included gender (an equal number of females versus males), ethnicity (black African first language versus white English first language), level of education ('Grade 12' with 12 to 14 years of education versus 'Graduate' with 15+ years of education), and quality of education (disadvantaged - DET/township versus advantaged - Private/Model C). This ensured that there was representivity of the different strata in a small group relative to the population.

In the previous study, as indicated above, it was difficult to recruit Xhosa first language graduates with advantaged education, which resulted in an imbalance between the subgroups as delineated in Table 3.1. For the DET grade 12 group, there were nine Xhosa first language participants versus one other African first language participant; for the DET graduate group, there were ten Xhosa first language participants; for the Private/Model C grade 12 group, there were nine Xhosa first language participants versus one other African first language participant and for the Private/Model C graduate group, there were two Xhosa first language participants versus eight African first language participants.

Table 3.1. Number of Xhosa first language and other African first language participants tested in Shuttleworth-Edwards et al. (2004) study.		
Quality of education	Level of education	
	Grade 12	Graduate (Degree)
DET n = 20	9 Xhosa / 1 Other	10 Xhosa
Private/Model C n = 20	9 Xhosa / 1 Other	2 Xhosa / 8 Other

Thus, the present study aimed to ensure that all the subgroups consisted of only Xhosa first language speakers and to supplement the subgroups with additional Xhosa first language participants so that each subgroup consisted of eleven or twelve Xhosa first language participants

(Table 3.2). Thus, for the DET grade 12 group, two additional participants were included, for the DET graduate group, two additional participants were included, for the Private/Model C grade 12 group, three additional participants were included and for the Private/Model C graduate group, nine additional participants were included.

Table 3.2. Additional Xhosa first language participants tested in current research, bringing each sub-group up to a total of 11 or 12 Xhosa first language participants.

Quality of education	Level of education	
	Grade 12	Graduate (Degree)
DET	2	2
Private/Model C	3	9

Initially, attempts were made to recruit participants from the Eastern Cape, South Africa. Although a few participants volunteered, in order to fill the sample groups, it was necessary to include participants who were born and schooled in the Eastern Cape but were living in Cape Town or Gauteng. Two participants were tested in the Eastern Cape, three in Cape Town and eleven in Gauteng.

As in the original study, due attention was paid to keeping equivalent numbers of males and females in each of the subgroups such that the final Xhosa first language groups had the following gender distribution: DET Grade 12 (5F; 6M), Private/Model C Grade 12 (6F; 6M), DET Graduate (5F; 7M), Private/Model C Graduate (5F; 6M).

It might be argued that the five-year delay in additional sampling could introduce a cohort effect if the majority of the sample was from former DET/township schools, as this is the area that the Department of Education has been trying to develop in the last decade in an attempt to redress the effects of disadvantaged education. However, it is considered that a cohort effect is unlikely to be a confounding factor in this study in that the educational imbalances in DET and Private/Model C schooling remain marked (see earlier discussion) and will take decades to redress. Furthermore, only four of the additional sixteen participants tested for the purposes of the present study were originally from a DET/township school (See Table 3.2).

Language

All participants were either studying or working in the medium of English, or speaking English at home. In the prior and current research, Xhosa dialectal differences (i.e. Gcaleka, Mfengu, Ngquika, Pondo and Thembu) were not recorded. While subtle differences may exist between these groups, it is considered that the cultural and language similarities out-weigh the differences. Furthermore, in South Africa there are eleven official languages and at this stage it is not realistic to assess the effects of subtle variations across dialects within a language.

In the previous research, the black groups were referred to as 'black African first language', as this incorporated the variation of the first language spoken in some of the groups. However, in the current research, these mixed groups will be referred to as 'Mixed African Language', as they include a mix of Xhosa, Shona, Sotho or Zulu speakers. The new groups formed in the current research consist exclusively of Xhosa first language individuals and will be referred to as the 'Xhosa Language' groups.

Level of education

In the previous research (Shuttleworth-Edwards et al., 2004), it was difficult to find black South Africans who had attended advantaged schooling who did not complete twelve years of schooling and usually these individuals continued studying at a tertiary level. Consequently, the previous research stratified the participants according to two levels: grade 12 (12 – 14 years of education) and graduate (15+ years of education). Completion of Grade 12 suggests that the individual has completed twelve years of schooling and has attained a matric certificate. Some of the grade 12 Private/Model C participants had completed one or two years of a degree or a diploma but had not yet completed the course or graduated. The graduate participants were all university graduates with the exception of one participant with a three-year diploma. Thus these terms are potentially misleading, in that some of the 'grade 12' participants had studied further than grade 12, and for the 'graduate' group, it was considered legitimate for those with a three year diploma to be included whereas the term graduate implies that all the participants were university graduates. Thus, to facilitate accuracy of reference in the current study, the previous terms 'grade 12' and 'graduate' will be operationalized as the *12+ years of education group* (to refer to those with a grade 12 and possibly one or two years of tertiary education) and the *15+ years of education group* (three or more years of tertiary education, resulting in the completion

of a degree or a diploma) respectively. Regardless of the numbers of years studied, an undergraduate degree or diploma counts for three years, an honours counts for one year and a masters counts for two years.

In the South African context, entrance to tertiary institutions is contingent on the symbols achieved during the final Grade 12 or Matric exams. When apartheid ended, there were basically two types of tertiary institutions: universities and technikons. Universities aim to focus on 'teaching and research of the basic principles of science', while technikons aimed to foster the 'development, implementation and practical application of technology' (quotes from Qualifications Structure for university and technikons, in Gillard, 2005, p. 6). In 1993, technikons were granted permission to offer undergraduate and postgraduate degrees. Thus, over the last decade, there has been an increasing focus on research in the technikon environment. In the last year, various universities and technikons have merged, and former technikons are now called universities of technology (Gillard, 2005). Thus recently in the South African context, the distinction between degrees and diplomas have become less well defined.

In the current study, partly in response to the difficulty in finding Xhosa Language Private/Model C 15+ years of education to participate, four individuals with a three or four year diploma were included in the study. While it could be argued that this makes the data less homogeneous, it can also be countered that it rather makes the normative data more representative of a wider population group. An ANOVA comparing the four participants who had completed a three or four year tertiary diploma at recognized Technikons versus those with a University degree, revealed no significant difference between the two groups for any of the subtest, index or IQ scores. For subtests the p-values ranged from $p=0.21$ to $p=0.85$, for index scores, the p-values ranged from $p=0.18$ to $p=0.86$ and for the IQ scores, the p-values ranged from $p=0.38$ to $p=0.80$. Similarly, the Mann-Whitney U Test revealed no significant discrepancies. For the subtests, the p-values ranged from $p=0.19$ to $p=1.00$, for the index scores, the p-values ranged from $p=0.11$ to $p=0.78$ and for the IQ scores, the p-values ranged from $p=0.26$ to $p=0.92$. This warrants including those with degrees and those with diplomas in the same category.

In the previous research (Shuttleworth-Edwards et al., 2004) all the Mixed African Language Private/Model C 15+ years of education were graduates from Rhodes University. In the current research, the newly constituted Xhosa Language Private/Model C 15+ years of education subgroup consisted of seven University graduates all from previously advantaged Universities (three from Rhodes University, two from WITS, one from UCT and one from UNISA), and four Technikon graduates with a diploma.

In the previous research (Shuttleworth-Edwards et al., 2004) the total sample comprised three groups at the 12+ years of education level (Mixed African Language DET, Mixed African Language Private/Model C and white English Private/Model C) and three groups at the 15+ years of education (Mixed African Language DET, Mixed African Language Private/Model C and white English Private/Model C). The level of education for the three 12+ years of education groups ranged from 12.20 to 12.60 (mean=12.45) and the level of education for the three 15+ years of education groups ranged from 16.30 to 16.70 (mean=16.50) (Shuttleworth-Edwards et al., 2004). In the current research, the level of education for the 12+ years of education groups ranged from 12.09 to 13.17 (mean=12.63) and the level of education of the 15+ years of education ranged from 15.82 to 16.42 (mean=16.11). The only significant change in level of education between the original and newly constituted groups is that the Xhosa Language Private/Model C 15+ years of education group had a mean number of years of education of 15.82 years which is lower than the Xhosa first language DET 15+ years of education and all the other 15+ years of education groups from the previous research. This indicates that the Xhosa Language Private/Model C 15+ years of education had less tertiary education (15.82 years) than the Mixed African Language Private/Model C 15+ years of education group from the original research, making it a less advantaged group in the sense of having less number of years of tertiary education.

In the original research, 80% of the Mixed African Language Private/Model C 15+ years of education group had completed post-graduate studies. In the current research, only 54.44% of the Xhosa first language Private/Model C 15+ years of education group had completed post-graduate studies. Thus, the additional Xhosa Language Private/Model C 15+ years of education participants in the current study differ from the Mixed African Language Private/Model C 15+ years of education participants from the prior research not only with regards to the quality of

their primary schooling in that the majority (80%) of the Mixed African Language group attended advantaged primary school, while only a few (27.27%) of the Xhosa Language group attended advantaged primary school, but also the level of tertiary education obtained.

Quality of education

As discussed above, South Africa has a legacy of variations in the quality of education available to learners. The old DET system of educating black South Africans no longer officially exists, but as reports have stated, considerable difficulties and shortages continue to make the old DET /township schools of poor quality of education (See earlier review, pp 14). Although DET schooling no longer exists, for the purpose of this research project, those who were township educated will be referred to as DET. By contrast, the Model C and Private schools were regarded as offering high quality education (Kallaway, 1984). The Model C schools were available to white South Africans exclusively during apartheid and became accessible to all races since apartheid ended. Private schools accepted all race groups during apartheid and continued to be multi-racial. Thus, in both the previous and current research, the Mixed African Language participants were divided into two groups with regard to quality of education: the disadvantaged DET schools and the advantaged Private/Model C schools. To qualify for the DET group, participants had to have attended a DET school throughout high school, which invariably also meant that they had also attended DET primary schooling. To qualify for the Private/Model C group, participants had to have attended four or more years of Private/Model C schooling. Thus, a participant could have a disadvantaged (DET) primary school education and an advantaged high school education (Private/Model C) and be included in the Private/Model C category.

As in the previous research, in the current research, all DET 12 + years of education and DET 15+ years of education were schooled at township schools all the way from grade 1 to grade 12. Of the two additional DET 15+ years of education participants included in the current research, one completed grade 12 in 1991, and therefore attended DET schooling throughout his/her school career. The other additional DET 15+ years of education participant completed grade 12 in 1995; consequently his/her high school years fell post-apartheid in a township school. The two DET 12+ years of education participants were schooled post-apartheid in Cape Town. Thus, the additional data acquired by the current research contains one DET schooled participant, one with a mix of DET schooling and township schooling, and two participants with township

schooling in Cape Town. However, as stated above, it is not considered that changes in former DET schools have yet been sufficient to substantially alter quality of education.

In the previous research, no delineation was noted on the biological questionnaire as to whether the participant attended Model C or Private schooling. All the participants were grouped together as one entity. In the current research, this refinement was added. Of the nine additional 15+ years of education participants, during high school, four of the nine participants attended Model C high school, four participants attended a Private high school and one attended both Private and Model C schools during high school. An ANOVA comparing the four participants with Model C schooling versus the four participants with Private schooling on the subtest, index and IQ scores revealed no significant differences. P-values ranged for the subtests from $p=0.27$ to $p=0.88$, for the index scores from $p=0.55$ to $p=0.95$ and for the IQ scores from $p=0.84$ to $p=0.89$. Thus, this warrants the use of Private/Model C as one category.

The delineation of attendance at DET versus Private/Model C between primary and high school for 15+ years of education appears in Table 3.3 below. In the previous study, within the Mixed African Language Private/Model C 12+ years of education group, 80% attended a DET school during primary school, and a Private/Model C high school. In the current study, 75% of the newly configured Xhosa Language group attended a DET primary school and a Private/Model C high school. Thus, this group remains very similar to the original group with regard to quality of education and consequently, only the advantaged 15+ years of education group were included in this table, and not the 12+ years of education group, as described above, the original and new groups were similar with respect to the number of participants with advantaged primary schooling.

Table 3.3. Variations in quality of education in primary and high schooling in new Xhosa Language 15+ years of education groups and the prior Mixed African Language 15+ years of education group.			
	Xhosa Language DET 15+ years of education	Xhosa Language Private/Model C 15+ years of education	Mixed African Language Private/Model C 15+ years of education
Primary school	0% Private/Model C	27% Private/Model C	80% Private/Model C
High school	0% Private/Model C	100% Private/Model C	100% Private/Model C

In the current study, the Xhosa Language DET 15+ years of education group had no advantaged primary or secondary schooling. Of the eleven Xhosa Language Private/Model C 15+ years of education participants of the newly configured group, only 27.27% (i.e. three of eleven) were educated at a Private/Model C school from grade one to grade 12; only 27.27% of the participants (i.e. three of eleven) had one to three years of Private/Model C education at the end of primary school; the remaining 45.45% (i.e. five of eleven) attended a DET school throughout primary school. In the previous research, 80% of the Mixed African Language Private/Model C 15+ years of education group attended a Private/Model C school for both primary *and* high school levels. Consequently, the majority of this group had equitable educational opportunities as white English Language South Africans. Thus, 72.72% of the Xhosa Language Private/Model C 15+ years of education participants attended the bulk of their primary schooling at a DET school, making them more advantaged than those with DET schooling throughout their school careers, as they attended a Private/Model C high school, but less advantaged than the Mixed African Language Private/Model C 15+ years of education group who generally attended advantaged schooling throughout their school careers.

With reference to these three subgroups, it can be seen that they have therefore been exposed to varying levels of quality of education, which can be conceptualized along Van de Vijver & Phalet's (2004) continuum: the Xhosa first language DET participants experienced disadvantaged primary and high schooling, the Xhosa first language Private/Model C 15+ years of education generally experienced disadvantaged primary school and advantaged high school, and the Mixed African Language 15+ years of education group from the previous research experienced high quality education throughout primary and high school that was commensurate with the white English Language Private/Model C 15+ years of education group.

Age

Commensurate with the methodology of the previous study (age range 19 – 30 years), the age range was 19-31 years. This locates all the participants within one of the second to fifth WAIS-III young adult categories (18-19, 20-24, 25-29, 30-34), for whom there is arguably a similar age effect (Shuttleworth-Edwards et al., 2004). This age range was isolated for study because it is the group most at risk for traumatic brain injury, calling for the facility for accurate clinical

assessment. In addition, it is the age range most likely to benefit from ability assessment, as this is generally the stage when individuals enter tertiary education or the labour market. The average age of all the participants was 24.20 years. More specifically, a summary of mean age and age range of participants, stratified for language, level and quality of education appears in Table 3.4 below.

Table 3.4. Summary of mean age and age range of participants, stratified for language, level and quality of education.			
Language:	Xhosa Language		White English Language
Quality of education	DET	Private/Model C	Private/Model C
TOTAL	26.13 (20 – 31)	23.34 (20 – 30)	23.28 (20 – 27)
12+ years of education	24.27 (20 – 30)	21.75 (20 – 26)	23.64 (20 – 27)
15+ years of education	27.83 (25 – 31)	25.09 (21 – 30)	22.92 (21 – 25)

As in the previous study, DET educated participants tended to be slightly older than those educated in Private/Model C systems. Within the Xhosa Language subgroups: DET 12+ years of education (20-30 years), DET 15+ years of education (25-31 years), Private/Model C 12+ years of education (20-26 years), Private/Model C 15+ years of education (21-30 years) and the English subgroups: Private/Model C 12+ years of education (20-27 years), Private/Model C 15+ years of education (21-25 years). This slightly higher age of the predominantly DET subgroup participants is not thought to be problematic, as it remains well within the decade bracket normally used for stratification purposes (Lezak et al., 2004; Shuttleworth-Edwards et al., 2004). Furthermore, there are minimal differences in the conversion of raw to scaled scores between the ages 18-19, 20-24, 25-29 and 30-34 (Wechsler, 1997). Commensurate with this, a correlation analysis revealed weak and negative correlations for age in relation to subtest scores ($-0.004 < r < -0.348$), index scores ($-0.058 > r > -0.307$) and IQ scores ($-0.138 > r > -0.312$).

While the absolute correlation values were low (the highest is only $r=-0.348$), it is of interest that a number of negative correlations were significant selectively on the Performance timed tasks: Picture Completion ($r=-0.288$; $p=0.007$), Block Design ($r=-0.288$; $p=0.007$), Picture Arrangement ($r=-0.348$; $p=0.001$), Symbol Search ($r=-0.310$; $p=0.004$) & Object Assembly ($r=-0.333$; $p=0.002$) and on the untimed Performance task: Matrix Reasoning ($r=-0.250$; $p=0.016$), index scores: Perceptual Organization Index (POI) ($r=-0.307$; $p=0.008$) and IQ scores: Performance IQ (PIQ) ($r=-0.312$; $p=0.007$). This suggests that the slightly older participants performed less well on tasks requiring visuo-perceptual, visual problem solving, scanning and visual sequencing skills. While there is a relative lowering on performance tasks and a higher verbal ability in the aging process, this typically occurs in the middle to late adult years and not in this early adult age decade (WAIS-III standardization manual, 1997). The older participants tended to be from the Xhosa Language groups and to have been schooled in the DET system. These effects are understood therefore to be related to poorer quality of education and less acculturation in older DET participants rather than the effects of aging.

Exclusion criteria

As with the original cohort, all additional individuals included in this study did not report a history of head injury, cerebral disease, learning disability, substance abuse or mental illness. One potential participant was excluded as he had attended an Indian high school, and although this is probably commensurate with white schooling during apartheid, it was decided that his inclusion in the test results would introduce a possible confounding variable.

3.2 Procedure

Data Collection

In the present study, as in the previous study, participation was voluntary. In accordance with the protocol from the previous research, each participant in the present study who met the requirements of the sampling matrix completed a biographical questionnaire and the WAIS-III was administered in English by the researcher, a trainee Clinical Psychologist.

Data Processing

Tests were scored according to the WAIS-III manual (Wechsler, 1997). Responses to the Verbal subtests were scored by the researcher and an independent clinician blind to the aims of the study. Any discrepancies in results were resolved between the two scorers. Thereafter, the raw scores were converted to scaled, factor index and IQ scores using the American normative tables for comparability with the USA, the Claassen et al. (2001) and Shuttleworth-Edwards et al. (2004) data. Both the researcher and an independent clinician blind to the aims of the study checked the addition to obtain the raw scores and the accuracy of the scaled, index and IQ scores.

Data Analysis

Statistical comparisons between Mixed African Language versus new Xhosa Language groups.

A t-test comparison of each of the following groups was run in order to determine whether there was a significant difference between the previous groups and the newly formed groups homogeneous for Xhosa Language.

- 1) The Mixed African Language DET 12+ years of education group versus the Xhosa Language DET 12+ years of education group.
- 2) The Mixed African Language Private/Model C 12+ years of education group versus the Xhosa Language Private/Model C 12+ years of education group.
- 3) The Mixed African Language DET 15+ years of education group versus the Xhosa Language DET 15+ years of education group.
- 4) The Mixed African Language Private/Model C 15+ years of education group versus the Xhosa Language Private/Model C 15+ year of education group.

The effects of quality of education in the original and current research

To investigate the effects of quality of education, Shuttleworth-Edwards et al. (2004) ran a t-test analysis of WAIS-III subtest, factor index and IQ scores for:

- 1) Mixed African Language 12+ years of education with DET versus Private/Model C groups.
- 2) Mixed African Language 15+ years of education with DET versus Private/Model C groups.

These analyses were replicated for the present study using the newly constituted Xhosa Language groups, and presented in tables for comparative purposes with the analyses for the original data.

Normative tables

In the previous research, the data were not co-ordinated into comparative normative tables across the various categories. In the present research, for the purposes of descriptive comparison and future clinical practice, normative tables were drawn up for each level of education (12+ years of education and 15+ years of education), with stratification for race, language of origin and quality of education.

Chapter 4 RESULTS

The results will be presented in the following manner:

- 1) Comparisons of the original data (Mixed African Language) from the Shuttleworth-Edwards et al. (2004) research and the new data (Xhosa Language) to determine any significant differences between the groups.
- 2) A comparison to examine the effects of quality of education on WAIS-III subtests, index and IQ scores. The results of the original and new analyses are combined for comparative purposes and appear in Tables 4.1 and 4.2 for 12+ and 15+ years of education respectively.
- 3) Normative tables will be presented for descriptive and future clinical purposes in Tables 4.3 and 4.4. The data for white English South Africans are taken from Shuttleworth-Edwards et al. (2004) and included in Tables 4.3 and 4.4.

As described by Wechsler (1997), the index and IQ scores were converted to a scale with a mean of 100 and a standard deviation of 15 (p. 42). Thus for the purposes of this discussion, index and IQ scores with more than a 15 point difference are classified as more substantially different (i.e. relatively divergent) than scores of less than 15 points that are classified as less substantially different (i.e. relatively convergent). In addition, for comparative and discussion purposes, an estimate of level of performance was extrapolated by multiplying scaled score points by a factor of 10 so that they could be roughly equated with standard IQ score ranges described by Wechsler (1997).

4.1 Statistical comparisons between Mixed African Language groups versus Xhosa Language groups.

T-test comparisons were run comparing the data from the previous research to the newly configured groups that are homogeneous for Xhosa Language. For the original Mixed African Language DET 12+ years of education group versus the equivalent Xhosa Language DET 12+ years of education group there were no significant differences for subtest, index and IQ scores. The p-values ranged for subtest scores (p=0.388 to p=1.000), for index scores (p=0.514 to p=0.959), and for IQ scores (p=0.531 to p=0.583). Similarly, for the original Mixed African Language Private/Model C 12+ years of education group versus the equivalent Xhosa Language

Private/Model C 12+ years of education group there were no significant differences for subtest, index and IQ scores. P-values ranged for subtest scores ($p=0.274$ to $p=0.952$), for index scores ($p=0.322$ to $p=0.883$) and for IQ scores ($p=0.489$ to $p=0.711$). In addition, the original Mixed African Language DET 15+ years of education group versus the equivalent Xhosa Language group 15+ years of education group revealed no significant differences on subtest, index and IQ scores. P-values ranged for subtest scores ($p=0.487$ to $p=0.962$), for index scores ($p=0.379$ to $p=0.801$) and for IQ scores ($p=0.714$ to $p=0.934$).

In contrast, the t-test comparisons of the original group of Mixed African Language Private/Model C 15+ years of education group and the Xhosa Language Private/Model C 15+ year of education group revealed a substantial number of differences between the subtest, index and IQ scores, all in the direction of higher scores for the original Mixed African Language group (As reported later in sections 4.2. and 4.3.). P-values ranged for subtest scores ($p=0.005$ to $p=0.928$), for index scores ($p=0.025$ to $p=0.934$) and for IQ scores ($p=0.045$ to $p=0.134$). The subtests that were significantly different ($p<0.05$) between the two groups were: Arithmetic ($p=0.005$, the original Mixed African Language group scored in the High Average Range - 11.70; while the Xhosa Language group scored in the Low Average Range - 8.18), Picture Arrangement ($p=0.041$, the original Mixed African Language group scored in the Superior Range - 12.00; while the Xhosa Language group scored in the Low Average Range - 8.82), Symbol Search ($p=0.013$, the original Mixed African Language group scored in the Average Range - 10.40; while the Xhosa Language group scored in the Borderline Range - 7.73), Object Assembly ($p=0.007$, the original Mixed African Language group scored in the Low Average Range - 8.30; while the Xhosa Language group scored in the Extremely Low Range - 5.82). On the index scores, there were significant differences for Working Memory Index (WMI) and Processing Speed Index (PSI). On WMI, ($p=0.025$, the Mixed African Language group scored at the upper end of the Average Range - 109.70 points; the Xhosa Language group scored in the Average Range - 97.82 points), and on PSI, ($p=0.035$, the Mixed African Language group scored in the Average Range - 103.30 points; the Xhosa Language group scored at the lower end of the Average Range - 91.09 points). On PIQ, ($p=0.044$, the Mixed African Language group scored in the Average Range - 107.80 points; the Xhosa Language group also scored in the Average Range - 95.55 points, but more than 12 IQ points below the Mixed African Language group).

Conversely, the two groups scored very similarly on verbal tasks, with the Xhosa Language group at times scoring better than the Mixed African Language group. For example, on Vocabulary (the original Mixed African Language group scored in the Very Superior Range - 13.10; and the Xhosa Language group scored in the Very Superior Range - 13.27), Similarities, (the original Mixed African Language group scored in the Superior Range - 12.60; the Xhosa Language group scored in the Very Superior Range - 13.55), Information (the original Mixed African Language group scored in the Average Range - 10.10; the Xhosa Language group scored in the Superior Range - 12.00), Comprehension (the original Mixed African Language group scored in the Very Superior Range - 13.90; the Xhosa Language group *also* scored in the Very Superior Range - 13.82), Letter-Number Sequencing (the original Mixed African Language group scored in the Superior Range - 12.10; the Xhosa Language group scored in the High Average Range - 11.18), on the VCI (the original Mixed African Language group scored in the High Average Range - 116.00 points; the Xhosa Language group scored in the High Average Range - 116.36 points), and on the VIQ (the original Mixed African Language group scored in the High Average Range - 116.10 points; the Xhosa Language group *also* scored in the High Average Range - 110.36 points).

4.2. The effects of quality of education in the original and current research

The original statistical comparisons for quality of education from the Shuttleworth-Edwards et al. (2004) was included with the statistical comparisons from the current research, and appears in Table 4.1 for Mixed African Language DET versus Private/Model C 12+ years of education and Xhosa Language DET versus Private/Model C 12+ years of education, and in Table 4.2 for Mixed African Language DET versus Private/Model C 15+ years of education and Xhosa Language DET versus Private/Model C 15+ years of education, respectively. As in the original research, the subtest, index and IQ scores in the present research were all significant in the direction of those with advantaged education performing better than those with disadvantaged education, however, more comparisons reached significance in the original data than in the current data.

12+ years of education (Table 4.1)

The comparisons between the 12+ years of education groups found that both the groups with advantaged education performed better than those with disadvantaged education. In the original research, the Mixed African Language Private/Model C 12+ years of education participants performed significantly better than the DET participants on ten of the subtests (i.e. Picture Completion, Vocabulary, Digit Symbol, Similarities, Arithmetic, Matrix Reasoning, Digit Span, Picture Arrangement, Comprehension, Symbol Search). Significant differences were evident on all the index scores and all the IQ scores.

In the current research, the Xhosa Language Private/Model C 12+ years of education group performed significantly better than the DET group on six of the subtests (i.e. Vocabulary, Digit Symbol, Similarities, Information, Picture Arrangement, and Comprehension). Significant differences were evident on all the index scores except WMI and all the IQ scores. Thus, in comparing those with 12+ years of education from the original research and the current research, the original data demonstrated significant differences between Private/Model C versus DET in the direction of higher scores for advantaged Private/Model C education that are not repeated in the current research for the following subtests: Picture Completion, Arithmetic, Matrix Reasoning, Digit Span and Symbol Search, and on the index score: WMI. Conversely, the Xhosa Language Private/Model C group performed significantly better than the Xhosa Language DET group on Information, which was not significantly higher for the Mixed African DET group compared to the Private/Model C group in the original research data.

It is of note that in both the prior and current research, there was no significant difference between DET and Private/Model C participants with 12+ years of education with regard to their performance on Block Design. Both the disadvantaged DET groups scored in the Extremely Low Range and both the advantaged Private/Model C groups scored in the Low Average Range (Mixed African Language DET - 6.10, Mixed African Language Private/Model C - 8.40, Xhosa Language DET - 6.55, Xhosa Language Private/Model C - 8.33), On Object Assembly, this profoundly lowered performance was repeated for all four groups. Both the disadvantaged DET groups and the Xhosa Language advantaged Private/Model C group all scored in the Extremely Low Range, and the Mixed African Language advantaged Private/Model C group scored in the Borderline Range (Mixed African Language DET - 4.90, Mixed

Table 4.2: A t-test comparison of WAIS-III subtest scaled scores, factor indexes and IQ scores for Mixed African language 15+ years of education DET versus Private/Model C education from the previous research, and first language Xhosa 15+ years of education DET versus Private/Model C education.

	Mixed African Language DET 15+ years of education <i>n</i> = 10	Mixed African Language Private/Model C 15+ years of education <i>n</i> = 10	p – Value	Xhosa Language DET 15+ years of education <i>n</i> = 12	Xhosa Language Private/Model C 15+ years of education <i>n</i> = 11	p – Value
	Mean (<i>SD</i>)	Mean (<i>SD</i>)		Mean (<i>SD</i>)	Mean (<i>SD</i>)	
Picture Completion	8.90 (3.31)	11.20 (2.30)	0.088	8.83 (3.19)	10.64 (2.62)	0.155
Vocabulary	9.30 (2.63)	13.10 (1.66)	0.001**	10.08 (3.26)	13.27 (1.79)	0.009*
Digit Symbol	9.10 (2.23)	10.90 (2.73)	0.124	8.58 (2.35)	9.00 (3.52)	0.740
Similarities	10.30 (2.83)	12.60 (2.32)	0.062	10.83 (2.86)	13.55 (2.16)	0.019*
Block Design	8.70 (3.09)	9.60 (1.78)	0.435	8.08 (3.18)	8.36 (2.34)	0.813
Arithmetic	9.40 (2.37)	11.70 (2.98)	0.072	8.58 (2.94)	8.18 (2.09)	0.712
Matrix Reasoning	9.60 (2.88)	12.40 (3.41)	0.062	9.42 (2.71)	10.00 (3.07)	0.633
Digit Span	9.80 (1.62)	11.40 (2.99)	0.154	9.58 (1.88)	9.73 (2.72)	0.883
Information	9.90 (2.28)	13.10 (1.66)	0.002**	10.08 (2.15)	12.00 (2.37)	0.055
Picture Arrangement	6.60 (1.90)	12.00 (3.62)	0.001**	6.42 (1.78)	8.82 (3.03)	0.029
Comprehension	10.70 (1.89)	13.90 (2.42)	0.004**	11.08 (1.98)	13.82 (1.66)	0.002**
Symbol Search	7.80 (2.15)	10.40 (2.01)	0.012*	7.42 (2.15)	7.73 (2.41)	0.747
Let-Numb. Sequencing	10.80 (2.04)	12.10 (2.51)	0.221	10.17 (2.37)	11.18 (3.09)	0.384
Object Assembly	6.30 (2.26)	8.30 (1.57)	0.034	6.00 (2.17)	5.82 (2.09)	0.840
Verbal Comprehension Index	99.00 (12.30)	116.00 (8.78)	0.002**	101.75 (13.35)	116.36 (10.74)	0.009*
Perceptual Organisation Index	94.10 (15.92)	105.90 (10.87)	0.069	92.42 (14.93)	97.45 (11.74)	0.382
Working Memory Index	99.50 (6.59)	109.70 (11.46)	0.025*	96.25 (9.69)	97.82 (10.86)	0.718
Processing Speed Index	91.20 (9.32)	103.30 (11.07)	0.016*	88.92 (10.00)	91.09 (13.39)	0.662
Verbal IQ	98.80 (9.43)	116.10 (7.50)	0.000**	99.58 (8.93)	110.36 (9.10)	0.009*
Performance IQ	90.40 (12.63)	107.80 (11.82)	0.005**	88.42 (12.32)	95.55 (14.10)	0.210
Full Scale IQ	94.90 (11.67)	113.40 (9.03)	0.001**	94.50 (10.65)	104.36 (11.30)	0.043

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

African Language Private/Model C- 7.10, Xhosa Language DET - 5.55, Xhosa Language Private/Model C - 6.92). Thus, all four of the groups scored in the Extremely Low to Low Average Range on these two subtests. This finding correlates well with the results of the advantaged Mixed African Language and Xhosa Language 15+ years of education groups, who scored in the Extremely Low to Average Range for both these subtests (i.e. Block Design and Object Assembly), which represents a significant lowering for both groups relative to their performance on other subtests.

There was also no significant difference in performance between the groups on Letter-Number Sequencing, however, all the groups tended to converge towards the mean (Mixed African Language DET scored in the Low Average Range - 8.00, Mixed African Language Private/Model C scored in the High Average Range - 11.40, Xhosa Language DET scored in the Low Average Range - 8.00, Xhosa Language Private/Model C scored in the Average Range - 10.92) all the groups scored in the Low Average to Average Range. The results suggest a relatively lower performance for the groups with disadvantaged education compared to the groups with advantaged education.

While all four groups demonstrated lowered performance for Block Design and Object Assembly, and a relative convergence of scores closer to the Average Range for Letter-Number Sequencing, this was not repeated for the verbal subtests, where statistically significant discrepancies between disadvantaged DET and advantaged Private/Model C participants in favour of the advantaged education groups were noted. There was a relative lowering for both Vocabulary and Information, and a trend towards relative convergence towards the Average Range for Similarities and Comprehension.

For Vocabulary, (the Mixed African Language DET group scored in the Extremely Low Range - 4.40, Mixed African Language Private/Model C group scored in the Low Average Range - 8.50, Xhosa Language DET group scored in the Extremely Low Range - 4.82, Xhosa Language Private/Model C group scored in the Low Average Range - 8.67); the disadvantaged groups scored in the Extremely Low Range, and the advantaged groups scored in the Low Average Range. Similarly, for Information, (the Mixed African Language DET group scored in the Extremely Low Range - 6.10, Mixed African Language Private/Model C group scored in the

Low Average Range - 8.40, Xhosa Language DET group scored in the Extremely Low Range - 6.55, Xhosa Language Private/Model C group scored in the Low Average Range - 9.00); the disadvantaged groups scored in the Extremely Low Range, and the advantaged groups scored in the Low Average Range.

However, for Similarities (the Mixed African Language DET group scored in the Extremely Low Range - 6.10, the Mixed African Language Private/Model C group scored in the Average Range - 10.20, the Xhosa Language DET group scored in the Extremely Low Range - 6.64 and the Xhosa Language Private/Model C group scored in the Average Range - 9.92); the disadvantaged groups scored in the Extremely Low Range, and the advantaged groups scored in the Average Range. Similarly, for Comprehension, (the Mixed African Language DET group scored in the Extremely Low Range - 6.50, the Mixed African Language Private/Model C group scored in the High Average Range - 11.00, the Xhosa Language DET group scored in the Borderline Range - 7.00 and the Xhosa Language Private/Model C group scored in the High Average Range - 11.33); the disadvantaged groups scored in the Extremely Low and Borderline Range, and the advantaged groups scored in the High Average Range.

There were two performance subtests (Digit Symbol and Picture Arrangement) that were statistically significant for both the original and current research with the advantaged education groups performing better than the disadvantaged groups. For Digit Symbol, the Mixed African Language DET 12+ years of education group scored in the Extremely Low Range -6.10, the Mixed African Language Private/Model C 12+ years of education scored in the High Average Range -11.30, the Xhosa Language DET 12+ years of education group scored in the Extremely Low Range - 6.18, and the Xhosa Language Private/Model C 12+ years of education scored in the Average Range -10.42. For Picture Arrangement, the Mixed African Language DET 12+ years of education group scored in the Extremely Low Range -4.20, the Mixed African Language Private/Model C 12+ years of education scored in the Low Average Range -8.90, the Xhosa Language DET 12+ years of education group scored in the Extremely Low Range -5.00, and the Xhosa Language Private/Model C 12+ years of education scored in the Low Average Range - 8.33.

15+ years of education (Table 4.2)

The comparisons between the 15+ years of education groups revealed that overall, both the groups with advantaged education performed better than those with disadvantaged education. In the original research, the Mixed African Language Private/Model C 15+ years of education participants performed significantly better than the DET participants on five of the subtests (i.e. Vocabulary, Information, Picture Arrangement, Comprehension and Symbol Search), on all the index scores except POI, and all the IQ scores.

In the current research, the Xhosa Language Private/Model C 15+ years of education participants performed significantly better than the DET participants on only three of the subtests (i.e. Vocabulary, Similarities and Comprehension). The Xhosa Language Private/Model C group scored in the Very Superior Range for all three of the above-listed subtests, while the Xhosa Language DET group scored in the Average Range. For the index scores, significant differences were only evident on Verbal Comprehension Index (VCI). The only IQ score that revealed significant difference between the two groups was the Verbal IQ (VIQ).

It is of note that there was no significant difference between the disadvantaged DET and advantaged Private/Model C groups of the original or current research for Block Design (Mixed African Language DET scored in the Low Average Range - 8.70, Mixed African Language Private/Model C scored in the Average Range - 9.60, Xhosa Language DET scored in the Low Average Range - 8.08, and Xhosa Language Private/Model C scored in the Low Average Range - 8.36), and Object Assembly (Mixed African Language DET scored in the Extremely Low Range - 6.30, Mixed African Language Private/Model C scored in the Low Average Range - 8.30, Xhosa Language DET scored in the Extremely Low Range - 6.00, Xhosa Language Private/Model C scored in the Extremely Low Range - 5.82).

Conversely, there was no statistically significant difference between the original Mixed African Language DET versus Private/Model C groups and the current Xhosa Language DET versus Private/Model C groups on Letter-Number Sequencing, Picture Completion, Digit Symbol, Arithmetic, Matrix Reasoning and Digit Span. On Letter-Number Sequencing (the Mixed African Language DET group scored in the Average Range - 10.80, the Mixed African Language Private/Model C group scored in the Superior Range - 12.10, The Xhosa Language

Table 4.2: A t-test comparison of WAIS-III subtest scaled scores, factor indexes and IQ scores for Mixed African language 15+ years of education DET versus Private/Model C education from the previous research, and first language Xhosa 15+ years of education DET versus Private/Model C education.

	Mixed African Language DET 15+ years of education <i>n</i> = 10	Mixed African Language Private/Model C 15+ years of education <i>n</i> = 10	p – Value	Xhosa Language DET 15+ years of education <i>n</i> = 12	Xhosa Language Private/Model C 15+ years of education <i>n</i> = 11	p – Value
	Mean (<i>SD</i>)	Mean (<i>SD</i>)		Mean (<i>SD</i>)	Mean (<i>SD</i>)	
Picture Completion	8.90 (3.31)	11.20 (2.30)	0.088	8.83 (3.19)	10.64 (2.62)	0.155
Vocabulary	9.30 (2.63)	13.10 (1.66)	0.001**	10.08 (3.26)	13.27 (1.79)	0.009*
Digit Symbol	9.10 (2.23)	10.90 (2.73)	0.124	8.58 (2.35)	9.00 (3.52)	0.740
Similarities	10.30 (2.83)	12.60 (2.32)	0.062	10.83 (2.86)	13.55 (2.16)	0.019*
Block Design	8.70 (3.09)	9.60 (1.78)	0.435	8.08 (3.18)	8.36 (2.34)	0.813
Arithmetic	9.40 (2.37)	11.70 (2.98)	0.072	8.58 (2.94)	8.18 (2.09)	0.712
Matrix Reasoning	9.60 (2.88)	12.40 (3.41)	0.062	9.42 (2.71)	10.00 (3.07)	0.633
Digit Span	9.80 (1.62)	11.40 (2.99)	0.154	9.58 (1.88)	9.73 (2.72)	0.883
Information	9.90 (2.28)	13.10 (1.66)	0.002**	10.08 (2.15)	12.00 (2.37)	0.055
Picture Arrangement	6.60 (1.90)	12.00 (3.62)	0.001**	6.42 (1.78)	8.82 (3.03)	0.029
Comprehension	10.70 (1.89)	13.90 (2.42)	0.004**	11.08 (1.98)	13.82 (1.66)	0.002**
Symbol Search	7.80 (2.15)	10.40 (2.01)	0.012*	7.42 (2.15)	7.73 (2.41)	0.747
Let-Numb. Sequencing	10.80 (2.04)	12.10 (2.51)	0.221	10.17 (2.37)	11.18 (3.09)	0.384
Object Assembly	6.30 (2.26)	8.30 (1.57)	0.034	6.00 (2.17)	5.82 (2.09)	0.840
Verbal Comprehension Index	99.00 (12.30)	116.00 (8.78)	0.002**	101.75 (13.35)	116.36 (10.74)	0.009*
Perceptual Organisation Index	94.10 (15.92)	105.90 (10.87)	0.069	92.42 (14.93)	97.45 (11.74)	0.382
Working Memory Index	99.50 (6.59)	109.70 (11.46)	0.025*	96.25 (9.69)	97.82 (10.86)	0.718
Processing Speed Index	91.20 (9.32)	103.30 (11.07)	0.016*	88.92 (10.00)	91.09 (13.39)	0.662
Verbal IQ	98.80 (9.43)	116.10 (7.50)	0.000**	99.58 (8.93)	110.36 (9.10)	0.009*
Performance IQ	90.40 (12.63)	107.80 (11.82)	0.005**	88.42 (12.32)	95.55 (14.10)	0.210
Full Scale IQ	94.90 (11.67)	113.40 (9.03)	0.001**	94.50 (10.65)	104.36 (11.30)	0.043

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

DET group scored in the Average Range - 10.17 and the Xhosa Language Private/Model C group scored in the High Average Range - 11.18). Thus, all the groups scored in the Average to Superior Ranges. This convergence in results towards the mean was also found for Picture Completion, where results ranged from Low Average to High Average, Digit Symbol, where results ranged from Low Average to Average, Arithmetic, where results ranged from Low Average to High Average, Matrix Reasoning, where results ranged from Low Average to High Average, and Digit Span, where results ranged from Average to High Average. Thus, the groups with higher quality of education did score higher scores than those with poor quality of education, suggesting that quality of education has affected the participant's performance, but this was to a lesser extent than the trend evident in comparing the Xhosa Language DET 15+ years of education group versus Xhosa Language Private/Model C 15+ years of education group on Vocabulary, Comprehension and Similarities subtests.

Finally, in comparing the performance of those with 15+ years of education from the original research and the current research, the original Mixed African Language groups demonstrated significant differences between Private/Model C versus DET in the direction of higher scores for advantaged Private/Model C education, that were not repeated in the current research for the subtests: Picture Arrangement, Symbol Search and Information; the index scores: WMI and PSI; and on Performance IQ (PIQ) and FSIQ. For Picture Arrangement ($p=0.001$, the Mixed African Language DET 15+ years of education group scored in the Extremely Low Range -6.60, while the Mixed African Language Private/Model C 15+ years of education group scored in the Superior Range -12.00), for Symbol Search ($p=0.012$, the Mixed African Language DET 15+ years of education group scored in the Borderline Range -7.80, while the Mixed African Language Private/Model C 15+ years of education group scored in the Average Range -10.40) and for Information ($p=0.002$, the Mixed African Language DET 15+ years of education group scored in the Average Range -9.90, while the Mixed African Language Private/Model C 15+ years of education group scored in the Very Superior Range -13.10). On the index scores, there were significant differences for WMI and PSI. For the WMI ($p=0.025$, the Mixed African Language DET 15+ years of education group scored in the Average Range - 99.50 points, while the Mixed African Language Private/Model C 15+ years of education group scored in the upper end of the Average Range - 109.70) and for PSI ($p=0.016$, the Mixed African Language DET 15+ years of education group scored in the lower end of the Average Range - 91.20 points, while

the Mixed African Language Private/Model C 15+ years of education group scored in the Average Range – 103.30) and the PIQ and FSIQ. On IQ scores, there were significant differences for PIQ and FSIQ. On PIQ, ($p=0.005$, the Mixed African Language DET 15+ years of education group scored in the lower end of the Average Range – 90.40 points, while the Mixed African Language Private/Model C 15+ years of education group scored in the upper end of the Average Range – 107.80) and on FSIQ, ($p=0.001$, the Mixed African Language DET 15+ years of education group scored in the lower end of the Average Range – 94.90 points, while the Mixed African Language Private/Model C 15+ years of education group scored in the High Average Range – 113.40).

However, in the current research, the Xhosa Language Private/Model C group performed significantly better than the DET group on Similarities, (the Xhosa Language DET 15+ years of education group scored in the Average Range –10.83 and the Xhosa Language Private/Model C 15+ years of education group scored in the Very Superior Range –13.55), which was not of significance in the original research data (the Mixed African Language DET 15+ years of education group scored in the Average Range –10.30 and the Mixed African Language Private/Model C 15+ years of education group scored in the Superior Range –10.30).

4.3. Normative tables

For descriptive and clinical use, Normative tables with means and standard deviations are included for the four newly configured groups (Xhosa Language DET 12+ years of education, Xhosa Language Private/Model C 12+ years of education, Xhosa Language DET 15+ years of education, Xhosa Language Private/Model C 15+ years of education) and for those groups from the original research, (Mixed African Language Private/Model C 15+ years of education, white English Language Private/Model C 12+ and white English Language Private/Model C 15+ years of education). The Mixed African Language Private/Model C 15+ years of education data has been selectively included from the original data as it was found to demonstrate significant differences from the newly configured Xhosa Language Private/Model C 15+ years of education (see section 4.1, p34-36). The normative tables were collated into two separate tables for 12+ years of education (Table 4.3) and 15+ years of education (Table 4.4) that are stratified for race, language and quality of education.

12+ years of education (Table 4.3)

The 12+ years of education groups include the two newly configured Xhosa Language DET and Private/Model C groups and the English Language 12+ years of education from the previous research (Shuttleworth-Edwards et al., 2004). Overall, performance on all the subtests, index and IQ scores of the two Xhosa Language groups was higher for the Private/Model C group than the DET group, with differences tending towards divergence. This was evident in the index Scores, where the differences between all the Xhosa Language DET and Xhosa Language Private/Model C index scores ranged between 14.31 and 17.60 scaled score points. Similarly, for the IQ scores, the differences between the Xhosa Language DET group and Xhosa Language Private/Model C group were more than one standard deviation apart, and the difference in IQ scores ranged between 17.67 and 19.87 scaled score points. The difference between the Xhosa Language Private/Model C and white English Private/Model C 12+ years of education were all in the direction of the white English group scoring higher than the Xhosa Language group, but with differences generally being less far apart (i.e. tending towards convergence) than between the Xhosa Language DET versus the Xhosa Language Private/Model C groups. On the index scores, the difference between the two groups ranged between 6.28 and 14.94 scaled score points, and for the IQ-scores, the difference ranged only between 6.04 and 10.15 scaled score points.

In contrast, the differences between the Xhosa Language DET 12+ years of education and the white English Language Private/Model C 12+ years of education were marked (i.e. tending towards divergence) at the subtest, index and IQ score level in favour of the white English Private/Model C group. The difference in index scores ranged between 20.59 and 30.31 scaled score points, and the differences in IQ points ranged between 23.71 to 30.02 scaled score points.

Table 4.3. Normative data for 12+ years of education, stratified for race, language of origin, and quality of education.			
Race	Black		White
Language	Xhosa Language		English Language
Quality	DET	Private/Model C	Private/Model C
	<i>n = 11</i>	<i>n = 12</i>	<i>n = 14</i>
	Mean (SD)	Mean (SD)	Mean (SD)
Picture Comp.	6.82 (2.60)	9.42 (2.84)	12.21 (3.26)
Vocabulary	4.82 (1.47)	8.67 (3.08)	10.57 (2.68)
Digit Symbol	6.18 (2.09)	10.42 (3.23)	11.50 (1.87)
Similarities	6.64 (1.50)	9.92 (2.87)	11.00 (2.88)
Block Design	6.55 (2.30)	8.33 (2.42)	11.14 (2.91)
Arithmetic	7.18 (2.04)	8.67 (3.58)	10.00 (2.91)
Matrix Reasoning	7.55 (3.05)	10.83 (3.79)	12.43 (2.79)
Digit Span	6.82 (2.52)	9.42 (2.68)	10.86 (3.63)
Information	6.55 (2.58)	9.00 (2.13)	10.29 (2.27)
Picture Arrangement	5.00 (2.37)	8.33 (2.06)	10.57 (2.28)
Comprehension	7.00 (2.79)	11.33 (2.96)	10.50 (2.18)
Symbol Search	5.82 (2.56)	7.92 (2.35)	10.07 (2.70)
Let-Number Sequencing	8.00 (3.55)	10.92 (2.61)	11.14 (2.93)
Object Assembly	5.55 (2.11)	6.92 (3.29)	9.79 (3.02)
Verbal Comprehension Index (VCI)	77.73 (9.10)	95.33 (12.53)	103.14 (11.36)
Perceptual Organization Index (POI)	81.55 (10.27)	96.92 (15.68)	111.86 (15.36)
Working Memory Index (WMI)	83.27 (14.43)	97.58 (15.76)	103.86 (16.17)
Processing Speed Index (PSI)	78.55 (9.91)	95.33 (13.49)	104.29 (11.97)
Verbal IQ	79.00 (7.25)	96.67 (12.92)	102.71 (10.96)
Performance IQ	77.00 (9.21)	96.25 (15.69)	110.50 (13.46)
Full Scale IQ	76.55 (8.29)	96.42 (13.68)	106.57 (12.15)

15+ years of education (Table 4.4)

The 15+ years of education groups include the two newly configured Xhosa Language DET and Private/Model C groups, the Mixed African Language Private/Model C group from the previous research (as it was shown to be significantly different from the equivalent Xhosa Language Private/Model C 15+ years of education group) and the English Language 15+ years of education from the previous research (Shuttleworth-Edwards et al., 2004).

Overall there is a steady incremental increase in the subgroups' FSIQ performance that increased by about nine scaled score points per group. Compared to the data in table 4.3, which revealed considerable differences between the Xhosa Language DET versus Private/Model C 12+ years of education, in table 4.4 it is apparent that there is less of a difference between the Xhosa Language DET group versus Xhosa Language Private/Model C group. For example, there was a relatively minor difference of 9.86 IQ points between the Xhosa Language DET and the Xhosa Language Private/Model C 15+ years, there was a relatively minor difference of 9.04 IQ points between the Xhosa Language Private/Model C and Mixed African Language Private/Model C 15+ years, and there was a relatively minor difference of 9.60 IQ points between the Mixed African Language Private/Model C 15+ years of education and the English Language Private/Model C 15+ years of education. A comparison of the two Xhosa Language groups revealed that there was a divergence on the index scores between the DET and Private/Model C in favour of the Private/Model C group for VCI, as there was a 14.61 point difference between the two groups. However, this trend was not repeated with any of the other index scores. Rather, there was a convergence in the two groups for POI, WMI and PSI with scores ranging from 5.03 to 1.57 to 2.17 points respectively. This trend towards convergence was repeated in the IQ scores, as the VIQ revealed an 11 point difference while there was more of a convergence on the PIQ of 7 points.

A comparison of the Xhosa Language Private/Model C and Mixed African Language Private/Model C groups revealed that there was a relative convergence on the index scores between the two groups in favour of the Mixed African Language Private/Model C group for POI, WMI and PSI with differences between the two groups ranging from 8.45 to 11.88 to 12.21 point differences respectively between the two groups. However, there was a substantial convergence in the two groups for VCI, of 0.36 points. This trend was repeated in the IQ scores,

Table 4.4. Normative data for 15+ years of education, stratified for race, language, and quality of education.				
Race	Black			White
Language	Xhosa Language		Mixed African Language	English Language
Quality	DET	Private/Model C	Private/Model C	Private/Model C
	<i>n = 12</i>	<i>n = 11</i>	<i>n = 10</i>	<i>n = 14</i>
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Picture Comp.	8.83 (3.19)	10.64 (2.62)	11.20 (2.30)	13.00 (2.72)
Vocabulary	10.08 (3.26)	13.27 (1.79)	13.10 (1.66)	15.43 (2.14)
Digit Symbol	8.58 (2.35)	9.00 (3.52)	10.90 (2.73)	12.43 (1.91)
Similarities	10.83 (2.86)	13.55 (2.16)	12.60 (2.32)	13.57 (2.31)
Block Design	8.08 (3.18)	8.36 (2.34)	9.60 (1.78)	11.64 (2.50)
Arithmetic	8.58 (2.94)	8.18 (2.09)	11.70 (2.98)	13.50 (1.91)
Matrix Reasoning	9.42 (2.71)	10.00 (3.07)	12.40 (3.41)	13.36 (3.03)
Digit Span	9.58 (1.88)	9.73 (2.72)	11.40 (2.99)	12.86 (2.74)
Information	10.08 (2.15)	12.00 (2.37)	13.10 (1.66)	13.86 (1.51)
Picture Arrangement	6.42 (1.78)	8.82 (3.03)	12.00 (3.62)	11.43 (2.53)
Comprehension	11.08 (1.98)	13.82 (1.66)	13.90 (2.42)	13.93 (1.82)
Symbol Search	7.42 (2.15)	7.73 (2.41)	10.40 (2.01)	11.78 (2.33)
Let-Number Sequencing	10.17 (2.37)	11.18 (3.09)	12.10 (2.51)	13.57 (2.24)
Object Assembly	6.00 (2.17)	5.82 (2.09)	8.30 (1.57)	9.86 (2.69)
Verbal Comprehension Index (VCI)	101.75 (13.35)	116.36 (10.74)	116.00 (8.78)	124.29 (8.41)
Perceptual Organization Index (POI)	92.42 (14.93)	97.45 (11.74)	105.90 (10.87)	116.29 (10.60)
Working Memory Index (WMI)	96.25 (9.69)	97.82 (10.86)	109.70 (11.46)	119.79 (11.23)
Processing Speed Index (PSI)	88.92 (10.00)	91.09 (13.39)	103.30 (11.07)	111.64 (11.07)
Verbal IQ	99.58 (8.93)	110.36 (9.10)	116.10 (7.50)	124.93 (8.20)
Performance IQ	88.42 (12.32)	95.55 (14.10)	107.80 (11.82)	116.14 (9.78)
Full Scale IQ	94.50 (10.65)	104.36 (11.30)	113.40 (9.03)	123.00 (8.44)

as the VIQ revealed a relatively minor difference of 5.74 points between the two groups, and there was more of a difference on the PIQ of 12.25 points in favour of the Mixed African Language group.

A comparison between the Mixed African Language and white English Language groups revealed a convergence on the index scores in favour of the English Language group for POI and WMI of 10 scaled score points and for VCI and PSI, of about 8 scaled score points. There was essentially a convergence on all the IQ scores, which ranged from 8-9 scaled score points.

A comparison of the Xhosa Language DET 15+ years of education versus Mixed African Language Private/Model C 15+ years of education revealed significant differences in performance on index scores ranging between 13.45 and 14.38 points and IQ scores ranging between 16.52 and 19.38 in favour of the Mixed African Language group. These results were similar for the Xhosa Language DET 15+ years of education versus English Language Private/Model C 15+ years of education. A significant difference in performance on index scores ranged between 22.54 and 23.87 points and IQ scores ranged between 25.35 and 28.50 points.

Finally, a comparison of Xhosa Language Private/Model C 15+ years of education and English Language Private/Model C 15+ years of education demonstrated a relative convergence of scaled score points for VCI (7.93) and a relative divergence for the other index scores ranging between 18.84 and 21.97 scaled score points in favour of the English Language group. The IQ scores demonstrated a divergence in favour of the English Language group ranging between 14.57 and 20.59 scaled score points.

Chapter 5 DISCUSSION

The aim of this study was to administer the WAIS-III to a number of Xhosa first language adults (n=16) between 19-31 years, who used the English Language either at work, at home or studied at an English-medium institution, so that the data from prior research of Shuttleworth-Edwards et al. (2004) and current research could be combined to form groups homogeneous for Xhosa Language. The new pure Xhosa Language groups were compared to the prior research of Mixed African Language groups, to determine any significant differences between the groups on WAIS-III test performance. The data from the new pure Xhosa Language groups were then analyzed to determine the effects of quality of education. These results were examined in relation to the results obtained in respect of quality of education on the original Mixed African Language data base. Finally, normative tables were prepared for descriptive, comparative purposes and future clinical use.

As described by Wechsler (1997), the index and IQ scores were converted to a scale with a mean of 100 and a standard deviation of 15 (p. 42). Thus for the purposes of this discussion, index and IQ scores with more than a 15 point difference are classified as more substantially different (i.e. relatively divergent) than scores of less than 15 points that are classified as less substantially different (i.e. relatively convergent). In addition, an estimate of level of performance was extrapolated by multiplying scaled score points by a factor of 10 so that they could be roughly equated with the standard IQ score ranges described by Wechsler (1997).

5.1. Statistical comparisons between Mixed African Language versus new Xhosa Language groups

There was no significant difference between the original Mixed African Language DET 12+ years of education group versus the new Xhosa Language DET 12+ years of education group, the original Mixed African Language Private/Model C 12+ years of education group versus the new Xhosa Language Private/Model C 12+ years of education group and the original Mixed African Language DET 15+ years of education group versus the new Xhosa Language DET 15+ years of education group. However, there was a significant difference between the original Mixed African Language Private/Model C 15+ years of education group versus the new Xhosa

Language Private/Model C 15+ year of education group, which was reflected in a lowering in several WAIS-III subtests, two index scores and the Performance IQ for the Xhosa Language group relative to the Mixed African Language group. This was evident in the following subtests: Arithmetic, Picture Arrangement, Symbol Search and Object Assembly. On the index scores, there were significant differences for Working Memory Index (WMI) and Processing Speed Index (PSI) and on PIQ. Conversely, the two groups scored very similarly on verbal subtests. These included Vocabulary, Similarities, Information, Comprehension, Letter-Number Sequencing, on the VCI, and on the VIQ.

These differences and similarities in scores on the WAIS-III for the Mixed African Language Private/Model C 15+ years of education group versus the Xhosa Language Private/Model C 15+ years of education group are explicable in terms of differential levels of quality of education, in that the majority of the Mixed African Language group attended advantaged Private/Model C primary school while only a few of the Xhosa Language group attended advantaged primary school. Both groups attended advantaged high school, but again at the tertiary level, the Mixed African group was more advantaged, as 80% were post-graduate students, while only 54.44% of the Xhosa Language group was post-graduate students. Furthermore, 60% of the Mixed African Language group were schooled during primary and high school in Zimbabwe, which was recognized during the 1980s and early 1990s for its high quality of education (Answers.com, 2005). Thus this Mixed African Language Private/Model C 15+ years of education group was a particularly unpure group with regards to language, South African education or South African nationality. All the other Mixed African Language groups from the original research (Shuttleworth-Edwards et al., 2004) comprised 80-100% of Xhosa first language participants, the Private/Model C 15+ years of education group consisted of only 20% Xhosa first language participants. The differences in WAIS-III test performance between the original Mixed African Language Private/Model C 15+ years of education group and the pure Xhosa Language Private/Model C 15+ years of education group justified re-analyzing the research with a group homogeneous for Language, South African education and South African nationality. Generally, these differences in the direction of poorer performance for the Xhosa Language group can be explained by recent research, where acculturation and quality of education have been linked to improved performance on neuropsychological tests (for example Manly et al., 1998, 2002, 2004; Shuttleworth-Edwards et al., 2004). In the case of the Mixed African Language group, they were

exposed to advantaged education throughout their school careers, while the majority of the Xhosa Language group only received advantaged education during high school, making them a less advantaged group.

Specifically, significant differences between the original Mixed African Language Private/Model C 15+ years of education group versus the pure Xhosa Language Private/Model C 15+ years of education group were evident for particular subtests (Arithmetic, Picture Arrangement and Symbol Search) in the direction of poorer performance for the Xhosa Language group versus the Mixed African Language group, and can be explained in the following way. For **Arithmetic**, the Xhosa Language group scored in the Low Average Range (8.18), while the Mixed African Language group scored in the High Average Range (11.70). Lezak (1983, p. 262) and Kaufman (1994, p. 69) describe various areas of ability that Arithmetic assesses. These include concentration and mental alertness, immediate & long-term memory, conceptual manipulation, sequential processing, maths skills, acquired knowledge, and numerical reasoning (which are affected by the manner in which the participant is taught). In contrast to Arithmetic, the Xhosa Language group scored in the High Average Range for Letter-Number Sequencing (11.18), which suggests that the participants generally have good concentration skills and that their immediate and long-term memory skills must be intact. Furthermore, the Xhosa Language group scored in the Very Superior Range for Similarities (13.55), and thus it is reasonable to conclude that this group had excellent abstract reasoning ability. Therefore, by exclusion of the functions which appeared to be relatively strong for this group, the Low Average performance by the Xhosa Language group on Arithmetic may be explained as due to inadequate exposure to numerical reasoning skills during the primary school years in disadvantaged (DET) education compared with the skills that were more effectively acquired and mastered by the Mixed African Language group who had advantaged (Private/Model C) primary school education.

Similarly, the Picture Arrangement subtest was significantly different for the two groups. The Xhosa Language group scored in the Low Average Range (8.82) for Picture Arrangement, while the Mixed African Language group scored in the Superior Range (12.00). Wechsler (1997) described Picture Arrangement as having a split-loading for both Verbal and Performance scales, as participants can 'talk out' their understanding of the pictures and thus solve the problem. Kaufman (1994, p. 85) summarized various areas of ability that Picture Arrangement assesses.

These include visual organization, simultaneous processing, ability to work under time pressure, speed of mental processing, social judgment, common sense, non-verbal reasoning, visual sequencing, creativity and cultural opportunities at home. These are all skills that one would expect an individual with advantaged education to have developed. Compared with the Low Average score for Picture Arrangement, the Xhosa Language group scored in the Average Range for Picture Completion (10.64), which is a subtest that also assesses visual organization, simultaneous processing and ability to respond within a time limit. Furthermore, the Xhosa Language group scored in the Very Superior Range for Comprehension, which suggests excellent common sense, social judgment and verbal reasoning. Therefore again by exclusion, a poor level of attainment on Picture Arrangement in the Xhosa Language group versus the Mixed African Language group may be highlighting a particular weakness in nonverbal reasoning, creativity, visual sequencing and speed of mental processing that can be explained as a result of lack of cultural opportunities in the home and early school environment. This suggests that this subtest is particularly sensitive to disadvantaged primary school education.

The Xhosa Language group scored in the Borderline Range (7.73) for Symbol Search, while the Mixed African Language group scored in the Average Range (10.40). Kaufman (1994, p. 94) summarized the skills that are required to respond to the Symbol Search subtest. These include: visual perception of abstract stimuli, planning, scanning, short-term visual memory, processing speed, and the skill that is unique to Symbol Search is the speed of the visual search. In contrast to the Borderline Range scaled score obtained for Symbol Search, the Xhosa Language group scored in the Average Range for Picture Completion (10.64), which also assesses speed of visual response, and visual perception, organization and recognition of the pictures. Thus, by exclusion of the functions that appear to be well developed in the Xhosa Language group, it appears that scanning and visual search skills have not been adequately developed. To the author's knowledge, there is not at present literature that has demonstrated that advantaged primary school education develops scanning and search skills, but the above results strongly suggest such a finding.

Overall, these comparisons may suggest that advantaged education at a primary level develops a good enough basis for such strategies and skills as sequencing and non-verbal problem solving, scanning, mental arithmetic and concentration span and although there is good quality of

education at the high school level for the Xhosa Language Private/Model C 15+ years of education group, they have not caught up what was lacking during primary school. As Nell (1999) wrote – advantaged education develops ‘test-wiseness’ in cross cultural groups, which equips individuals to concentrate, pay attention to the task, and be confident in their responses. The differential results for the Mixed African Language Private/Model C 15+ years of education group versus the Xhosa Language Private/Model C 15+ years of education group in the direction of significantly poorer scores for the more educationally disadvantaged Xhosa Language group, confirms that ‘test-wiseness’ is strongly linked to the amount of quality education available to the individual. On the basis of this research, it is evident that this is strongly reflected in non-verbal subtests. Grieve and Viljoen (2000) found that there was a relationship between disadvantaged education and poor performance on nonverbal problem solving tasks such as the Austin Maze test, but to the author’s knowledge this has not been shown to relate to a specific stage in schooling as has been possible to demonstrate in this research.

The results of the Object Assembly subtest demonstrated a lowering for both groups, but the less advantaged Xhosa Language (Private/Model C 15+ years of education) group scored significantly poorer than the more advantaged Mixed African Language (Private/Model C 15+ years of education) group. The Mixed African Language group scored in the Low Average Range (8.30), and the Xhosa Language group scored in the Extremely Low Range (5.82). According to the USA standardization, Object Assembly correlates well with the other Performance tasks and gives information about visuoperceptual ability (Wechsler Manual, p. 98). However, the performance on Object Assembly for both the Mixed African Language group and the Xhosa Language group was their lowest subtest score, suggesting a relative weakness in this area. Kaufman (1994, p. 92) lists the requisite skills for the participant to successfully respond to Object Assembly. These include: simultaneous processing, synthesis (part-whole relationships), non-verbal reasoning, speed of mental processing, anticipation of relationships among parts which is closely related to experience with puzzles. This may suggest that while quality of education plays a role in the score obtained on Object Assembly (seen in the significantly higher score obtained by the Mixed African Language group), there also remains a cultural bias that makes this subtest particularly culturally unfair.

While not statistically significant, the results of the Mixed African Language Private/Model C 15+ years of education versus the Xhosa Language Private/Model C 15+ years of education on Block Design showed a relative lowering for both groups; but again the less advantaged Xhosa Language group achieved a lower score than the more advantaged Mixed African Language group. The Mixed African Language group achieved in the Average Range (9.60) and the Xhosa Language group scored in the Low Average Range (8.36). According to Kaufman (1994), Block Design, also assesses simultaneous processing and synthesis (part-whole relationships). It has been established that the Mixed African Language group is able to process information simultaneously, synthesize part-whole relationships and reason non-verbally (skills also assessed by Picture Arrangement, for which they achieved in the Superior Range - 12.00), and to process information quickly (a skill also assessed by Symbol Search, for which they achieved in the Average Range - 10.40). The less advantaged Xhosa Language group demonstrated a different profile; their speed of mental processing is thought to be less well developed than the Mixed African Language group, as they scored in the Borderline Range for Symbol Search (7.73). Their ability to process information simultaneously, synthesize part-whole relationships and reason non-verbally (skills also assessed by Picture Arrangement, where they achieved in the Low Average Range - 8.82) were also adequate, yet compared to the Mixed African Language Private/Model C 15+ years of education group, this skill appears to be less developed. Thus, by exclusion, it appears that both the Mixed African Language and Xhosa Language groups' lowered performance on Object Assembly and Block Design is probably due to a lack of exposure to puzzles and consequently, difficulty in anticipating the relationship between parts. This suggests that Block Design is a less culturally-fair task.

Rosselli & Ardila (2003) reviewed research comparing performance on non-verbal and visuospatial tests in different cultural groups with equal levels of education, and in those with the same cultural background but different levels of education. Rosselli & Ardila cautioned against the use of non-verbal tests, as they are not thought to be 'culture-fair', irrespective of quality of education. The lowered performance on Object Assembly and Block Design of both advantaged groups (Mixed African Language Private/Model C 15+ years of education and Xhosa Language Private/Model C 15+ years of education) does not reflect their ability and therefore, Object Assembly particularly and Block Design may be regarded as tests that are not 'culture-fair'. In addition, the Xhosa Language group's more pervasively lowered scores on performance tasks

may also be understood in the light of their less advantaged education, which consequently did not equip them with the necessary skills for such subtests as Picture Arrangement and Symbol Search.

5.2 The effects of quality of education in the original and current research

Perusal of all the data sets for the original and current research reveals that there was a consistent trend of the advantaged groups scoring higher on the subtest, index and IQ scores than the disadvantaged groups. This was found for the following comparisons: (i) The Mixed African Language DET 12+ years of education versus Mixed African Language Private/Model C 12+ years of education. (ii) The Xhosa Language DET 12+ years of education versus the Xhosa Language Private/Model C 12+ years of education. (iii) The Mixed African Language DET 15+ years of education versus Mixed African Language Private/Model C 15+ years of education. (iv) The Xhosa Language DET 15+ years of education versus the Xhosa Language Private/Model C 15+ years of education.

This trend of discrepancies on WAIS-III subtest, index and IQ scores for both 12+ and 15+ years of education (Table 4.1 and 4.2 respectively) in the direction of those groups with advantaged education scoring higher than those with disadvantaged education was anticipated and commensurate with the literature (for example, Manly et al., 2002, 2004; Shuttleworth-Edwards et al., 2004).

12+ years of education

Specifically, in respect of 12+ years of education, the original Mixed African Language DET group versus the original Mixed African Language Private/Model C group demonstrated more significant differences on the WAIS-III subtest, index and IQ scores than for the comparison of the new Xhosa Language DET group versus the new Xhosa Language Private/Model C group in the direction of the advantaged (Private/Model C) education groups scoring better than the disadvantaged (DET) education groups. In the prior research, 80% of the advantaged Mixed African Language group experienced disadvantaged (DET) primary schooling, and then all participants experienced advantaged high school; in the current research, 75% of the advantaged Xhosa Language group experienced disadvantaged (DET) primary schooling, and then all

participants experienced advantaged high school. Thus, the original and new advantaged 12+ years of education groups are very similar with regards to quality of education. Perhaps the loss of some difference for quality of education within the newly constituted Xhosa Language groups (compared with the original Mixed African Language groups) may be explained as a result of two factors. Firstly, losing a Zimbabwean Private/Model C participant who would have had a particularly high quality of education, thus bringing down the scores of the advantaged education group, in conjunction with marginally higher scores obtained by the new Xhosa Language DET group, due to the addition of two new Xhosa participants who were schooled in Cape Town township schools and who may have experienced education of a relatively higher quality than Eastern Cape township schools. This may explain the slight raising of scores in the Xhosa Language DET group. The slight lowering of the advantaged Xhosa Language group's scores, and the slight raising of the disadvantaged Xhosa Language group's scores explains the loss of some of the significance between the two groups when compared to the original data.

It is of note that in both the prior and current research, there was no significant difference between DET and Private/Model C participants with 12+ years of education with regard to their performance on Object Assembly and Block Design. For Object Assembly, a profoundly lowered performance was found for all four groups. Scores ranged from 4.90 to 7.10. Both the disadvantaged DET groups and the Xhosa Language advantaged Private/Model C group all scored in the Extremely Low Range, and the Mixed African Language Private/Model C group scored in the Borderline Range. Similarly, for Block Design, scores ranged from 6.10 to 8.40. Both the disadvantaged DET groups scored in the Extremely Low Range and both the advantaged Private/Model C groups scored in the Low Average Range. Thus, all four of the groups scored in the Extremely Low to Low Average Range on these two subtests. As previously discussed (Section 5.1), this finding correlates well with the results of the advantaged Mixed African Language and Xhosa Language 15+ years of education groups, who scored in the Extremely Low to Average Range for both these subtests. These results represent a significant lowering for all groups relative to their performance on other subtests. Rosselli & Ardila, (2003) have suggested that Performance subtests are not culturally fair, and this finding substantiates these claims.

There was also no significant difference in performance between the four 12+ years of education groups on Letter-Number Sequencing however, unlike the relatively lowered results on the Object Assembly and Block Design subtests, the results of all four groups on Letter-Number Sequencing were closer to the Average Range, and ranged from the Low to High Average Range. While these scores are closer to the mean than Object Assembly and Block Design, it is of note that the DET participants from the original and current groups scored in the Low Average Range whereas the Private/Model C participants from the original and current research scored in the Average to High Average Ranges. This is understood to reflect quality of education, but the convergence of scores in all four groups suggests that Letter-Number Sequencing is a subtest that is more culturally unbiased.

Significant differences were found between the disadvantaged DET and advantaged Private/Model C participants in favour of the advantaged education groups for four of the verbal subtests: Vocabulary, Similarities, Information and Comprehension. However, it appeared that there was a relative lowering of the scores in all the groups for those subtests that assess more rote learning and crystallized knowledge (Vocabulary and Information), and a trend of slightly higher performance on those verbal subtests that assess verbal reasoning skills (Similarities and Comprehension).

For Vocabulary, the disadvantaged groups scored in the Extremely Low Range, and the advantaged groups scored in the Low Average Range; scores ranged from 4.40 to 8.67. Similarly, for Information, the disadvantaged groups scored in the Extremely Low Range, and the advantaged groups scored in the Low Average Range; scores ranged from 6.10 to 9.00. However, for Similarities, the disadvantaged groups scored in the Extremely Low Range (albeit relatively higher than for Vocabulary), and the advantaged groups scored in the Average Range; scores ranged from 6.10 to 10.20. Similarly, for Comprehension, the disadvantaged groups scored in the Extremely Low and Borderline Range, and the advantaged groups scored in the High Average Range; scores ranged from 6.50 to 11.33.

Kaufman (1994) wrote that both Vocabulary and Information assess crystallized intelligence, long-term memory, learning ability, the fund of taught information, and performance on these tasks is influenced by interests and school learning (p. 64 and p. 72). He further described

Similarities and Comprehension as both assessing crystallized intelligence and verbal reasoning ability, however, Similarities also assesses abstract thinking and verbal concept formation, while Comprehension also assesses social judgment and culture-loaded knowledge (p. 66 and p. 74). Thus all four subtests assess crystallized intelligence, but Vocabulary and Information are constrained as they are factual and rely on information that is didactically taught to the learners; conversely, Comprehension and Similarities are more fluid, and require application and problem solving skills. This suggests that disadvantaged primary schooling results in less well-developed general knowledge and vocabulary, and this lack of grounding at the primary school level is not really developed to the full potential of the individuals who then attended advantaged high schools.

The two performance subtests that demonstrated significant differences between the two groups in favour of the advantaged education groups in both the original and current research, were Digit Symbol and Picture Arrangement. This may suggest that disadvantaged education does not equip the individual with strategies and the experience of balancing thoroughness with speed. Nell (1999) described how test-wisness skills are 'absorbed' during school, but facilitated in a Western environment, where speed is valued. The disadvantaged education groups had less exposure to a Western culture, and their lowered performance on these two subtests may therefore be understood to reflect less developed test-wisness as a result of lower 'quality' of education. This suggests that Digit Symbol and Picture Arrangement are two subtests that are not culturally fair specifically for those with 12+ years of disadvantaged education.

In summary, the 12+ years of education groups consisted of two groups with disadvantaged primary and high school education, and two groups with generally disadvantaged primary schooling and advantaged high school education. Results overall demonstrated significant differences in subtest, index and IQ scores in favour of the advantaged groups however, there was a lowering for all groups on the non-verbal performance subtests (Object Assembly and Block Design), which suggests that these two subtests are not culture-fair. In addition, there was a slight lowering on subtests that assess acquired knowledge (Vocabulary and Information) for all groups, suggesting that disadvantaged primary school does not equip the participants with enough rehearsal and exposure to English and the Western middleclass culture assessed by the WAIS-III. Results further suggest that advantaged high schooling facilitates test-wisness and

this will affect test performance. Letter-Number Sequencing appears to be a subtest that is relatively culture-fair and was spared for lowered quality of education.

15+ years of education

Unlike the 12+ years of education groups, where the differences between disadvantaged and advantaged education were evident on most of the subtest, index and IQ scores, the overarching trend for the 15+ years of education groups with regard to quality of education was that there were less significant subtest, index and IQ scores for both the original and current data. The same trend of the advantaged education groups scoring higher than the disadvantaged education groups remained.

Specifically, in the original data (Mixed African Language DET 15+ years of education group versus Mixed African Language Private/Model C 15+ years of education group), the effects of quality of education were evident for some verbal and performance subtests, most of the index scores and all of the IQ scores, in favour of the advantaged group. Conversely, in the new Xhosa Language groups (Xhosa Language DET 15+ years of education group versus Xhosa Language Private/Model C 15+ years of education group), the specific areas of discrepancy between DET versus Private/Model C appear to be occurring selectively on verbal-related tasks including the Vocabulary, Similarities and Comprehension subtests, the VCI index scores and VIQ score, in favour of the group with advantaged education. As discussed at length above (Section 5.1), the reason for the loss of significance in the newly configured Xhosa Language groups is that the new Private/Model C group had less advantaged primary schooling, and less advantaged tertiary education. Furthermore, 60% of the original advantaged group were Zimbabweans, who would have experienced primary and high school education of a particularly high standard (Answers.com, 2005).

In the current research, the newly constituted Xhosa Language Private/Model C group generally had disadvantaged primary schooling and advantaged high schooling. It is therefore of note that the only areas where the Xhosa Language Private/Model C group scored significantly higher than the disadvantaged Xhosa Language DET group were in the verbal subtests. There was no statistically significant difference between the Xhosa Language DET versus Private/Model C

15+ years of education groups on all the performance subtests and four of the verbal subtests (Arithmetic, Digit Span, Information and Letter-Number Sequencing).

Conversely, in the original data, there was a significant discrepancy between the DET versus the Private/Model C groups, as the advantaged Private/Model C group generally had advantaged education throughout their schooling. However, as discussed in Section 5.1, there were also significant differences between the original Mixed African Language Private/Model C group versus the new Xhosa Language Private/Model C group (who had disadvantaged primary schooling) on a number of subtest, index and the PIQ. This suggests that disadvantaged primary school results in less exposure to ‘western’ cultural skills, values or test-wiseness (Nell, 1999), which will affect WAIS-III test performance particularly on performance subtests.

With regard to the Verbal subtests, the Xhosa Language Private/Model C group scored in the Very Superior Range for Vocabulary, Similarities and Comprehension, while the Xhosa Language DET group scored in the Average Range. Interestingly, these three subtests were amongst the disadvantaged Xhosa Language group’s highest subtest scores, and consequently, are considered relative strengths for both of these groups. These results suggest that verbal subtests are a relative strength for both groups.

It is of note that for Object Assembly, the group’s performance ranged from the Extremely Low Range to the Low Average Range (6.00 – 8.30). Similarly, for Block Design, the group’s performance ranged from the Low Average to Average Range (8.08 – 9.60). These results are similar to the 12+ years of education groups in that they are also amongst the lowest of the 15+ years of education group’s subtest scores. Thus all eight subgroups demonstrate a lowering of scores for both Object Assembly and Block Design, which adds further support for Rosselli & Ardila’s (2003) caution that nonverbal tasks are not “culture-fair”.

In summary, the 15+ years of education groups consisted of two groups with disadvantaged education, (i.e. the Mixed African and Xhosa Language DET 15+ years of education groups – all of whom attended disadvantaged primary and high school), one group with advantaged high school (i.e. Xhosa Language Private/Model C 15+ years of education – a few of whom attended advantaged primary and all attended advantaged high school), and one very advantaged group

(i.e. Mixed African Language Private/Model C 15+ years of education – the majority of whom attended advantaged primary and all of whom attended advantaged high school). Results overall demonstrated significant differences in subtest, index and IQ scores in the direction of the advantaged groups generally scoring higher than the disadvantaged groups. There was a lowering for all groups on the non-verbal performance subtests (Object Assembly and Block Design), which suggests that these two subtests are not culture-fair. Relatively lower performance for all the groups with disadvantaged (DET) primary schooling on performance and many verbal subtests added further support for the impact of quality of education on WAIS-III performance, as the advantaged (Mixed African Language Private/Model C group) generally scored significantly better than the other three groups.

Finally, both the 12+ and 15+ years of education analyses have demonstrated that quality of education plays a significant role in the various groups' performance. This was anticipated and commensurate with the literature (for example: Grieve & Viljoen, 2000; Lezak, 1995, Lezak et al, 2004; Manly et al., 2002; 2004; Nell, 1999; Shuttleworth-Edwards et al., 2004; Shuttleworth-Jordan, 1996; Van de Vijver & Phalet, 2004).

5.3 Normative tables

In both Table 4.3 and Table 4.4, the groups have been arranged so that the results of those groups with less advantaged education are placed on the left side of the page, and the level of advantaged education increases per group across the page. Thus, for Table 4.3, the results of the group with disadvantaged DET education during primary and high school (Xhosa Language DET 12+ years of education) appear in the left column. The results of the group with mainly disadvantaged DET primary school education and advantaged Private/Model C high school (Xhosa Language Private/Model C 12+ years of education) appear in the middle column of Table 4.3, and the data from Shuttleworth-Edwards et al. (2004) of the group who experienced advantaged education throughout primary and high school (white English Language Private/Model C 12+ years of education) is included in the right column of Table 4.3, for clinical and descriptive purposes. For Table 4.4, with respect to the 15+ years of education groups, the results of the group with disadvantaged DET education throughout both primary and high school (Xhosa Language DET 15+ years of education) appears in the left column. The results of the

group with mainly disadvantaged primary schooling and advantaged high schooling (Xhosa Language Private/Model C 15+ years of education) appears in the column second from the left of Table 4.4. The results of the group with mainly advantaged primary schooling and advantaged high school (Mixed African Language Private/Model C 15+ years of education) appears in the column third from the left of Table 4.4. As discussed above this data set from Shuttleworth-Edwards et al. (2004) was included as it demonstrated statistically significant differences from the data for the newly constituted Xhosa Language Private/Model C 15+ years of education group. Finally, the results from Shuttleworth-Edwards et al. (2004) of those who had advantaged education throughout primary and high school is included in the last column of Table 4.4 (white English Language Private/Model C 15+ years of education).

Thus, in both Tables 4.3 and Table 4.4 it is evident that the performance of the groups on subtest, index and IQ scores increases and rises across the rising levels of quality of education from left to right. Thus, the impact of quality of education and its relationship to acculturation is well demonstrated in Tables 4.3 and 4.4, as each group from left to right experienced increasingly advantaged education and each group increasingly scored higher on subtest, index and IQ scores. This finding is in accord with Manly et al. (1998; 2002; 2004) where increasing test scores was found to be related to increasing acculturation and increasing quality of education. These results further provide an excellent demonstration of Van de Vijver & Phalet's (2004) description of acculturation being like a continuum, as the varying degrees of quality of education are reflected in the results obtained.

In Table 4.3, examination of the FSIQ score of the Xhosa Language Private/Model C 12+ years of education group suggests good correlation with the HSRC normative data for the South African Black (Claassen et al., 2001), as the HSRC FSIQ is 92.51 points, and the Xhosa Language Private/Model C 12+ years of education group FSIQ is 96.42 points. However, a significant difference between the Xhosa Language DET group versus the Xhosa Language Private/Model C group of about 20 points is evident on the Index and IQ-scores. The disadvantaged DET group is generally scoring in the Borderline Range, (commensurate with Avenant's research, 1988), while the advantaged Private/Model C group is scoring in the Average Range. This has momentous clinical implications, as the use of the HSRC normative

data in the assessment of an individual with disadvantaged 12+ years of education may result in misdiagnosis, and possibly could result in an individual not being hired or promoted.

A perusal of the scores of the advantaged Xhosa Language Private/Model C group and the advantaged English Language Private/Model C group in Table 4.3, suggested that the FSIQ scores of the two groups were comparable (96.42, with a standard deviation of 13.68 for the Xhosa Language group; and 106.57, with a standard deviation of 12.15 for the English Language group).

Significantly, in Table 4.4, it appears that for both the Xhosa Language and Mixed African Language groups, Verbal Comprehension Index is a relative strength, as it is the highest Index score across all the groups. However, scrutiny of the other index scores of the two Xhosa Language groups suggests that disadvantaged primary schooling results in less well-developed test-taking skills which will affect WAIS-III performance. With regards to FSIQ, there is an incremental increase in scores along the continuum of advantaged education. This has significant implications for occupational assessment and diagnostic purposes. For example, if a DET 15+ years of education is assessed to determine suitability for employment or promotion, slightly lowered performance as a result of his or her disadvantaged education may affect his or her future career opportunities. Similarly, normative data that is not specific to quality of education may result in a failure to provide adequate compensation to an individual post traumatic brain injury who had advantaged education, as he may score above the expected normative data.

5.4 Overall implications

In summary, the research has provided data for two *levels* of education (12+ and 15+ years of education), and the effects of quality of education have been demonstrated across fine gradations of different degrees of disadvantaged and advantaged education at primary and high school. The relationship between good quality primary schooling and IQ test performance was evident in that the groups with advantaged primary schooling were exposed to a Western middleclass culture and were taught and had ample opportunity to rehearse and master concepts and information as well as develop test-wisness skills (Nell, 1999).

While there were significant differences in performance in the Xhosa Language 12+ years of education groups as a result of quality of education, evident in the substantially lowered Full Scale IQ of the disadvantaged group relative to the advantaged group, the effects of quality of education in the 15+ years of education appeared to be less significant. Never-the-less, differentiating between advantaged primary & high school versus advantaged high school did give rise to differences in performance on the WAIS-III.

Finally, Object Assembly and Block Design are subtests that were not culturally fair. This was evident in the substantial lowering in the most advantaged Mixed African Language Private/Model C 15+ years of education group (with advantaged primary and high school), who scored in the Low Average Range for Object Assembly. This was not felt to be a true reflection of this group's ability. This suggests that PIQ scores are as affected as VIQ by quality of education and culture (Ardila, 1995, Manly et al., 2004; Ostrosky-Solis; Ramirez & Ardila, 2004, Rosselli & Ardila, 2003; Soffer, 1997).

Normative data has been included to demonstrate the effects of quality of education on WAIS-III performance. The normative tables were arranged in such a manner that the groups with less advantaged education appeared in the left columns and the level of advantaged education increased across the page. There is an incremental increase in WAIS-III performance for both Table 4.3 and 4.4. In Table 4.3, it is evident that there is a significant disparity in the FSIQ of the Xhosa Language disadvantaged (DET) and advantaged (Private/Model C) 12+ years of education groups. The normative tables therefore aim to ensure that those individuals with disadvantaged education are not mis-diagnosed or are not further disadvantaged by being found unsuitable for employment or promotion. The normative data is therefore more relevant than the HSRC standardization, as it takes into account the effect of variations in quality of education.

5.5 Evaluation of the research

Strengths of this study are that the original data from the Shuttleworth-Edwards et al. (2004) study were improved by providing groups homogeneous for language, South African education and nationality. This study has added further support for the growing awareness of the

significance of quality of education on WAIS-III test performance (Manly et al., 2002, 2004; Nell, 1999; Shuttleworth-Edwards, 1996; Shuttleworth-Edwards et al., 2004). Normative tables have been compiled that are more relevant to the South African context, as they are homogeneous for South African education and South African language, as well as taking into account the effect of quality of education. The results of the groups were arranged in a progression according to quality of education. In differentiating between various degrees of quality of education, it is apparent the pronounced effects of disadvantaged education, particularly at the 12+ years of education level, where there was a discrepancy in FSIQ of 20 points between the Xhosa Language DET versus Private/Model C groups. This has significant clinical and diagnostic implications. The results of the Mixed African Language Private/Model C 15+ years of education group from the original Shuttleworth-Edwards et al. (2004) study were included in the normative table, as it represented a particularly elite group and although not homogeneous for language or South African education, the results demonstrate the impact of high quality primary and high school education. The current data has therefore added further detail to the continuum of acculturation classified according to quality of primary and high school education.

An additional strength of this research is that the methodology was strictly replicated and therefore it was valid to use the data from the Shuttleworth-Edwards et al. (2004) study for comparative purposes. There was consistency in terms of testers, as all the testers were Clinical Psychologists, trained by the same research co-ordinator. All the scripts were rigorously checked by a Clinical Psychologist blind to the aims of the study, who scored each of the verbal responses separately, and then checked the adding of all the raw scores and the conversions to scaled, index and IQ scores. Thus, it is considered that the results obtained are reliable. In conclusion, this research is thought to provide a valid indicator of the progression of improved quality of education commensurate with the literature (for example: Grieve & Viljoen, 2000; Lezak, 1995, Lezak et al, 2004; Manly et al., 2002; 2004; Nell, 1999; Shuttleworth-Edwards et al., 2004; Shuttleworth-Jordan, 1996; Van de Vijver & Phalet, 2004).

It is considered that the limitations of the research were that the groups comprise small numbers of participants (11 or 12 participants per group); however, the data appear robust in that they are entirely commensurate with expected performance in that the differences between the groups

were in the expected direction and were highly significant despite the small numbers per group. A further limitation is that the whole cohort generally has a high level of education in terms of the general population (all 12+ years of education), and these results cannot be generalized to those with lower levels of education. Whereas the results do have good clinical application for those with 12+ years of education stratified for quality of education, they are not generalizable to those with less education (i.e. less than 12 years of education).

5.6 Recommendations for future research

Arising out of the current research, it is believed that it would not add any significant information to collect further data for Xhosa Language individuals. Rather, what resources are available should be used to explore variations in language and lower levels of education. Other language groups that could be tested should ideally include participants from language groups that are more structurally different from Xhosa, such as Sotho and Venda (Wikipedia, 2004; Zeller, 2005). With regard to lower levels of education, it would be difficult to replicate the assessment of quality of education in groups of lower levels of education (e.g. completion of grade 8-9 or grade 10-11), as generally individuals with advantaged education complete matric. For this reason, it may be useful rather to use the Wechsler Intelligence Scale for Children – IV (WISC-IV) to compare the effects of quality and level of education on children in urban versus rural areas.

Chapter 6 REFERENCES

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INFORMED CONSENT

WAIS-III MASTERS RESEARCH

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

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

I _____ have read the above and give my consent for information given and test performance to be used for the above-mentioned research.

I am aware that my participation is voluntary and will involve about three hours of my time.

_____ (Signed by participant)

_____ (Signed by researcher)

_____ (Date)