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WISC-IV performance of South African Grade 7 English and Xhosa speaking children with advantaged versus disadvantaged education.

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ABSTRACT

Research reveals that the level as well as the quality of education plays a role in the determination of an individual's intellectual capacity. Substantial differences in quality of education for black and white individuals were experienced in South Africa due to Apartheid. Compared to the traditionally white Private and Model C schools, Township/ DET schools had limited resources, as well as a separate syllabus and examination system, a situation that has not improved substantially since democratisation in 1994. Research on black South African adults with the WAIS-III has confirmed significant influences on IQ in association with exposure to either such advantaged (Private/Model C) schooling, or disadvantaged (Township/DET) schooling. However to date there has been no published research on the use of the Wechsler intelligence tests on a black South African child population similarly stratified for quality of education. Therefore, for the purposes of this study, the latest Wechsler Intelligence Scale for Children (WISC-IV) was administered to a sample of 36 Grade 7 learners between the ages of 12-13 (mean 13.01 years), stratified for quality of education to form three comparative groups. Data analyses revealed significant differences on the WISC-IV Factor Indices and Full Scale IQ with the English speaking Private/ Model C school group performing the best, followed by the Xhosa speaking Private/ Model C school group, and the Xhosa speaking Township/ DET school group performing the worst. This continuum of lowering is understood to occur abreast of a continuum of decreased exposure to relatively advantaged education. These normative indications are considered to have vital implications for the use of the WISC-IV in the South African cross-cultural situation where vastly differential educational opportunities continue to exist.

Pencil, ink marks and highlighting ruin books for other readers.

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1. LITERATURE REVIEW

1.1 Cultural issues in cognitive testing

Ardila (1996) states that cognitive abilities measured in neuropsychological tests epitomise learned abilities. It can therefore be said that the cognitive abilities measured in these tests are directly linked to an individual's learning opportunities and contextual experiences (Ardila, 1996). It must also be noted that the individual's culture, states what is worth learning and at what age, resulting in variations in content and relevance of learning between different cultures.

A number of studies have observed that the average intelligence test scores of black and white people differ by around 10 IQ points (Howe, 1997). For many years the explanation for this phenomenon was explained through postulated genetic differences present between races. A corollary of this argument tends to be that it is not possible to change too much regarding genetic or biological variables. In contrast to this, Howe (1997) suggests that many factors, other than genetics may play a role in the establishment of measurable IQ scores. He questions the authors of *The Bell Curve*, Herrnstein and Murray (1994) whose view of intelligence is that this is a phenomenon that is stable and resistant to change. Howe (1997) proposes that numerous studies showed that the genetic differences are of no significance in favouring one race above the other when discussing intellectual functioning.

Ardila (1996) notes that the neuropsychological tests used presently are culturally biased, and that a consequence of this is continued support for the argument that race and genetics play a central role in IQ performance. However, Ardila (1996) emphasizes that cognitive capacity differences between races does not necessarily exist and that the organisation of cognition in the brain varies rather according to the particular culture. This variation is due to the cultural view on education influencing the perception of the individual towards testing and performance as well as what is regarded as important. It is therefore crucial that the researcher or clinician be aware of such factors and attitudes towards testing before using westernised neuropsychological tests on all cultures. Accordingly, seminal neuropsychological

texts (e.g., Lezak, Howieson and Loring, 2004) point out that socio-cultural factors play a significant role on results in neuropsychological testing and that this must be kept in mind when comparing the scores of different race groups for clinical purposes.

Helms (1992) suggests that the level of urbanisation and the ensuing acculturation plays an intricate role on the performance of the individual. Studies showed that learners presenting with more westernised socio-cultural features tend to perform better on intelligence tests than their more traditional counter parts. The likely explanation for this is that with acculturation (i.e., greater exposure to westernised facilities and ideas through urbanisation) they may start to share the westernised view around testing and performance (Ardila, 1996; Helms, 1992).

1.2 Socio-Economic Factors and IQ

Numerous studies have identified age, sex, years of education, quality of education and acculturation as important factors in determining an individual's cognitive functioning (Manly, Byrd, Touradji & Stern, 2004; Marcopulos, McLain & Giuliano, 1997; Shuttleworth-Edwards, Kemp, Rust, Muirhead, Hartman & Radloff, 2004). Studies as early as the 1970's have reported that socio-economical factors such as nutritional status of the individual plays a role on the individual's IQ score (Arija, Esparó, Fernández-Ballart, Murphy, Biarnés & Canals, 2006; Carlson, Reynolds & Gutkin, 1983; Georgas, Weiss, Van de Vijver & Saklofske, 2003; Kramer, Allen & Gergen, 1995; Smith, Hays & Solway, 1977; Skuy, Schutte, Fridjhon & O'Carroll, 2001). The authors acknowledge that certain hereditary components do influence intellectual functioning, but that the role of environmental factors such as lack of intellectual stimulation, poor health, differing value systems and inadequate motivation plays an equal role in intellectual performance. Adoption studies show that children brought up in socially advantaged adoptive homes were likely to perform better on intellectual level than their disadvantaged peers (Howe, 1997).

A study by Amante, Van Houten, Grieve, Bender and Margules (1977) showed that the differences in intelligence between white and blacks decrease significantly if socio-

economic status and related factors remain constant. It is thus stated by White (2000), that intelligence tests, described as achievement tests, are therefore very sensitive to the experiences of the individual.

Studies showed that rural participants tend to be discriminated against due to their socio-economic, education and health status (Marcopulos, et al., 1997). Kendall, Verster and Von Mollendorf (in Irvine & Berry, 1988) report that studies showed that urban children perform better than their rural peers. This can be explained due to the fact that urban children may be more exposed to a higher quality of formal education. There is therefore a synergistic effect between socio-economic status, health and educational opportunities. The latter will be discussed in more detail below.

1.3 Language and IQ testing

Van der Berg (in Nell, 1994) remarks that language can be described as the most influential factor on test performance. To illustrate the critical role of language on neuropsychological testing, Wechsler (2004) stated that participants not fluent in English must be excluded from the WISC-IV standardisation.

Ceci (1991) remarks that children are taught in a formal and descriptive form of language, which may differ significantly from the child's mother language. By teaching in this formal language, children are given the opportunity to recognize and comprehend the questions used in IQ tests. In South Africa, with its eleven official languages, this factor complicates the implementing of westernised neuropsychological tests. Research from Skuy, et al. (2001) show language plays a significant role in the performance of individuals not educated in their mother language. The author also states that being raised in a multilingual environment may also affect scores negatively.

It is important to note the role of language on intellectual testing within the South African context as a high percentage of children tested in the country may be non-English speaking. This results in biases against the non-English speaking learners

versus English speaking learners. Not only does language influence the verbal component of the test, but these individuals may also struggle with understanding instructions or expressing themselves adequately.

1.4 Educational factors and quality of education

Wolfle (1980) states that evidence suggests that education have a long term effect on cognitive abilities and the distribution thereof. It is proposed that education may generate large, persistent and lasting effects on knowledge, general intelligence and cognitive abilities (Wolfle, 1980). Research also shows that education (formal schooling) has a significant influence on the changes in IQ scores between generations (Husen & Tuijnman, 1991). Data showed that IQ scores demonstrated a gain of an average of 5 to 25 points between generations.

Ardila (1996) noted that not only the level of education plays a role but that the cultural view on education influences testing. Some cultures may view testing as an unimportant situation, resulting in these individuals scoring lower than their peers from other cultures. Snow and Yalow (in Sternberg, 1982) propose that the differences in intelligence can be studied by looking at the differences in education. According to these authors, education is essential to the defining of intelligence. Kendall, Verster and Von Mollendorf (in Irvine & Berry, 1988) state that education itself plays a significant role in stimulating and developing the intellect. These authors propose that the amount of formal schooling received has a noticeable effect on the test performance of participants in the USA and Africa. But Ardila (1996) warns that the effect of education on neurological tests cannot be described as linear. The author states that the difference between one to three years of education is highly significant while the difference between twelve and fifteen years of education are noticeably lower and insignificant.

Nell (1999) and Manly, et al. (2004) indicate that the type of education determines the level of test-wiseness. This means that children, receiving a lower quality of education, do not have the necessary skills required to take part in tests, resulting in them

performing lower in the named tests. Test-wise learners consequently know that they need to be more alert when taking tests and may be more motivated than non-test-wise participants. An individual in this situation will be more familiar with test instructions, test-taking skills and the testing experience as testing is used as the main form of assessing in the school environment. Test skills include the correct way to hold a pencil, familiarity of test booklets, instructions, letters, numbers and symbols, speed and accuracy of work, paying attention and sitting still while taking a test. Nell (1999) remarks that test-taking skills are taught directly, by exposure to multiple test experiences and indirectly as test taking skills draws on valued class behaviour such as paying attention, sitting still, pen and paper dexterity, copying of designs, reading skills, problem solving, working fast and completing tasks. The above skills place the individual in an immediate advantage over their less educated peers (Manly, et al., 2004). Nell (1999) states that these participants will know, without being told, that they must work as fast and accurately as possible. Non-test-wise participants may concentrate more on completing the tests as accurately as possible, causing them to take longer in completing it. As the WISC-IV makes use of timed tests, this factor may influence the IQ score of non-test-wise participants negatively.

Accordingly, research has indicated that not only verbal tasks but performance tasks also may be culturally sensitive due to the influence of test-wiseness (Shuttleworth, et al., 2004). Certain abilities such as drawing on conceptual depth perception cues, concept formation and the ability to perceive abstract visuo-spatial organisation can be enhanced through the schooling process (Ceci, 1991). Research also found that literacy level influences memory, visuo-spatial ability, digit span, naming, calculation, praxis, alternating movements and cancellation tasks (Manly, Jacobs, Sano, Bell, Merchant, Small & Stern, 1999). It is therefore suggested that the literacy level influences the performance of the individual on traditional neuropsychological tests. These skills are of great consequence in completing a neuropsychological test such as the WISC-IV. Zindi (1994) reasons that the lack of test sophistication may play a vital role in the lower performance of African participants. Ceci (1991) also states that teaching through direct instruction allows children the access to knowledge used in the

WISC and relevant tests. This is particularly true for subtests such as Comprehension and Information.

The popular view that IQ cannot be influenced by schooling but influences the level of education received, was found to be incorrect as more researchers discovered a possible link between the individual's IQ score and the ability to reach a higher level of education (Ceci, 1991). Ardila (1996) states that studies showed that diversity in educational level acts as an important variable in neuropsychological test performance. Howe (1997) and Snow and Yalow (in Sternberg, 1982) proposed that evidence demonstrated that the educational environment of a child plays a significant role in the level of intellectual functioning. It is proposed that the quality and the amount of schooling that an individual is exposed, to may have a considerable impact on the level of the individual's intellectual functioning (Finlayson, Johnson & Reitan, 1977; Lezak, et al., 2004; Manly, et al., 2004; Matarazzo & Herman, 1984; Paolo & Ryan, 1994). In order to give disadvantaged children a better chance, various intervention programmes were launched in 1960's United States. The Bell Curve's authors, Herrnstein and Murray used the failure of these programmes to support their hypotheses that intelligence cannot be raised but that it is a genetic component. Howe (1997) states that it would take more than just the removal of negative cultural influences, such as inadequate schooling and facilities, to allow deprived communities the support and opportunities to minimise disparity.

Studies showed that the amount of schooling, that is how many years the individual attends school, affects intelligence test scores (Ceci, 1991; Howe, 1997; Husen & Tuijnman, 1991; Kramer, Allen & Gergen, 1995). Missing of school or non-attendance is thus associated with lower IQ. Ceci (1991) remarks that an individual's intellectual development needs the stimulation and opportunities offered by schooling. This might play a significant role in the South African context, due to the fact that disadvantaged children are exposed to irregular school attendance due to shortage of staff, resources and strikes. Howe (1997) reported that studies demonstrated a decrease in IQ of around 5 points per year due to the forced closure of schools.

Accordingly, a growing body of international research reveals that quality of education is an even more influential variable on psychometric test performance than level (i.e. Grade) of education (Manly, Jacobs, Sano, Bell, Merchant, Small & Stern, 1998). Similarly, Shuttleworth-Edwards, et al. (2004) confirmed that level of education plays a less influential role than the quality of education in the lower performance of disadvantaged South African adults on the WAIS-III. Specifically this research (Shuttleworth-Edwards et al., 2004) revealed that when level of education was kept constant, black African first language adults, who have been exposed to high quality education, were able to perform at a level equivalent to the US standardisation used in the WAIS-III, whereas those exposed to relatively deprived DET type quality of education showed a lowering of between 20 to 25 points in scores obtained.

A study by Avenant (in Shuttleworth, et al., 2004) showed that participants from historically disadvantaged education systems demonstrate an IQ level equivalent to borderline intellectual functioning. Manly, et al. (2004) remarks that studies in the US showed that African American individuals in the northern part of the country obtained higher intellectual scores. The research suggests that this may be due to the fact that the individuals in the south of the country attended segregated schools where as the individuals in the north were exposed to integrated and thus higher quality, education (Manly, Jacobs, Touradji, Small & Stern, 2002). It was also noted that these individuals' scores would rise with every year they stayed in the northern cities. Research in United Kingdom indicates that resources and physical factors of a school do not influence the quality of education as much as classroom organisation and academic emphasis (Ceci, 1991). Nell (1999) remarks that the quality of education in developing countries cannot be taken for granted as in developed countries. Factors that need to be considered in the South African context include teachers' level of training, teacher-learner ratio as well as availability and quality of equipment and resources.

Huge differences in quality of education for blacks and whites were experienced in South Africa due to Apartheid (Nell, 1999; Shuttleworth-Edwards, et al., 2004).

Schooling for blacks were controlled by the Department of Education and Training (DET schools) and separated from white schooling. Compared to the traditionally white Private and Model C schools, DET schools had limited resources, as well as a separate syllabus and examination system. This resulted in a vast majority of the population not receiving adequate education. After 1994 and the start of democracy, steps were taken to integrate all races into previously white schools such as Model C schools and attempts were made to standardise the curriculum and allocate resources more equally between schools. Even after these changes, a large percentage of black children still attended the former DET schools which remained relatively impoverished caused by factors such as under-qualified teachers as well as poor and limited facilities and equipment. This meant that these learners still received a lower standard and quality of education than learners in Model C schools (Shuttleworth-Edwards, et al., 2004). It must be noted that democracy did not have the desired effect on quality of schooling (Jasson da Costa, 2006). Instead of elevating the quality of education for all groups a further drop in standards were noted. The report claimed that poor planning of the curriculum and the implementation thereof as well as limited resources were to blame for the continued poor quality of schooling experienced in Township/ DET schools. Currently, therefore, as at the time of the earlier study on the WAIS-III, it can still be said that in broad terms the Model C/ Private Schools offer relatively advantaged education compared with the schooling received in the former DET/ township schools. This is without making the assumption that there is exact equivalence between any of these categories of school in terms of quality of education.

Studies regarding the specific role of quality of education on intellectual functioning found that the effect of education can be seen on measures tapping stored knowledge rather than immediate problem solving task (Finlayson et al., 1977). Manly, et al. (2004) reasons that quality of education may influence matters such as non-verbal memory, abstraction, naming, letter fluency, repetition, comprehension and visuo-spatial skills. Preliminary results in a study by Shuttleworth-Edwards and colleagues (Shuttleworth-Edwards, et al., 2004) shows that African first language participants,

proficient in English and exposed to high quality education, will be more likely to perform at a level comparable to US standardisations. In contrast to this, individuals receiving a lower quality of education will display a lowering of between 20 to 25 points on the WAIS-III.

To summarise, research indicates that schooling plays an important role in neuropsychological test performance, despite the culture or race of the individual (Manly, et al., 2004). It is also proposed that school attendance in years, is not an accurate predictor as compared to the quality of education received (Manly, et al., 2004). In the South African situation, due to the legacy of Apartheid, this has particular relevance, due to the widely discrepant exposure that occurs amongst the population to either disadvantaged or relatively advantaged quality of educational systems.

1.5 The Wechsler Intelligence Scale for Children

Assessment of the intelligence of children is usually handled by administrating one of the editions of the Wechsler Intelligence Scale for Children (WISC) (Cockshott, Marsh & Hine, 2006). Keith, Fine, Taub, Reynolds and Kranzler (2006) describe the WISC as the "golden standard" in intelligence testing, due to the fact that it is able to test individuals from both normal and clinical populations. Wechsler (in Nell, 1994) defined intelligence as an overall ability or capacity to act purposefully, think rationally and to deal and react to the environment in an effective manner. This definition has been in use since 1944 (Nell, 1994).

The Wechsler intelligence scales have been in use since 1939 and have been updated over the years to incorporate advances in the field of intellectual assessment. The different Wechsler scales are widely accepted and used as intelligence tests as both verbal and non-verbal aspects are assessed to determine intellectual ability. Gabel and Shaughnessy (2006) note that a number of changes were made to the most recent update of the child scales, viz. the WISC-IV. These include incorporating subtests to determine the four factor indices: Verbal Comprehension Index (VCI), Processing Speed Index (PSI), Working Memory Index (WMI) and Perceptual

Reasoning Index (PRI). In order to incorporate such changes, the following set of subtests is included in the WISC-IV and grouped under a specific index: the Verbal Comprehension Index is based on vocabulary, similarities and comprehension subtests, whereas the Working Memory Index, determining fluid reasoning and the ability to maintain information in order to use or manipulate at a later stage, includes the digit span and letter number sequencing tests (Wechsler, 2004). The Perceptual Reasoning Index was developed to determine abstract-visual problem solving skills, thereby making the test less verbally loaded and potentially more culture fair (Baron, 2005). The subtests are compiled out of block design, picture concepts and matrix reasoning. The Processing Speed Index in the WISC-IV is evaluated within the context of perceptual motor tasks determining how the person processes pieces of information in order to make decisions and is comprised of the coding and symbol search subtests (Gabel & Shaughnessy, 2006; Keith, et al., 2006). It is also possible to supplement the ten core subtests with one or more of the following five subtests including Information, Word Reasoning, Picture Completion, Arithmetic and Cancellation. This test can therefore be described as a full test battery as each subtest assesses specific aspects of intelligence. (Lezak et al., 2004).

Keith, et al. (2006) comments that the WISC-IV can be described as a better instrument than the previous versions as it closely reflects existing research and theory in the field of intelligence.

1.6 Applying Wechsler Intelligence Tests to Different Cultures

As stated above, the Wechsler Intelligence tests are some of the most widely used tests in neuropsychology. In order to use it more widely, certain modifications were required in order to administer it in English speaking countries such as Ireland and New Zeeland (Shuttleworth, et al., 2004). It is also recommended that adjustments to subtests such as Vocabulary, Information and Comprehension are necessary in order to administer the Wechsler test on different cultural groups (Shuttleworth, et al., 2004). Various researchers indicated that these verbal subtests as well as Block Design and Digit Span were found to be highly sensitive to cultural diversity.

If the tests need modifications for English speaking countries, it can be deduced that the administration of western IQ tests on African cultures may be more complicated (Kendall, Verster & Von Mollendorf, 1988). Huysamen (1980) state that psychological test development in South Africa is faced with a unique problem. Not only does the country have eleven official languages to translate the test into, but each language group tends to have a different cultural background. Verster (in Huysamen, 1988) indicated that each cultural group makes use of different problem-solving styles in responding to tests situations.

As it is unlikely that a culture-free and culture-fair test will be developed, the best approach to the problem would be to create different norms for the different sub-groups in South Africa (Huysamen, 1988). The knowledge that a child possesses depends on his/her natural ability, the extent and quality of education the child was exposed to as well as cultural variables and opportunities. In the US, Sattler (1992) proposed that national norms were inappropriate when testing disadvantaged minority groups. Factors such as language, test-taking skills, content of the test, cultural diversity and differences in quality of education were identified as some of the negative influences impacting on test results. The difficulty is that attempts to develop culture-fair tests have not been successful up to this stage as all tests are culturally loaded to a certain extent. Sattler (1992) states that if variables such as social and economic class are taken into consideration, important differences in terms of lifestyle and experience will still play a role in test scores. Accordingly, the negative effect of such factors has been demonstrated in cross-cultural research on earlier versions of the WISC. For example, Zindi's (1994) research showed that a group of English children in London performed better than a group of Zimbabwean children on the WISC-R by at least 2,56 scaled points on each subtest. In comparing this with the US norm it was found that the Zimbabwean children showed a lowering of at least three to four scaled points, indicating that the identification of intellectual level in non-westernised children from rural areas is negatively effected on a test such as the WISC and its follow-up versions.

Huysamen (1988) warns against the use of stated norms for intergroup (between-group) analysis as it will provide a skewed view of the results. Nell (1994) indicated that it is not advisable to use US norms in a South African context as it does not consider environmental influences that play a role, such as education. Due to the historical background of South Africa, Nell (1994) proposes that race must be used as the main factor in determining elements such as quality of education and economic opportunity. Kaufman, McLean and Reynolds (1988) propose that race and educational level have a significant influence on the Verbal, Performance and Full Scale scores of the WAIS-R. Their study showed that the mean scores for each subtest increased with the increase in the amount of schooling. The study also showed that Vocabulary and Information was the most sensitive in terms of the amount of schooling received, with Object Assembly, Picture Completion and Picture Arrangement as the tests least related to educational level (Kaufman, McLean & Reynolds, 1988).

As stated earlier, Nell (1999) warns that test-wiseness is one of the main obstacles for participants in developing countries. One way of avoiding this is to allow participants to practice the skills needed. Nell (1999) remarks that the WAIS-III incorporated guided learning and extended practice into the test. This can also be seen in WISC-IV for example in the Cancellation, Coding and Word Reasoning subtests.

1.7 Cultural norms in South Africa

Marcopulos, et al. (1997) observes that the population used for norms in most neuropsychological tests, can be described as white, urban, high school educated adults. Norms refer to the performance of a specific group (Ardila, 1996). Currently a need for unbiased measurements of intelligence on an international level resulted in the revisiting of controversies around standardisation of existing tests and the normative population used. It is stated that tests in use are racially and culturally biased resulting in the discrimination of minority groups (Hale, Raymond & Gajar, 1982). Smith, Hays and Solway (1977) states that any intellectual screening instrument should have as little cultural bias as possible, including for administration,

scoring and interpretation level.

Ardila (1996) proposes that norms need to be obtained for different age, educational and cultural groups in order to prevent misdiagnosing of certain groups. Manly, Byrd, Touradji and Stern (2004) observe that these norms may reduce the likelihood of misdiagnosis, but that it leaves the differences unexplained and unsolved. Manly, et al. (2004) remarks that measuring instruments developed for or by the majority culture may not assess the same cognitive abilities in other cultures. The author also warns that the level of acculturation plays a huge role in the determining of groups and norms. This influence must first be understood before it is possible to develop representative norms (Manly et al., 2004). Researchers also need to be aware that racial classification cannot be seen as consistent or scientific. To divide participants in this way may cause norms to be misleading.

White (2000) remarks that it is virtually impossible to design intelligence tests to be culture 'fair' or 'free'. It is therefore important that test-administrators be aware of limitations and try to minimise its influence as far as possible. Nell (1994) remarks that 'old' norms cannot be used in determining an individual's functioning as it does not take the development of education in consideration. The result is that 'old' norms will inflate an individual's ability to such a degree that notably impaired people will be classified as average.

In particular the extensively used Wechsler tests are primarily American-based, with standardisations relevant to the American population, which makes the use of these tests problematic in a South African context until they have been appropriately normed for use in this country. Cross-cultural researchers such as Nell (1999) and Shuttleworth-Edwards, et al., (2004) propose that appropriate standardisation must form part of the application of cognitive ability tests from one ethnic group to another. This will help to minimise potential problems in terms of diagnostic and placement situations. Thus instead of discarding existing tests for use in the South African context, and embarking on totally new test development, Shuttleworth-Jordan (1996)

proposes that internationally recognised tests should be renormed, and effects such as cultural or educational disadvantages be taken in consideration, when testing non-American and non-western participants.

In accordance with this sentiment, an initial attempt at a South African standardisation was carried out on the WAIS-III for a young adult population by the Human Sciences Research Council (HSRC) (Claasen, Krynauw, Paterson & Mathe, 2001), and as indicated above, additional cross-cultural norming on the WAIS-III also for a young adult population that took quality of education into account was conducted by Shuttleworth-Edwards et al. (2004). However, there has been no further attempt at standardisation of the Wechsler Scales by the HSRC, and no formal South African standardisation has been initiated in respect of the Wechsler child IQ tests at any stage, seriously limiting the applicability of this internationally renowned test for use in the South African context especially on relatively disadvantaged populations. As the test is frequently required for use in clinical settings in South Africa, the current study set out to do a preliminary investigation to facilitate clinical work in the Eastern Cape, with a view to determining the role of quality of education on intellectual functioning for a group of Grade 7 English and Xhosa first language learners in both advantaged and disadvantaged educational systems.

Clearly the optimal situation would be for the WISC-IV to be translated into the Xhosa language and standardised on a large representative sample. However, in the absence of this occurrence it appears imperative to acquire some normative indications as to how various race and language groups of children perform on the test in the manner that it is typically used in current clinical and even medico-legal settings (given the absence of any more adequate test options). Typically what occurs in South African settings is that the test is administered in English to a testee whose second-language is English as long as the testee is either working or studying in the medium of English, and therefore relatively proficient in that language. On the other hand, when individuals who are not proficient in English are tested, what usually occurs is that a translator will be present and simply repeat the instructions given in English to

the testee in the relevant indigenous language, translating as they go rather than working from any formal translation since this is not available. In the South African Eastern Cape clinical settings this usually occurs in the indigenous Xhosa language.

Accordingly, specifically with reference to the WISC-IV, it was decided to do a follow up study on the earlier cross-cultural research conducted on the WAIS-III (Shuttleworth- Edwards, et al., 2004), using the same stratification model used in that research in respect of relatively advantaged versus relatively disadvantaged quality of education (Model C/ Private versus DET education, respectively). Unlike the former study that investigated two different *levels* of education (Grade 12 and Graduate) the participants for the present study were on the same academic level such that level of education was kept constant. Also differing from the former adult study, where all adult participants had to be either working or studying in the English language and therefore the test was administered in English, a translator was used when testing the Xhosa speaking learners in the Township/ DET schools who would not necessarily be proficient in the English language, in order to reduce the influence of language on results. It was understood that this study did *not* set out to produce a refined standardisation in terms of a reliably translated test and accompanying norms, but rather had the objective of providing broad normative indications for English and Xhosa first language Grade 7 children with advantaged versus disadvantaged education, given the typical manner in which the test is currently in clinical use.

2. METHODOLOGY

2.1 Participants

The method of participation selection replicated the cross-cultural stratification criteria used in the research cited earlier (Shuttleworth-Edwards et al., 2004) that was conducted in respect of an adult population on the WAIS-III. In contrast to that research, the present study made use of a sample of 36 child participants between the ages of 12-13 (mean 13.01 years), all in Grade 7. As with the prior research the participants were then stratified in terms of language, gender and quality of education as seen in Table 1.

Table 1: Participants stratified according to language, gender and quality of education.

	Male	Female	Total 36
Xhosa First Language- Private/ Model C School	N = 6	N = 6	N = 12
Xhosa First Language- Former DET School	N = 6	N = 6	N = 12
English First Language-Private/ Model C School	N = 6	N = 6	N = 12

As seen from the table an equal number of male and female participants were used for each of the first language strata, and for each type of educational level. Although the sample is small, a set of similar subgroups of n = 12 characterised the earlier adult research of Shuttleworth-Edwards, et al. (2004), and was found to offer sufficient statistical power to reveal substantial differentiation in performance between the relative comparative groups. Furthermore this research has been extensively cited in a leading neuropsychological text (Strauss, Sherman & Spreen, 2006) given its important practitioner-oriented indications for cross-cultural assessment where there appears to be no other published material. Accordingly the present research was conducted with a view to being similarly practitioner-oriented, and the small, well-stratified sample, which isolates variables of race in association with level and quality of education, is regarded as suitable for the establishment of a set of preliminary normative guidelines for practitioners using the WISC-IV with Grade 7 children in the Eastern Cape.

The research was conducted in Grahamstown, Eastern Cape, South Africa. Purposeful sampling was used, and participants were identified by the headmaster/mistress and teachers at six targeted schools (to be described below) in order to promote an equal distribution between gender and level of performance (in terms of marks). This allowed the researchers to prevent an uneven marks distribution across comparative groups, such as all above average to superior performers in one group versus only average performers in another group. To ensure a sample with a spectrum of normal rather than compromised intellectual function, participants with at least average school performance were targeted. Sampling in terms of achievement

was carried out in conjunction with the assistance of the school personnel, by looking at learners' symbol records at the end of Grade 6, together with the most resent class records available.

Parents were contacted to obtain signed consent for the testing (See Appendix B). Participation was voluntary and testees were free to withdraw from the research at any point in the process.

Exclusion Criteria: Exclusion criteria included: Children with less than three years attendance at the targeted school type; any child who had ever repeated a grade or with a learning difficulty, or who had exceptionally low, borderline-pass type achievement; children with a history of medical, psychiatric or neurological disorder or prior history of traumatic brain injury (See Appendix C). This resulted in a nonclinical sample of children who were reportedly performing normally within the targeted school situations.

2.2 Level of education

In order to investigate the role of quality of education on intelligence, the level of education was restricted for this study. Participants were all in Grade 7 and within the age bracket of 12 to 13 years. This was necessary as both age and level of education influences IQ test performance (Lezak et al., 2004). Grade 7, the final year of primary school, was chosen in order to provide a contrast between current data and data acquired in the prior research done on participants who completed Grade 12 (Shuttleworth-Edwards et al., 2004).

2.3 Quality of education

During the Apartheid regime, South African schools were divided according to race. This resulted in black learners having a separate schooling system under the Department of Education and Training (DET Schools) with its own syllabus and allocation of relatively limited resources. In contrast, white learners attended government funded Model C schools or privately funded (hereafter Private) schools,

both of which offered more favourably resourced learning facilities than DET schooling. After democracy, black children had the opportunity to attend the schools of their choice. Unfortunately, a large part of the other-than-white population is still attending the former DET or Township schools. Since the dismantling of Apartheid, these schools have continued to be under-resourced resulting in high teacher-learner ratios, under-qualified teachers, limited facilities and materials and staff shortages (Nell, 1999). As indicated above, research conducted by Shuttleworth- Edwards, et al. (2004) show a difference of 20 to 25 points in association with quality of education in the direction of poorer performance for those African first language individuals with relatively disadvantaged education (operationalised as those attending the former DET/ Township schools) compared with those African first language individuals with relatively advantaged education (operationalised as those attending the traditionally white Private/ Model C schools). As indicated earlier, it appears that the vast divide in quality of education between these two types of schools has not changed substantially (Jasson Da Costa, 2006) , and accordingly it was considered pertinent to replicate this two-dimensional set of categories for the variable of quality of education for this WISC-IV study, viz. advantaged education being that provided by the traditionally white Private/ Model C schools versus disadvantaged education being that provided by the former DET/ Township schools.

The sample was divided into three groups for the study according to race and language of origin: 1) White English speaking individuals attending Private/Model C schools (n =12, six from Private and six from Model C schools); 2) Black Xhosa speaking individuals attending Private/Model C school (n =12, six from Private schools, six from Model C schools); 3) Black Xhosa speaking individuals attending Township/ DET schools (n =12, using two Township schools, six from each school). Due to the exclusion criteria it was necessary to make use of more than one school for the Township/ DET school section. T-test comparisons were run on all the WISC-IV scores between the two Township/ DET schools, revealing no significant differences for any of the test score comparisons ($p < 0.05$ in all instances, ranging from $p = 1.000$ to $p = 0.134$). It is therefore noted that between the two schools no advantages

were offered that would bring the learners equivalent with the resources available for the Private/ Model C schools. Similarly t-test comparisons were run on all the WISC-IV scores for the Xhosa Private/ Model C learners, and the English Private/Model C learners, (p = < 0.05 in all instances, ranging from p = 1.000 to p = 0.468 for the Xhosa speaking learners and from p = 1.000 to p = 0.085 for the English speaking learners). On this basis it was considered appropriate to combine the scores into three groups of 12 each for further analysis. The three groups are English first language Private/ Model C vs. Xhosa first language Private/ Model C vs. Xhosa first language Township/ DET schools. It should be noted, however, that there were some comparisons between the two Township/ DET schools that strongly approached significance suggesting that with larger samples these differences might become significant implicating possible differential levels of quality of education of clinical relevance *within* this globally more disadvantaged Township/ DET group. However, for the purposes of this preliminary investigation these Township/ DET subgroups were considered sufficiently homogenous to use for combined normative indications concerning a *broadly* disadvantaged Township/ DET group relative to the more *broadly* advantaged Private/Model C groups in respect of quality of education. As indicated above, no assumptions were made in terms of exact equivalence of poor quality of education amongst these Township/ DET schools in the knowledge that there may be wide variations in this regard. However, it is considered unlikely that any of these schools will have advanced as yet in the post-apartheid years, to the extent that they can offer the quality of education available in the Private or Model C schools.

2.4 Procedure

The WISC-IV as a whole was administered, including all the subtests. All the tests were administered during school hours on an individual basis. The entire battery was given to each participant in a single sitting with a break half way through the sitting. Each test took between 90 to 150 minutes to administer. Tests were administered in a testing room at the particular school, free of noise and distraction. As in previous studies (Gaylard, 2005; Runciman, 1995; Shuttleworth-Edwards, et al., 2004), minor alterations in terms of obvious cultural biases were completed. For example, rands

were used in place of pounds.

The English and Xhosa first language speakers in the Private/Model C schools received the test in English. It was considered that the participants in Private/ Model C schools receive their education in English from Grade 1 and can be assumed to be relatively proficient in English. Furthermore it was considered that such children would normally be tested in English in a clinical situation using a test standardised in the English language. In contrast, a Xhosa translator was used to repeat the English instructions given by the tester when testing the former DET school Xhosa first language participants whose education is usually in the Xhosa vernacular, and not exclusively in English. Whilst this informal mode of interpretation of the test has serious limitations in terms of strict standardisation criteria (i.e. repetition of test instructions via a Xhosa translator), it was considered sufficient to provide broad guidelines for the use of the test under similar testing conditions with an individual from a similar population for clinical purposes where a formal translation of the test is not currently available.

2.5 Data collection

Participants were requested to complete a medical history form (Appendices C). Following this the WISC-IV was administered individually to each one of the participants shared between three Intern Clinical Psychologists, trained in the standardised administration and scoring of the WISC-IV as described in the manual (Wechsler, 2004). Each tester was randomly allocated a selection of participants from each of the six targeted schools. This entailed that each of the administrators tested four participants from English first language Private/ Model C schools, four participants from Xhosa first language Private/ Model C schools and four participants from Xhosa first language Township/ DET school. As noted earlier each of the strata was made up from two schools. A fourth Intern Clinical Psychologist whose first language was Xhosa was paid to act as a translator for the administration of the WISC-IV to the learners in the DET/ Township schools. The four Intern Psychologists practiced the administration of the test with each other both in English and with repeat instructions

in Xhosa by the translator, to ensure relatively equivalent test administration procedure between testers that was closely in accordance with the standardised format. This was also done in order to ensure a smooth translation of the English test instructions when repeated in Xhosa.

2.6 Data analysis

The WISC-IV allows for the scoring of individual subtests, the four factor indices namely Verbal Comprehension Index (VCI), Processing Speed Index (PSI), Working Memory Index (WMI) and Perceptual Reasoning Index (PRI) and the Full Scale IQ (FSIQ). The scoring of each subtest was done strictly according to the guidelines in the WISC-IV technical and interpretive manual (Wechsler, 2004). As all the subtests were administered, no substitution of subtests was done during the analysis. Raw scores were converted to scaled scores and the different factor indices as well as the Full Scale IQ score were calculated. Consensus amongst the research team was reached in cases of scoring uncertainties.

Descriptive statistics were calculated in order to determine the mean scores and standard deviations for all the WISC-IV subtest Scaled Scores, Index and IQ scores. A three-way ANOVA, as described by Terre Blanche and Durrheim (1999), examined the differences between groups for quality of education, and post-hoc t-tests examined differences between each of the three pairs of groups stratified for first language and advantaged versus disadvantaged quality of education. In light of the multiple comparisons involved in the analysis the use of Bonferroni's adjustment to the level of significance was considered in order to reduce the chance of Type I error. However, the decision to make such an adjustment towards stringency needs to be balanced against the associated increased chance of Type II error. Due to the small sample size the present data analysis is already at risk for Type II error, and hence it was not considered appropriate to include Bonferroni's adjustment for the purposes of this preliminary exploratory norming study.

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3. RESULTS

3.1 Test results-: WISC-IV between groups comparison.

The results of the three-way ANOVA (Table 2), revealed a significant effect for quality of education for all Factor Indices and Full Scale IQ (FSIQ), as well as all subtests with the exception of Coding, Letter Number Sequencing and Cancellation. The differences are consistently in the direction of poorer performance for learners in Township/ DET schools versus learners, both Xhosa and English first language, across Private/ Model C schools. All significant results were at the $p < 0.01$ level, with the exception of the Processing Speed Index which was at the $p < 0.05$ level. It is of note that the analysis for Coding and to a lesser extent Letter Number Sequencing were approaching significance ($p = 0.154$ and $p = 0.350$ respectively).

3.2 Test results-: Full Scale and Index comparison

The post hoc t-test tests yielded three sets of comparisons with outcome as follows: The results of the t-test comparisons *for English first language Private/ Model C schools versus Xhosa First Language Private/ Model C schools (Table 3)* revealed a trend for the Xhosa speaking learners to perform lower than their English speaking peers. Significant differences were noticed on the Verbal Comprehension Index and Perceptual Reasoning Index with Verbal Comprehension Index $p = 0.003$ and Perceptual Reasoning Index's $p = 0.005$. The FSIQ also shows a significant difference with Xhosa speaking learners performing significantly lower than English speaking learners ($p = 0.001$). It was also noted that the Working Memory Index and Processing Speed Index scores did not show a significant difference between the two groups. The results of the t-test comparisons for *English first language learners versus the Xhosa speaking learners in Township/ DET schools (Table 4)* revealed significant differences for both Verbal Comprehension Index and Perceptual Reasoning Index showing a *p*-value of 0.000. Compared to this Working Memory Index ($p = 0.021$) and Processing Speed Index ($p = 0.034$) also showed a negative trend but not as strong as the other indices. Due to significant differences of the indices the FSIQ is also seen as significant ($p = 0.000$). The results for *Xhosa first language Private/ Model C schools versus Xhosa first language learners of Township/DET schools (Table 5)* reveals that

significant differences are only present for FSIQ (p = 0.004), Verbal Comprehension Index (p = 0.002) and Working Memory Index (p = 0.036). No significant differences were noticed for Perceptual Reasoning Index and Processing Speed Index.

According to this research, Township/ DET school learners scores in the Borderline range (FSIQ of 77.08), whereas the Xhosa speaking learners in the Private/ Model C schools score within the Average range (FSIQ of 93.92). In contrast to this English speaking learners in Private/ Model C schools score within the Above Average range (FSIQ of 112.83). Thus it is possible to state that a downward trend in WISC-IV performance is observed between English first language learners and Xhosa first language learners in Private/ Model C (advantaged schools), and a further downward trend between both of these schools and the Township/ DET (disadvantaged) schools.

3.3 Test results: Subtest comparison

It is noticed on the three-way ANOVA that Letter-Number Sequencing, Coding and Cancellation were the only subtests that did not reveal a significant difference across the three groups (p = 0.645, p = 0.156 and p = 0.103, respectively) (Table 2). In contrast significant differences are noted across the groups for all the other subtests, with verbal subtests showing the highest levels of significance for Xhosa speaking learners in Township/ DET schools followed by the Xhosa speaking learners in Private/ Model C schools to perform worse than their English speaking peers.

When English speaking learners are compared to Xhosa speaking learners in Private/ Model C schools (Table 3), it is observed that significant differences are present for Block Design and Vocabulary (p = 0.002 and p = 0.001 respectively) in a downward trend for the Xhosa speaking learners. Overall it is again apparent that there is a downward continuum of performance on the verbal subtests and the subtests for perceptual reasoning for the Xhosa speaking learners compared to the English speaking learners within the advantaged schooling system.

The above continuum is even more strongly in evidence when advantaged English speaking learners are compared with disadvantaged Xhosa speaking learners (Table 4). All the subtests are significantly lower for the Xhosa speaking disadvantaged learners with p - values ranging from 0.000 to $p = 0.011$. In the comparisons of Xhosa first language speakers from advantaged (Private/ Model C) and Xhosa first language speakers from disadvantaged (Townships/ DET) schools (Table 5) it is noted that the subtests Similarities, Information and Word Reasoning were all significantly different in the direction of the Township/ DET schools ($p< 0.01$) and Digit Span and Comprehension were also significantly different in the direction of a downwards trend for the disadvantaged group in contrast with the advantaged group ($p< 0.05$). The other subtests demonstrated no significant difference for this set of comparisons.

Table 2: Comparison of WISC IV performance for Grade 7 learners stratified for English First Language Private/ Model C versus Xhosa First language Private/ Model C versus Xhosa First Language Township/ DET schools.

Sub-tests	English First Lang. Private/Model C $n = 12$		Xhosa First Lang. Private/Model C $n = 12$		Xhosa First Lang. Township/DET $n = 12$		F-value	p-value
	Mean	***SD***	**Mean**	***SD***	**Mean**	***SD***		
Similarities	14.08	*2.353*	12.33	*2.348*	6.25	*3.571*	25.567	0.000 **
Vocabulary	13.75	*2.491*	9.08	*2.065*	7.08	*3.605*	17.958	0.000 **
Comprehension	12.92	*3.260*	9.58	*2.429*	6.50	*2.680*	15.635	0.000 **
(Information)	(12.67)	*2.49*	(10.25)	*2.498*	(5.58)	*1.881*	33.815	0.000 **
(Word Reasoning)	(12.75)	*2.633*	(10.67)	*2.774*	(6.75)	*1.765*	18.830	0.000 **
Block Design	11.83	*2.657*	8.33	*1.923*	6.42	*1.929*	18.759	0.000**
Picture Concept	11.67	*2.425*	10.00	*2.335*	7.67	*2.640*	7.940	0.002 **
Matrix Reasoning	10.75	*3.279*	8.08	*2.021*	6.58	*1.929*	8.642	0.001 **
(Picture Completion)	(11.92)	*2.906*	(9.42)	*1.240*	(7.42)	*3.059*	9.462	0.001**
Digit Span	11.42	*3.605*	10.42	*2.234*	7.25	*2.417*	7.149	0.003 **
Letter-Number Sequencing	9.25	*2.896*	9.83	*2.167*	8.17	*3.271*	1.083	0.350
(Arithmetic)	(11.58)	*3.370*	(9.08)	*2.503*	(7.08)	*1.505*	9.202	0.001 **
Coding	8.00	*2.663*	7.08	*2.644*	5.83	*2.725*	1.980	0.154
Symbol Search	10.75	*2.563*	7.33	*2.605*	6.92	*3.476*	6.260	0.005**
(Cancellation)	(12.50)	*2.970*	(10.92)	*2.353*	(10.08)	*2.678*	2.520	0.096
Verbal Comprehension Index	**120.92**	***14.755***	**101.33**	***10.120***	**80.42**	***13.588***	**29.256**	**0.000 ** **
Perceptual Reasoning Index	**111.67**	***18.097***	**92.75**	***7.569***	**80.83**	***11.207***	**17.051**	**0.000 ** **
Working Memory Index	**101.25**	***13.370***	**100.08**	***10.077***	**86.50**	***12.993***	**5.390**	**0.009 ** **
Processing Speed Index	**96.17**	***14.886***	**84.50**	***12.303***	**79.83**	***16.281***	**3.994**	**0.028 * **
Full Scale IQ	**112.83**	***13.169***	**93.92**	***5.854***	**77.08**	***13.787***	**28.950**	**0.000 ** **

Note: The additional subtests (indicated in parenthesis), are not calculated in the Index and IQ scores.
Significance: * $p < 0.05$; ** $p < 0.01$

Table 3: Comparison of WISC IV scores for Grade 7 learners stratified for Xhosa First Language Private/ Model C versus English First language Private/ Model C schools.

Sub-tests	English First Lang. Private/Model C *n* = 12		Xhosa First Lang. Private/Model C *n* = 12		Mean Difference	p-value
	Mean	***SD***	**Mean**	***SD***		
Similarities	14.08	*2.353*	12.33	*2.348*	1.750	0.329
Vocabulary	13.75	*2.491*	9.08	*2.065*	4.667	0.001 **
Comprehension	12.92	*3.260*	9.58	*2.429*	3.333	0.023 *
(Information)	(12.67)	*2.498*	(10.25)	*2.498*	2.417	0.033*
(Word Reasoning)	(12.75)	*2.633*	(10.67)	*2.774*	2.083	0.127
Block Design	11.83	*2.657*	8.33	*1.923*	3.500	0.002 **
Picture Concept	11.67	*2.425*	10.00	*2.335*	1.667	0.269
Matrix Reasoning	10.75	*3.279*	8.08	*2.021*	2.667	0.044 *
(Picture Completion)	(11.92)	*2.906*	(9.42)	*1.240*	2.500	0.069
Digit Span	11.42	*3.605*	10.42	*2.234*	1.000	0.688
Letter-Number Sequencing	9.25	*2.896*	9.83	*2.167*	-0.583	0.880
(Arithmetic)	(11.58)	*3.370*	(9.08)	*2.503*	2.500	0.073
Coding	8.00	*2.663*	7.08	*2.644*	0/917	0.706
Symbol Search	10.75	*2.563*	7.33	*2.605*	3.417	0.025 *
(Cancellation)	(12.50)	*2.970*	(10.92)	*2.353*	1.583	0.362
Verbal Comprehension Index	**120.92**	***14.755***	**101.33**	***10.120***	**19.583**	**0.003 ** **
Perceptual Reasoning Index	**111.67**	***18.097***	**92.75**	***7.569***	**18.917**	**0.005 ** **
Working Memory Index	**101.25**	***13.370***	**100.08**	***10.077***	**1.167**	**0.973**
Processing Speed Index	**96.17**	***14.886***	**84.50**	***12.303***	**11.667**	**0.163**
Full Scale IQ	**112.83**	***13.169***	**93.92**	***5.854***	**18.917**	**0.001 ** **

Note:The additional subtests (indicated in parenthesis), are not calculated in the Index and IQ scores.
Significance: * $p < 0.05$; ** $p < 0.01$

Table 4: Comparison of WISC IV scores for Grade 7 learners stratified for English First language Private/ Model C versus Xhosa First Language Township/ DET schools.

	English First Lang. Private/Model C $n = 12$		Xhosa First Lang. Township/DET $n = 12$		Mean Difference	p-value
	Mean	***SD***	**Mean**	***SD***		
Similarities	14.08	*2.353*	6.25	*3.571*	7.833	0.000 **
Vocabulary	13.75	*2.491*	7.08	*3.605*	6.667	0.000 **
Comprehension	12.92	*3.260*	6.50	*2.680*	6.417	0.000 **
(Information)	(12.67)	*2.498*	(5.58)	*1.881*	7.083	0.000 **
(Word Reasoning)	(12.75)	*2.633*	(6.75)	*1.765*	6.000	0.000 **
Block Design	11.83	*2.657*	6.42	*1.929*	5.417	0.000 **
Picture Concept	11.67	*2.425*	7.67	*2.640*	4.000	0.002 **
Matrix Reasoning	10.75	*3.279*	6.58	*1.929*	4.167	0.001 **
(Picture Completion)	(11.92)	*2.906*	(7.42)	*3.059*	4.500	0.001 **
Digit Span	11.42	*3.605*	7.25	*2.417*	4.167	0.004 **
Letter-Number Sequencing	9.25	*2.896*	8.17	*3.271*	1.083	0.645
(Arithmetic)	(11.58)	*3.370*	(7.08)	*1.505*	4.500	0.001 **
Coding	8.00	*2.663*	5.83	*2.725*	2.167	0.156
Symbol Search	10.75	*2.563*	6.92	*3.476*	3.833	0.011 *
(Cancellation)	(12.50)	*2.970*	(10.08)	*2.678*	2.417	0.103
Verbal Comprehension Index	**120.92**	***14.755***	**80.42**	***13.588***	**40.500**	**0.000 ** **
Perceptual Reasoning Index	**111.67**	***18.097***	**80.83**	***11.207***	**30.833**	**0.000 ** **
Working Memory Index	**101.25**	***13.370***	**86.50**	***12.993***	**14.750**	**0.021 * **
Processing Speed Index	**96.17**	***14.886***	**79.83**	***16.281***	**16.333**	**0.034 * **
Full Scale IQ	**112.83**	***13.169***	**77.08**	***13.787***	**35.750**	**0.000 ** **

Note: The additional subtests (indicated in parenthesis), are not calculated in the Index and IQ scores.

Significance: * $p < 0.05$; ** $p < 0.01$

Table 5: Comparison of WISC IV scores for Grade 7 learners stratified for Xhosa First Language Private/ Model C versus Xhosa First Language Township/ DET schools.

Sub-tests	Xhosa First Lang. Private/Model C $n = 12$		Xhosa First Lang. Township/DET $n = 12$		Mean Difference	p-value
	Mean	***SD***	**Mean**	***SD***		
Similarities	12.33	*2.348*	6.25	*3.571*	6.083	0.000 **
Vocabulary	9.08	*2.065*	7.08	*3.605*	2.000	0.231
Comprehension	9.58	*2.429*	6.50	*2.680*	3.082	0.035 *
(Information)	(10.25)	*2.498*	(5.58)	*1.881*	4.667	0.000 **
(Word Reasoning)	(10.67)	*2.774*	(6.75)	*1.765*	3.917	0.002 **
Block Design	8.33	*1.923*	6.42	*1.929*	1.917	0.118
Picture Concept	10.00	*2.335*	7.67	*2.640*	2.333	0.084
Matrix Reasoning	8.08	*2.021*	6.58	*1.929*	1.500	0.348
(Picture Completion)	(9.42)	*1.240*	(7.42)	*3.059*	2.000	0.171
Digit Span	10.42	*2.234*	7.25	*2.417*	3.167	0.033 *
Letter-Number Sequencing	9.83	*2.167*	8.17	*3.271*	1.667	0.361
(Arithmetic)	(9.08)	*2.503*	(7.08)	*1.505*	2.000	0.179
Coding	7.08	*2.644*	5.83	*2.725*	1.250	0.527
Symbol Search	7.33	*2.605*	6.92	*3.476*	0.417	0.941
(Cancellation)	(10.92)	*2.353*	(10.08)	*2.678*	.0833	0.750
Verbal Comprehension Index	**101.33**	***10.120***	**80.42**	***13.588***	**20.917**	**0.002 ** **
Perceptual Reasoning Index	**92.75**	***7.569***	**80.83**	***11.207***	**11.917**	**0.097**
Working Memory Index	**100.08**	***10.077***	**86.50**	***12.993***	**13.583**	**0.036 ***
Processing Speed Index	**84.50**	***12.303***	**79.83**	***16.281***	**4.667**	**0.738**
Full Scale IQ	**93.92**	***5.854***	**77.08**	***13.787***	**16.833**	**0.004 ** **

Note: The additional subtests (indicated in parenthesis), are not calculated in the Index and IQ scores.

Significance: * $p < 0.05$; ** $p < 0.01$

4. DISCUSSION

The current study was done to determine the role of quality of education on intellectual functioning in children. As indicated in the literature review, cross-cultural researchers indicate that quality of education might play a more significant role than the level of education (Manly, et al, 2004; Nell, 1999; Shuttleworth-Edwards, 2004). The findings of the present study serve to provide additional confirmation of this proposition, researched in respect of a cohort of Grade 7 South African English and Xhosa first language children from relatively advantaged versus relatively disadvantaged education. These were operationalised, respectively, as schooling from the traditionally white Model C/ Private school, and the traditionally black Township/ DET schools. Three comparative groups were targeted for investigation: English first language Private/ Model C, Xhosa first language Private/ Model C and Xhosa first language Township/ DET schools. These groups were equivalent for level of education (Grade 7) and for age (mean ages 13.0069, 13.1250 and 12.9097, respectively).

Results from a three way ANOVA that compared the three groups revealed that there is a significant difference for all subtests except for Letter-Number Sequencing (LNS), Coding (CO) and Cancellation (CA) (Table 2). In correspondence with the research of Shuttleworth-Edwards et al., (2004) in respect of adults on the WAIS-III, the learners in advantaged schools performed better than the disadvantaged group. Compared to the advantaged English and Xhosa speaking learners the disadvantaged group scored 35.75 and 18.92 points lower on FSIQ respectively. This trend was observed for the four indices as well, placing the disadvantaged school group in the mildly retarded range. This is of particular note because all participants were selected to achieve scholastically within at least the average range and had never failed a grade. From this it can be deduced that the quality of education plays a significant role in the performance of individuals on the WISC-IV. As noted, Coding, Cancellation and especially Letter-Number Sequencing were the only subtests not exhibiting significant difference between the three groups. It is proposed that this might change with a larger sample group.

In the two-way comparisons a number of noteworthy additional features are observed. In the comparisons between the English speaking and Xhosa speaking advantaged group (Table 3), in contrast to the WAIS-III data on Grade 12 adults from Shuttleworth-Edwards et al., (2004) where differences between these two advantaged groups was relatively minimal, a difference of 18.92 FSIQ points is noticed, with Xhosa speaking learners only scoring 93.92 on FSIQ compared to the 112.83 points of the English speaking learners. This is a much more pronounced lowering for the Xhosa speakers than identified by Shuttleworth- Edwards et al., (2004) where the difference was only 6.67 IQ points in favour of the Grade 12 white English speaking group. As expected the Verbal Comprehension Index is lower for the Xhosa speaking learners, but it is noted that both the Perceptual Reasoning Index and Processing Speed Index are also much lower than the English speaking participants. In contrast with this the Working Memory Index does not show as a big difference in accordance with Shuttleworth-Edwards' research. This indicated that verbal tasks are not the only ones influenced by the quality of education and that the Grade 7, as the Grade 12 Xhosa speaking learners in Private/ Model C schools still have a large disparity to meet in terms of their English speaking peers. The smaller difference in the WAIS-III research may indicate that it takes learners most of their high school years to benefit from the more advantaged education, and that by the end of primary school there is still a large amount of scholarship involved for them to perform equivalently on an IQ test.

An interesting result is noticed in terms of the Processing Speed Index. According to the current research white English speaking South African participants, compared to their US peers perform worse on this index, especially on the Coding subtest. This is in contrast with data from the WAIS-III research where they perform at an equivalent if not marginally higher level (Shuttleworth- Edwards, et al., 2004). A possible explanation might be that white South African learners at this age are not as speed orientated as their US counterparts. Another possible explanation may involve a phenomenon described by Cocodia, Kim, Shin, Kim, Ee, Wee and Howard (2003) as a decrease in learner motivation. The authors propose that current learners are more

prone to have shortened attention spans. This results in an increase in the need for entertainment in order to keep their attention. It is suggested that mundane tasks will thus not keep their attention, resulting in individuals performing poorly in the particular area. The authors state that this phenomenon has not, as yet, been researched in depth and propose that further studies might give a better idea of the interaction and other possible explanations for it (Cocodia, et al., 2003). It would be interesting to determine if this might have played a role in the stated poor performance and further research is recommended.

When the advantaged English speaking learners are compared to the disadvantaged Xhosa speaking (Township/ DET schools) learners, the difference in IQ performance is even more pronounced (Table 4). In this regard it is noticed that the disadvantaged group show a 40.5 difference for Verbal Comprehension Index and a 35.75 difference between the FSIQ of the two groups. It is thus clear that the Xhosa speaking Township/ DET schools fall far behind the English speaking Private / Model C schools. This demonstrates the wide disparity between the quality of schooling and intellectual functioning in the South African context. Once more it is noted that the Letter-Number Sequencing, Coding and Cancellation does not show a significant difference between the two groups in contrast with the other subtests and from this point of view may be considered relatively culture fair. As noted in the results section however, the difference for the Coding test approaches significance in the direction of $p = 0.156$ and with larger sample numbers might suggest that this test still favours children with more advantaged education, although to a lesser extent than all other subtests aside from Letter-Number Sequencing and Cancellation which do appear to elicit the most equivalent performance for learners regardless of their race and quality of education.

When the two Xhosa speaking groups are compared the tendencies are not as pronounced. According to the current research the Township/ DET schools score 77.08 on FSIQ compared to the 93.92 score of the Private/ Model C schools. It is noticed that the Verbal Comprehension Index is again the index with the biggest difference with the Township/ DET schools scoring 80.42 compared to 101.33 for the

Private/ Model C schools, a 20.92 point difference. This is followed by the Working Memory Index with a 13.58 difference. It must be highlighted that the Processing Speed Index and the Perceptual Reasoning Index does not reveal a significant difference in the current study. This is in contrast with the scores obtained by Shuttleworth- Edwards et al. (2004), showing that the difference between the indices and FSIQ to be in the vicinity of 20-25 points in favour of the Grade 12 Xhosa speaking learners in Private/ Model C schools relative to Grade 12 Xhosa speaking learners in Township/ DET schools.

It must be noted that the current study did not set out to determine causal factors for the difference between the three groups. However, as anticipated in the literature and previous research by Shuttleworth- Edwards et al. (2004) it became clear that quality of education plays a significant role in the demonstrated intellectual functioning of children who are ostensibly of fundamentally normal intelligence, as seen by the vast discrepancies in scores across the comparison of the three groups.

Of note is the fact that the differences between the Verbal Comprehension Indices across the three groups were still very high indicating that this index remains culturally biased. It was noted that the learners in the Township/ DET struggled with the Information subtest, and were unable to answer questions such as "What is a fossil?" and "Who was Christopher Columbus?". As indicated earlier, Information is one of the substitution tests for the Verbal Comprehension Index but care need to be taken when this subtests is used due to its biased nature.

Another subtest with potential implementation concerns is the Picture Completion subtest. It was indicated, by the test-subjects in the disadvantaged group, that some of the objects were foreign to them. This influences the score negatively as the subjects were unable to identify missing pieces as they are not familiar with the objects. As this falls outside the goal of the current research, it will not be discussed in further detail. It is also possible to substitute the particular subtest in order to boost the particular index and FSIQ score but further research around this point is recommended.

Shuttleworth- Edwards et al., (2004) cautions that quality of education cannot be seen in a causal relationship towards intellectual functioning. The author suggests that genetic factors may still play a role. It is proposed that parents with higher intellectual capacities may have had the opportunity to receive higher quality education resulting in better job opportunities and higher financial gain. Due to this, these parents may have the financial means to send their children to schools with high quality education. It may also be that the learners inherited the intellectual capacity from their parents that allowed them to perform better. However, the differences in attained IQ for the Grade 12 adult Xhosa speaking group with advantaged education is quite little compared to their white English speaking peers (as demonstrated on the earlier WAIS-III research), whereas the differences are quite substantial for the Grade 7 Xhosa speaking group with advantaged education compared with their white English speaking peers (as demonstrated on the present WISC-IV research). This strongly suggests that educational advantage is having a measure of causal influence on improving intellectual performance in the Xhosa speaking group over the span of high school, and that the differences seen between those with relatively advantaged and disadvantaged education cannot purely be attributed to differences in genetic endowment in the first instance.

In sum, this preliminary study suggests that quality of education plays a highly significant role in the intellectual attainment of Grade 7 learners on the WISC-IV test as indicated in the earlier research done on adults (Shuttleworth- Edwards et al., 2004), although the younger Grade 7 learners with advantaged education do not perform as well in relation to US standards as the Grade 12 participants in the earlier research, with the implication that many more years of exposure to advantaged education is needed than has occurred by the end of primary school. Of concern from a clinical perspective is that learners with a disadvantaged educational background are judged to fall within the mildly retarded range. This fact is alarming as the participants from the Township/ DET schools were all judged to be of an average academic standard and had never failed a grade before. The results thus show that practitioners must be especially careful in applying the US norms for learners falling in

this category since this could cause them to be misdiagnosed as cerebrally compromised or mentally handicapped and in need of special educational placement that would be inappropriate.

5. EVALUATION OF THE STUDY AND RECOMMENDATIONS FOR FUTURE RESEARCH

This study was carried out to determine the influences of quality of education on intellectual functioning as measured by the WISC-IV. The author is not aware of any published cross-cultural norming studies in respect of the WISC-IV that have been done within the South African context. The current research highlighted crucial information regarding the role of quality of education on intellectual functioning but it must be noted that the results must be used with care due to the small sample group used. Furthermore the results pertain only to an Eastern Cape English and Xhosa speaking Grade 7 population, and consequently, the results cannot be generalised to other language and race groups, or other age stages of individuals in the South African population as a whole.

It is acknowledged that there are severe limitations in terms of the lack of a formal translation of the test into the Xhosa language in terms of standardisation criteria. However, in the absence of any other data for clinical purposes, the data has important clinical applicability when used cautiously for the interpretation of test indications. Taken together with the earlier adult study for adults with Grade 12 on the WAIS-III, the present findings suggest that substantial IQ lowering of in excess of 20 points in association with relatively disadvantaged education, is a relatively robust finding, and probably can be broadly generalised to apply from Grade 7 through to Grade 12 learners being educated in the Eastern Cape DET/Township schools.

Another important issue to consider is the strong trend for a within groups difference for the two DET/Township schools in respect of IQ test performance, and it be acknowledged that some of these schools may be more or less advantaged and this needs to be taken into account when considering the interpretation of test results in an

individual case. However, it is not considered likely that any of these schools offers advantages that would bring the learner abreast with the resources available for the South African Private/Model C schools or those educational institutions pertaining to participants in the US standardisation. Therefore, the current norms can in broad terms be cautiously applied for Grade 7 individuals from any DET/Township school.

Indications for further research include the following:

1. It was noticed that the Processing Speed Index score for South African participants was much lower than the US sample. This was especially true for the Coding subtest and may be indicative of the current participants not being focused on speed as much as their US peers. In order to be sure this was not a sampling or chance effect specific only to the present research, this aspect requires further investigation with more and larger samples.

2. It was also noticed that Picture Completion was experienced as culturally biased within the South African context and further research is needed on item analysis on this test in order for clinicians to make the appropriate substitutions.

3. This study did not make use of substitution of core tests with alternative better-scoring tests, and future research might determine the extent to which substitution will influence indices and FSIQ scores positively.

4. Ardila (1996) states that if a specific cultural group obtains decreased scores on a neuropsychological test, it may be an indication that the test does not make use of tasks relevant for the group. In order to prevent this from happening, Ardila proposes that culture must be analysed from the inside. This might be useful when comparing the two Township/ DET schools used in the study. As the study used a small sample, the difference between the two schools was not significant enough to separate them. This might change with a bigger sample group and it is advised to determine possible differences in terms of the quality of education within such relatively disadvantaged school groupings as well.

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APPENDIX A

RHODES UNIVERSITY
DEPARTMENT OF PSYCHOLOGY

To: Headmaster / Headmistress

Re: Permission to conduct the Wechsler Intelligence Test for Children-IV (WISC IV)

Under the auspices of the Psychology Department at Rhodes University, two Intern Clinical Psychologists, under the supervision of Professor Ann Edwards, would like to request the permission to test ____ selected Grade 7 children from your school. The purpose of this research is to provide preliminary normative data on the Wechsler Intelligence Test for Children-IV (WISC IV) for Xhosa and English, first-language children. These data are important for use in professional settings in the South African context, because this frequently used IQ test is currently only standardized on American children whose first language is English.

As a result, we ask that your teachers help to select as many potential participants as possible, from which a final sample of ____ participants will be randomly selected An indication of the academic average of each potential participant is also necessary to ensure that the final sample is not skewed with respect to academic performance.

Criteria for selection are as follows:
Potential participants:
- must be either Xhosa or English first language speakers,
- must be currently between the age of 12 and 13 years old,
- must currently be in Grade 7,
- must have attended the school, or a similar type of school, since Grade 1[1]

To ensure that the final sample is representative of a normative population, children who have repeated a grade, or who have a history of any learning disabilities or psychiatric or neuropsychological disorder will be excluded from participation (for full exclusion criteria, please refer to the attached screening questionaire.

The researchers will assess the participants using the WISC-IV test, and have been trained in the administration and scoring of the WISC-IV by the project supervisor, Professor Ann Edwards, who is a registered Clinical Psychologist. These tests are regularly used by psychologists for placement and professional purposes, and their administration for research purposes is not considered to be invasive or harmful. Also, confidentiality is assured and no personal information will be disclosed. Only members of the research team will have access to the data, which will be stored in a confidential filing system by the supervisor at the Rhodes Psychology clinic. The data

[1] Due to the paucity of Xhosa first language participants from Private schools who fit this criteria, this criteria was subsequently changed to Grade 3.

may be used anonymously for research and publication purposes under the auspices of the Rhodes University Psychology Department.

No individual test results will be offered to the school, child or parent/guardian. However, should any of the individual data be required for professional purposes, it can be made available on request following consent from the child's parent or guardian. Such an event might occur, for example, if scholastic difficulties become apparent, or were a child to sustain a head injury at a later date, in which case information on the child's earlier cognitive ability would be useful. This is a potential benefit that would be available for those that participate in the research.

Participation will require signed consent from the headmaster or mistress of the school involved, as well as from parent or guardian in the case of each child. It is understood that participation in this research project is voluntary and a child can withdraw at any stage in the process.

Yours sincerely,

Phia van Tonder

Shayne Horsman

RHODES UNIVERSITY
DEPARTMENT OF PSYCHOLOGY
HEADMASTER/ HEADMISTRESS CONSENT FORM

I, _____ have been informed of the nature of the research which will be conducted on Xhosa / English speaking children in my school, by two Intern Clinical Psychologists, Shayne Horsman and Phia van Tonder.

I understand that:

1) The above-mentioned Intern Clinical Psychologists are conducting research to provide preliminary normative data on the Wechsler Intelligence Test for Children-IV (WISC-IV) for Xhosa and English first-language children, as a requirement for a Masters Degree in Clinical Psychology at Rhodes University.

2) The research will involve willing Xhosa / English first-language, Grade 7 children participants from your school. Participants will be assessed using the Wechsler Intelligence Test for Children-IV (WISC-IV).

3) Participation in the research is strictly voluntary. Individuals have the right to withdraw from the study at any stage.

4) The information collected on individual participants will be strictly confidential, with no personal information being disclosed. Access to this data will be restricted to members of the research team. On request, it may be accessed for professional purposes with parental/ guardian consent.

5) Data arising out of this project may be used anonymously for thesis and publication purposes.

Signed: _____ **Date:** _____

Name: _____ **E-mail:** _____

Address: _____

Contact Telephone Number(s):-

_____

APPENDIX B

To the Parent/Guardian

Re: Permission to conduct the Wechsler Intelligence Test for Children-IV (WISC IV)

Under the auspices of the Psychology Department at Rhodes University, two Intern Clinical Psychologists, under the supervision of Professor Ann Edwards, would like to request the permission to test your child. The purpose of this research is to provide preliminary normative data on the Wechsler Intelligence Test for Children-IV (WISC-IV) for Xhosa and English first- language children. These data are important for use in professional settings in the South African context, because this frequently used IQ test is currently only standardized on American children whose first-language is English.

The researchers will assess your child using the WISC-IV test, and have been trained in the administration and scoring of the WISC-IV by the project supervisor, Professor Ann Edwards, who is a registered Clinical Psychologist. These tests are regularly used by psychologists for placement and professional purposes, and their administration for research purposes is not considered to be invasive or harmful. Also, confidentiality is assured and no personal information will be disclosed. Only members of the research team will have access to the data, which will be stored in a confidential filing system by the supervisor at the Rhodes Psychology Clinic. The data may be used anonymously for research and publication purposes under the auspices of the Rhodes University Psychology Department.

No individual test results will be offered to the school, child or parent/guardian. However, should any of the individual data be required for professional purposes, it can be made available on request following consent from the child's parent or guardian. Such an event might occur, for example, if scholastic difficulties become apparent, or were a child to sustain a head injury at a later date, in which case information on the child's earlier cognitive ability would be useful. This is a potential benefit that would be available for those that participate in the research.

Participation will require signed consent from the headmaster or mistress of the school involved, as well as from parent or guardian in the case of each child. It is understood that participation in this research project is voluntary and a child can withdraw at any stage in the process.

Yours sincerely,

Phia van Tonder

Shayne Horsman

RHODES UNIVERSITY
DEPARTMENT OF PSYCHOLOGY
PARENT/GUARDIAN CONSENT FORM

I, _____ have been informed of the nature of the research which will be conducted on my child, by two Intern Clinical Psychologists from Rhodes University, Shayne Horsman and Phia van Tonder, and I hereby agree to the participation of my child in this project.

I understand that:

1) The above-mentioned Intern Clinical Psychologists are conducting research to provide preliminary normative data on the Wechsler Intelligence Test for Children-IV (WISC-IV) for Xhosa and English first-language children, as a requirement for a Masters Degree in Clinical Psychology at Rhodes University.

2) The research will involve willing Xhosa and English first-language, Grade 7 children participants from a number of Grahamstown schools. Participants will be assessed using the Wechsler Intelligence Test for Children-IV (WISC-IV).

3) Participation in the research is strictly voluntary. Individuals have the right to withdraw from the study at any stage.

4) The information collected on individual participants will be strictly confidential, with no personal information being disclosed. Access to this data will be restricted to members of the research team. On request, it may be accessed for professional purposes with parental/ guardian consent.

5) Data arising out of this project may be used anonymously for thesis and publication purposes.

Signed: _____ **Date:** _____

Name: _____ **E-mail:** _____

Address: _____

Contact Telephone Number(s):-

_____

APPENDIX C

Screening Questionnaire for potential participants

Date: _____

Name of participant: _____

Name of test administrator: _____

Mark with an X that which is applicable to participant:

Academic History:

- Has failed a grade at school ☐
- Is undergoing remedial teaching ☐
- Has a learning disability ☐

Medical History:

- Is on any medication for any reason ☐
  Please specify type of medication and reason for medication:
  _____
- Has any other neurological disorder ☐
  Please specify:
  _____
- Has epilepsy ☐
- Has previously sustained a head injury involving loss of consciousness and/or hospitalisation ☐
- Has any problems involving eyesight ☐
- Has any problems involving hearing ☐

Emotional well-being:

- Has depressed/irritable mood much of the time ☐
- Is presently seeing a psychologist / psychiatrist ☐