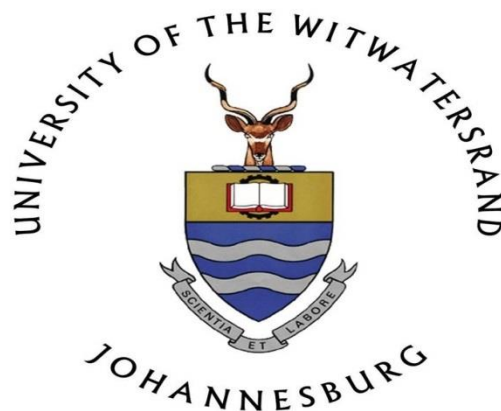


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**[TITLE: QUESTIONING THE
VALIDITY OF INTERNATIONAL
KNOWLEDGE FOR
UNDERSTANDING COGNITIVE
PROFILE FOR RURAL SOUTH
AFRICAN POPULATION]]**

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Abstract

Cognitive assessment tests that were standardised in the US and UK continues to be used to assess South African populations, and those that are standardised in South Africa are standardised using urban populations. These facts draw a question to the validity of the cognitive assessments when administered in rural South African populations. A test battery was conducted, containing WAIS-IV^{SA}, Stroop, Trail Making Test, Rey Osterrieth Complex Figure Test, Ray Auditory Verbal Learning Test, Controlled Oral Word Association Test, Wechsler Card Sorting Test, Logic Memory and One Minutes Maths. Construct validity of South African standardised test (WAIS-IV^{SA}) was therefore assessed with the use of Confirmatory Factor Analysis, and the results stipulated that the WAIS-IV^{SA} structure was not measuring what it is supposed to. Thus further analysis on individually selected measures was done. The effects of Language, Education, Age and gender were also assessed with the use of Spearmen correlation.

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Chapter 1: Introduction

Psychological assessment is a scientific study of behaviour and mental processes (Goldstein & Hersen, 2000) while Psychometric is the quantification of observing behavioural response for insinuating a mental process (Slovic, 1992). This study has rather focused on cognitive assessment which is a specific type of psychometric assessment. Cognition refers to the process whereby an individual acquires knowledge and understanding through perception and experience (Sparrow & Davis, 2000). This process of acquiring knowledge is characterized by mental abilities such as working memory, problem solving, reasoning, decision making and attention.

Systematic methods are used to assess these contrasts and one common approach is the norm referenced assessment (Davidshofer & Murphy, 2005) which will be used in this study. These cognitive assessment measures are developed for a specific purpose such as assessing a specific component of mental ability or a set of mental components that makes up intelligence. All cognitive assessment measures are required to be relevant to the particular group or society of interest as the normative information used to interpret test scores are limited to that particular group or society (Foxcroft & Roodt, 2009). Majority of these tests used in South Africa were developed for and standardized on homogenous populations of Europe and America. This specific standardization therefore raises the question of cultural biases and the validity of the test measures when used for a heterogeneous population of South Africa. South Africa has a diverse population which is far different from Europe and American populations, even tests that are standardised in South Africa should also be questioned as there is a vast difference between populations in South Africa. Practitioners thus cannot assume transferability of validity of standing knowledge cross-culturally. Using the same test on different sectors of a heterogeneous population is basically comparing two different populations and expecting the test to yield the same results. The differences of

cultures and societal influences that emanate from this do not allow such comparison, as the test may favor one population and discriminate against the other (Sparrow & Davis, 2000). The appropriateness of assessment measurement for other groups cannot be assumed without any investigation from other context without looking into possible test bias and without consideration being given to adapting or re-norming the assessment measure (Foxcroft & Roodt, 2009).

The above mentioned cultural bias fueled the anti-testing school of thought (Foxcroft, 2004). The anti-testing perspective disputes the idea of testing people and subsequently labeling as unethical (Cizek, 2005). Clarifying on this, Sacks (1997) characterizes psychological testing as a meritocracy's yardstick; he criticizes standardized tests and argues that cognitive assessment tests thwart rather than helping the educational improvement. Sacks (1997) further claims that more often than not standardized test scores tends to correlate with socioeconomic class. The counter argument however moves that testing is necessary for diagnostic purposes, directions for further interventions, for addressing specific learning barriers and for career guidance; to deprive sectors of the population from this information source could in itself be considered unethical.

It is unfortunate that in South Africa, published studies on test normantization and validity often focus on a single test rather than a more comprehensive cognitive profile. This diminished the quantity of available knowledge relative to the differential impact of these factors may exert across the spectrum of abilities.

This study therefore aimed to give insights across a large spectrum of cognitive abilities in a relatively remote rural population. Furthermore, to verify the inappropriateness of translating South African rural population results in accordance to international knowledge.

A sample was drawn from an Mpondo population resident in an isolated rural area of the Eastern Cape, South Africa. A comprehensive cognitive test battery was administered in an attempt to establish the broader cognitive profile characteristic of the population and to compare this group of 16 to 25 year olds with the internationally accepted normative group.

In South African there are high inequalities between the different populations, there still exists a large gap in academic quality and living standards (Foxcroft, 2004). Eastern Cape was identified as one of the provinces that are characterized by lack of infrastructure and poverty, and as the most deprived province (Noble, & Wright, 2013). The sample was drawn from an area called Bizana, this area is ranked in the third lowest level within Eastern Cape in terms of Provincial Indices of Multiple Deprivation (PIMD) 2001 (Babita et al., 2006). Noble, Barnes, Wright, and Roberts (2010) identified the five domains of deprivation as material deprivation, employment deprivation, health deprivation, education deprivation and living environment deprivation. They further identified that 100% of people in Eastern Cape fall under the top 25% of most deprived on two or more domains and as high as 27% fall under the top 25% of most deprived on all five domains (Noble et al., 2010). Hence this particular population was selected, for they have limited resources necessary for teaching and learning. Due to these predicaments researchers therefor need to accommodate for all these adversities where some are taught in high quality standards while others in low quality standards, and by not professionally trained teachers (Berg & Burger, 2003). As Reynolds (2013) said that these cognitive assessment tests are designed for people who are proficient in English, Mpondo population may not have this benefit as English was only introduced at a later stage of schooling.

Cognitive profile for this population was therefore established by converting the population raw scores into z-scores and comparing them to the international norms as well as South African urban population norms. The validity of the international knowledge was then

assessed through the use of confirmatory factor analysis (CFA) to assess the construct validity of the South African standardised test. Factor's loading was hence assessed to see whether tests load where they are supposed to load.

Chapter 2: Literature review

2.1 The field of cognitive assessment

South African psychology has a dubious history. Prior to the 1994 elections, due to the apartheid political policies, psychological assessments were only focused on whites and discriminated against other races (Terre'Blanche & Durrheim, 1999). This was despite the fact that people whom speak African languages covered the majority of the South African population (Blumenau & Broom, 2011). For example, between 1930 and 1940 the government administered a motor and reasoning test on a cross cultural population as the bases for establishing Bantu education (which was the 1953 education system for Black South Africans) (Foxcroft & Roodt, 2009). This assessment was only standardized for white children, and the results proved white children to be smarter than other races with blacks as the least smart (Foxcroft & Roodt, 2009). The misuse of the psychometric assessments led to the rise of anti-testing faction within the profession and legislation. A law in South Africa has been made by The Health Professional Act, Act 56 of 1974 that restricts the use of psychological assessments and that they may only be administered by registered professional psychologists.

However, given that it forms the foundation for diagnosis and intervention, psychometric assessment is integral to the practice of cognitive-neuropsychology. Although in the western world imaging has taken over from psychological assessment for the diagnosis of brain damage, in South Africa imaging services are limited. Local practitioners therefore use the psychometric assessment results to make assumptions of what might be seen in a scan. Cognitive assessment is thus an integral part to Cognitive Neuropsychology. It quantifies both the present function and lays foundation for rehabilitation programs in the likes of Traumatic Brain Injury (TBI), Acquired Brain Injury (ABI) and encephalopathy related to HIV-AIDS, specific barriers to learning among others. As mentioned, to deprive

specific sectors of the population from these assessments may be considered in itself bias. Unless one has an understanding of the available environmental opportunities and knows what is expected within a certain population, it becomes impossible to identify the strengths and weaknesses of the individual. As a result, Gregory (2004) emphasizes that psychology cannot attain certainty and accuracy of the physical sciences unless it relies on the basis of experiments and measures.

2.2 Cognitive assessment

Cognitive assessment is a standardized way of eliciting behaviour that is representative of specific abilities. Essentially, standardized tests ask different people to do the exact same thing in the same way, which gives us the basis for comparison (Foxcroft, 1997). One should remember that any higher cognitive function is not based on an isolated trait, it consist of a number of basic traits which are susceptible to cultural malleability (Rushton & Jensen, 2005) hence a test battery is more essential and effective.

There is substantial evidence that supports the notion that Verbal Comprehension, Working Memory, Perceptual Reasoning and Processing speed best characterises intelligence scales (Holdnack, Zhou, Larrabee, Millis & Salthouse, 2011; Weiss et al., 2013). Thurstone (in his Multiple Factor Theory), Spearman (in his Two-Factor Theory) and Sternberg (in his Triarchic Theory of Intelligence), in their theories, provided the seven components of cognitive functioning namely; working memory, word fluency, perceptual speed, verbal comprehension, number, perceptual speed ability and spatial relations and visualizations (Foxcroft & Roodt, 2009; Walsh & Betz, 1995). The point is that tests ostensibly directed at measuring these components of cognitive functioning may be achieved or retarded for different reasons. Therefore no test of higher cognitive functioning is exclusively reliant upon

a single skill. For advanced cognitive profiling, a comprehensive neuropsychological battery is necessary to assess the full range of cognitive functioning.

In psychological assessment there are two types of tests, verbal and non-verbal tests. Previously non-verbal tests were thought to be culturally fair; however there are some skills that may be more familiar to one culture than the other. Certain environments may facilitate increased practice of certain classes of task. Thus, the same demographic variable that threatens the validity and reliability of verbal tests may also impose a threat on non-verbal tests. According to Foxcroft and Roodt (2009) factors that impact on cognitive skill include educational and economic opportunities and many more, while Lev Vygotsky, Albert Bandura and Jerome Bruner, in their theories, put emphasis on the influence of environment and social interactions. Thus any undesirable impact from these nitty-gritties may impact on cognitive test performance, creating intellectual and cognitive limitations.

Factors such as age and gender should also be taken into consideration when conducting psychological tests for the reason that biological differences and cognitive development impacts on cognitive test performance. In view of that, age, gender and education are important for making decisions on how extreme score are in a given population (Elias, Elias, Agostino & Wolf, 1996).

2.2.1 Non-verbal tests

Non- verbal test do not use words to elicit behavior and to assess cognitive skills, but are rather tests that may involve drawing, solving puzzles and arranging patterns. Non-verbal tests assess the ability to analyze and reason by using hands or visual reasoning, as well as the level of education that has impact on cognitive development.

Just as it is expected for the performance to improve with maturity across populations, majority of non-verbal test studies have proved that age affects test performance and strategies of performance. This may be due to lack of equipment or other practice opportunities. Depending on the test being administered, it is evident that the performance increases and declines at particular ages.

Although educational level has a great impact on cognitive abilities, some studies (Shuttleworth-Edwards, Kock & Radloff, 2015) reported that there is little effect made by education level on test performance and some (Rhodes, 2004) reported a significant effect. Shuttleworth-Edward al., (2015) argues that the effect of education may be more pronounced within certain parameters such as in elderly and minority populations.

The impact of gender on test performance would suggest that there are variances in certain skills between males and females. Although this may be somewhat obscure, culturally, some societies may not allow girls and boys the same opportunities, so this would mediate any gender differences. In many studies the effect of gender is noted as being controversial, as others find males perform better than females and vice versa and others find results too small to be considered. In a study conducted by Shuttleworth-Edwards et al (2015) it was reported that there was no significant difference between the two sex, even after they have stratified the sex into age groups.

2.2.2 Verbal tests

Verbal tests are those that use audible strategies of testing They use constructs framed in words to assess traits such as verbal comprehension, verbal reasoning and fluency and understanding (Gregory, 2004). It is environmentally expected for language to mature with age (Kharkhurin, 2008). Evidence is given from the fluency study in which reported that fluency increases with age and that older child had larger number of semantic clusters

(Brickman et al. 2005; Koren, Kofman & Berg, 2005). Koren et al., (2005) stated that children who have not yet developed organizational skill would be expected to be less proficient in switching category of word fluency. Brickman et al., (2005) reported that those with higher education performed better and that there was no significance between the sexes.

2.3 Cognitive assessment in South Africa

When addressing the issue of test reliability and validity for the multilingual and multicultural South African society, there are three choices that emerge. At the great expense and the risk of losing the added value of international knowledge, local professionals could choose to develop new tests directed at the local population. They could choose to adapt standing measures to reflect the local culture or they could choose to re-normalize existing measures to ensure that the individual being assessed has had the same opportunity, motivation and orientation towards the test material as the comparative standard (Foxcroft & Roodt, 2009; Hambleton, Meranda & Spielberg, 2005).

Cognitive assessment in South Africa follows the international trends (Vijver & Rothman, 2004) and approximately 95% of the neuropsychological assessments are conducted in countries that only contain 12% of the world population (Chiao et al., 2013). Psychological assessment in South Africa is very much rooted in the European and United State culture, as it was colonized by the British who introduced psychology (Foxcroft & Roodt, 2009). Although the WAIS-IV (which will be used in this study) was standardized against the Western paradigm, given the heterogeneous population of South Africa we still question the idea of a South African norm as reality and whether this may lead to misdiagnosis in certain population groups.

Although 21 years in democracy, some parts of South Africa are still suffering from the consequences of apartheid and there is still enormous gap when it comes to socio economic

Status and level of education. Even though it is said that this generation is benefiting from “supposedly” equal educational opportunities, the reality is that this is not entirely true for the entire country. This is made explicit in the quintile divisions of schools. Therefore when conducting cognitive assessment tests in South Africa; multicultural and multilingual South African societies must be taken into consideration.

2.4 Education and language in South Africa

As South Africa is a polyglot society, it makes it difficult to leave out variety of factors when conducting an assessment measure. Language in South Africa is such that we have eleven official languages, but legally matric examination can only be written one of the two languages which are Afrikaans and English. In 1997 the “apartheid language” policy was replaced with the new policy based on the “non-discriminatory” language use, and this was intended to assure pupils proficiency in another language (Heugh, 2000). The use one language almost exclusively for one life area (school) and one for another life area (out of school) may lead to contextually specific language usage. This complicates the choice of testing in the home language versus the language of education as the preferable answer may be different dependent upon specific test content (Watson, Davies & Foxcroft, 2006). In this project we focused specifically on the problems inherent in the multicultural and multilingual South Africa and to do this we drew specifically on the problem as inherent in a pure culture. Without understanding how language impact on cognition it is difficult to do this, in this lies in test-don’t-test argument. Because cognitive assessment tests are developed in Western societies they are designed to be administered in English. The population in this area writes matric in English, this makes it important to look at the cognitive profile as this taps into language proficiency.

2.5 Validity of cognitive assessment tests

As mentioned above running a test that is not equivalent across cultures runs a risk of giving false results hence leading to misdiagnosis. Despite the large evidence that culture has an impact on cognitive performance, psychological tests still continues to be administered (Norman et al, 2011). Every test needs to be consistent and accurate. As the purpose of this study was to assess whether the American norm can be used when assessing South Africans, factors that impact on validity should be considered. The traditional conception of validity was criticised for failing to acknowledge the value of implications on the meaning of scores and consequences of social use of the scores (Messick, 1995). This criticism gave birth to a redefined validity which now considers the integration of content and criterion validity to construct framework for empirical testing on meaning of scores and theoretically relevant relationship (Messick, 1995).

Performance on psychometric tests revolves around the degree to which the content of the test is relevant to the behavioural domain of the representative sample, whether it predicts the future behaviour or performance of an individual, and also, it evaluates if the measure discriminates against the relative development and skill capacity between individuals. Furthermore, the accuracy of a measure relies on whether the standardised test can be generalised across cultures. This is especially important in that the current debate circles around the dispute of whether South Africans can be assessed based on American constructs (Foxcroft, 2004).

Foxcroft and Roodt (2009) define construct validity as a quantitative, statistical procedure that measures the extent to which a test measures the theoretical construct it is supposed to measure. Discriminant validity refers to the extent to which there is no

relationship between the measured variable and other measured variables that are designed to assess different conceptual variables (Stangor, 2011). The capacity with which a psychometric measure diagnoses depends on discriminant validity. For example, will an individual with a lesion in a specific brain region perform significantly differently from someone who does not have a lesion. It is important for one to consider the implications of clinical decision making when it comes to the argument as to whether American norms should be used to assess South Africans or whether tests should be standardised in accordance to South African customs. Here we have looked at the norm standards to comment on whether a specific test could identify a relevant deficit.

3. Research problem

Cross-cultural transferability is problematic because of different cultural backgrounds. Test items may not translate the same meaning across cultures and as a result will lead to fair or unfair discrimination (Owen, 1996). In this case, it has been investigated if the items will serve the purpose of which it was intended for. The use of Euro-American standardises norms discriminates against the cultural practices of South Africans, it may be of value to include the idea that for a norm standard to hold validity one must ensure that groups have had the same environmental opportunity and motivation to acquire the skill under examination.

3. Rational of the study

The tests that have been developed in the Western societies were primarily designed to be administered in English. Although South African learners are educated and examined in English in most areas, it is no guarantee that they are proficient. Given the contrast of languages between the societies, we can identify that the culture and environmental impacts differ as well. For these reasons this study is tried to investigate whether low performance on

the tests may not be caused by little capacity or may be due to that fact that the test is assessing a skill that is not a part of one's culture or part of daily life. In other words we have investigated factors that may impact on the scores so that we could understand what the scores represent. We needed to know with one's background how does the average person perform, and in that way the basis for comparison is formed.

4. Research question

- I. What is the cognitive profile of Mpondo population?
- II. Can results of Mpondo population be interpreted in terms of international knowledge?

5. Aim

It is important to demonstrate the need to adapt and use appropriate norms and procedures for a specific population, as well as when interpreting the obtained neuropsychological results. The intention of this study is to establish the cognitive profile in a reasonably homogeneous group of rural dwelling Xhosa speakers. This population supposedly have access to the privilege of the new dispensation, but due to the lack of access (both distance and amenities) to South African diversity or opportunity, are still at a disadvantage. Also, to examine the validity of the international knowledge when interpreting the cognitive profile of this group and to provide a comparative standard for a healthy rural Mpondo group aged 16 to 25.

Chapter 3: Methods

This was a quantitative study in which inferences were drawn from using numerical and statistical points of view. Quantitative research is a descriptive research in which data is subject to systematic observations and a formal statistical analysis (Stangor, 2011; Wilson & MacLean, 2011). This method is useful for a number of reasons; first it allows us to analyse the connection between variables or characteristics (Stangor, 2011), secondly, it allows us to make measurable predictions using our data, and thirdly it is useful for studying large samples.

3.1. Sample

Participants were accessed through Iqangi project, a project which runs summer school in the area to promote learner proficiency in English, Maths and Science, and they helped to recruit volunteers. We had a sample of 68 males and females, between the ages of 16 and 25. The prerequisites for being our participants was to be able to speak, read and understand English, to be in school or have finished school. Volunteers who were disqualified were those that did not fall under the age range, could not understand English, have a chronic disorder or previously diagnosed of such, and who are taking any chronic medication or having been for the past six months. Participants were given refreshment as well as remuneration of thirty rand airtime.

Because of the long distances between the villages, and a small population within a population, and also because the schools were closed, it was difficult to get volunteers. Hence we used non-probability sampling. Our sampling method was purposive in nature as we approached it with a specific purpose (Maree, 2007). As seen above our plan was to have participants who can speak English and were currently in school or finished school. Also, because we needed people who were readily available, we used convenient sampling.

Although it may not give a representative sample it was suitable for it allowed us to access participants easily and getting a proximal number of participants (Stangor, 2011; Maree, 2007).

There were a number of reasons for selecting this type of a sample. We selected this age group because they would have all benefited from the post-apartheid legislation of the “supposedly” equal educational opportunities. The idea of this equal educational opportunity is somewhat misleading. Several factors that label this as the urban versus rural opportunities would be the quintiles and facilities available for education, and the two prescribed languages for writing examinations.

Based on these factors we selected this population as it was in a reasonably isolated area. One of the factors that impact on the psychological cognitive performance is the degree of acculturation. The fact is that as soon as you go closer to towns you get varying degrees of acculturation and a mixture of cultures. This is because of things like exposure to things such as television and radio. We acknowledge that these tests may be culturally biased. This area was selected did not have access to electricity and the closest town where one could buy groceries was about two hour away on a 4x4 vehicle. Because of lack of electricity, limited travel and no or minimum exposure to television it was said that the western influence was minimal. So therefore the degree of acculturation in this population was expected to be minimal in comparison to other populations groups in this country.

Lastly, as we knew that being raised in a multilingual situation results in neuro plasticity and as such raised some questions about neurological organisation underlying cognition. Given what was said about the isolation of this community it was believed that these factors were minimal in this population in comparison to other populations. This population was a reasonably a pure society, reasonably linguistic pure and a representative

of the legislation that we have eleven official languages, but a limitation to educational languages. This research was therefore intended to investigate the cognitive profile that resulted in this population relative to their second language learning situation.

People from the age of sixteen were tested because the new South African adult WAIS-IV^{SA} test, which is a measure of intellect for the mixed South African population, starts at sixteen. The cut off age was twenty five because we wanted a sample of “new” South Africans, meaning that their full educational impact started in the new South Africa as the new syllabus was introduced in 1996. Therefore this sample was expected to provide us with some flexibility across educational level as we include both those who were still in school, those who have finished school and those who dropped out of school for specific purposes.

The exclusion criteria include history of brain injury, serious learning disabilities and other serious illnesses. The inclusion criteria include participants whom were between the ages of 16 and 25, who were currently in school and those that finished school, and those who understands and can speak English. Even though the population predominantly speaks Xhosa our sample was introduced to English at a later stage of childhood. This was facilitated by an introduction to English as a medium of instruction in grade 4, this therefore characterises our participants as unbalanced bilinguals. The exclusion criterion was thus imposed during the screening of participant. They were evaluated subjectively as to whether they met the requirements of English proficiency.

3.2 Instruments

As a test battery was conducted a number of tests were run, and all participants had to complete all the tests. These tests assessed factors such as verbal fluency, memory, perceptual reasoning, speed, attention and concentration.

3.2.1 Demographic questionnaire

The demographic questionnaire took approximately 15 to 20 minutes. It was used to gather information from participants pertaining their language, ethnicity, age, gender, academic history and living status. It included exclusion criteria which asked participants to report any history of brain injury, if they are on chronic medication and how long they have been using the medication, and if they have any other medical or health problems. The demographic questionnaire incorporated both the Language Experience and Proficiency Questionnaire (LEAP-Q) and Acculturation questions.

The (LEAP-Q) was intended for the use of adult and adolescent bilinguals and multilingual with varying language experiences and proficiency levels (Marian, Blumenfeld, & Kaushanskaya, 2007). It was authorised for use with individuals who have achieved literacy skills comparable to high school education or advanced in at least one language (Marian, Blumenfeld, & Kaushanskaya, 2007). This section of the demographic questionnaire was comprised of arrangement of open-ended, forced-choice, and likert-type scale responses. In order to expand inclusive understanding into the specific cognitive and linguistic profile, the LEAP-Q focused on the context of acquisition – including sources of attainment, current language use and preference as well as proficiency evaluations across areas involving verbal discourse, semantics, and reading. This questionnaire was administered by administrators that were fluent in Xhosa as it was anticipated that participants' would require elaboration or an explanation of certain questions or concepts within the questions.

The acculturation section focused on factors that expose our participants to Western cultures. Factors such as the availability of television, radio, books cell phone and newspapers were included.

3.2.2 WAIS-IV

Wechsler acknowledges that intelligence is composed of qualitatively different abilities (Weiss, Keith, Zhu & Chen, 2013). WAIS-IV is the most recent version of the Wechsler Psychometric test batteries (Benson, Hulac & Kranzler, 2010; Canivez & Watkins, 2010) internationally; it was standardized in 2008 for age 16 to 90 and was only released in 2014 in South Africa (Lichtenberger & Kaufman, 2009). WAIS-IV is a commonly used adult and adolescent's intelligent scale (Canivez & Watkins, 2010; Weiss et al, 2013) used for assessing general cognitive functioning.

3.2.2.1 Verbal comprehension Index (VCI)

The VCI which is designed to measure verbal acquired knowledge and verbal reasoning (Poyau, 2013) consist of four tests which are Similarities, Vocabulary, information and Comprehension. VCI is one of the components that are deemed as one of the factors that make up intelligence. This test is believed to measure pure verbal ability that is free from influence of auditory attention and concentration (Poyau, 2013) and it also assess the ability to listen to a question, to draw from learned information, how the participant gives reason to the response and how they verbally express their thoughts.

Similarities (Sim) measures abstract verbal reasoning, verbal concept formation ability to form associations and the ability to classify concepts (Cockcroft, 2013). It consists of 16 verbal items that are paired, and the participant is required to give the similarities of the paired words. *Vocabulary* (Voc) test measures the degree in which one has learned and has the ability to comprehend and verbally express vocabulary. This test consists of 30 words that has to be defined separately without context (Poyau, 2013). *Information* (Info) test consist of 26 items that are used to measure general knowledge of history, art, culture and politics (Poyau, 2013). Lastly, *Comprehension* (Info) test is a verbal subtest that is used to

measure the ability to deal with abstract social conventions and everyday practices (Landman, 1997). It consist of 18 problem questions that assess social and logic reasoning, long term memory, orientation towards reality and general knowledge (Cockcroft, 2013).

3.2.2.2 Perceptual Reasoning Index (PRI)

PRI assess the ability to reason through non- verbal information using fluid reasoning and non-verbal concept information, visual perception and organisation, and visual motor coordination (Poyau, 2013). It consists of subtests which are Block Design, Matrix Reasoning, Visual Puzzles, Figure Weights and Picture Completion. Skills in these test helps one to recognise patterns of mental pictures that are critical in solving word problems (Poyau, 2013).

Block Design (BD) consists of items that assesse spatial visualisation ability and motor skills. The participant is required to rearrange the printed blocks using between 4 and 6 blacks to form various patterns. This test evaluates visuospatial problem solving, visuospatial analysis and construction, visual perception and organisation, planning logic reasoning, visuomotor coordination, and sustained attention (Cockcroft, 2013).

Matrix Reasoning (MR) is usually used to measure fluid intelligence which is the capacity to think logically and give reason in a unusual situation. It consists of 26 problem in which a participant has to look at incomplete matrix and to select from a list of options a pattern that will complete the matrix. *Visual Puzzles* (VP) this test measures nonverbal reasoning and the ability to analyse abstract stimuli. This test consists of 26 problems in which a participant has to reconstruct a puzzle by selecting three response options, and the participant is required to complete the puzzle, with in a given time frame. *Figure Weights* (FW) assesses quantitative and analogical reasoning which refers to the ability to transfer meaning from particular subject to the other. FW consists of 27 problems that require the

participant to balance a scale by selecting an option to complete a scale that has missing weights. Each problem has to be completed within a given time frame. *Picture Completion* (PC) test measures visual perception, visual recognition and concentration. The participant has to identify a missing piece in a picture, there are 24 pictures and each has to be solved within a time frame.

3.2.2.3 Working memory Index (WMI)

WMI is related to fluid intelligence and is said to be implicated in learning and attention (Egeland, 2015). This index assesses the ability to store and retrieve audio information by storing new information and retrieving it from short term memory. WMI has three subtests which are Digit Span, Arithmetic and Letter Number Sequencing.

Digit Span (DS) measures memory, cognitive flexibility and attention. It consists of three trials: 1) Digit Span Forward, participant has to recall the numbers in a sequence they were read by the administrator. 2) Digit Span Backwards, the participant has to say the numbers in a reverse order they were read by the administrator. 3) Digit Span Sequencing, the participant has to say the numbers that are read in an ascending order. Each trial has 8 problems to be complete. *Arithmetic* (A) measures the long term and short term memory, as well as attention and concentration. The participant has to solve a series of arithmetic problems mentally. There are 22 problems and each problem has to be complete within a specific time frame. *Letter Number Sequencing* (LNS) measures memory span, attention and concentration. The participant is required to read numbers and letters in a sequence, the numbers has to be in an ascending order and letters has to be said in an alphabetic order.

3.2.2.4 Processing speed Index (PSI)

PSI is one of the four indices on the WAIS-IV^{SA}, and it is also one of the factors that make up the component of intelligence. This index consists of three subtests which are Coding, Symbol Search and Cancellation.

Coding (C) measures processing speed and short term visual memory. Participants are required to copy symbols that are paired with numbers and this exercise is timed. Symbol Search (SS) measures information processing speed and visual perception. On this sub-test the participant is asked to mark either yes or no in a box and to do this as soon as possible. Cancellation (Can) this test also measures processing speed, and the student is required to scan structured arrangement of shapes and mark target shapes.

3.2.3 Rey Osterrith Complex Figure (ROCFT)

The ROCFT taps into Visiospatial constructional ability, visual memory and executive functioning (Strauss et al., 2006; Caffarra, Vezzadini, Dieci, Zonato & Venneri, 2002). Particularly for this research executive functioning and memory were of the main concern. The task was comprised of two conditions; initially the participant was given a complex Figure to copy and then after a 30 minute delay the participant was required to draw on incidental memory to replicate the figure. The final product was scored based on the location, accuracy and organisation of the individual features on the figure.

For the first task four colouring pencils were used. The coloured pencils were switched just at about the equal points in the construction of the figure. Every time the participant completed a section of the drawing the administrator gave the participant a different coloured pencil. 30 minutes later the second task was administered in which the participant was asked to draw the figure from memory.

It is said that spatial perception varies from culture to culture, and it has been shown that Rey-Osterrieth Complex Figure results vary according to the cultural context (Bossuroy, Wallon, Falissard & Moro, 2014; Rossellia & Ardila, 2003). This test is therefore ideal as the aim of this research is to see how Mpondo sample differ from urban population.

3.2.4 Rey Auditory Verbal learning (RAVLT)

This test was used to assess memory on individuals. It was adapted for individuals between the ages of 6 and 89 years. The test was originally in French and was later on adapted for English speaking individuals and other languages as well (Strauss et al, 2006). RAVLT is one of the most widely used word learning and memory tests both internationally and in South Africa (Blumenau & Broom, 2011). It provides insights into immediate memory span, transfer and recall for long term memory, new learning, and susceptibility to interference and recognition memory, (Strauss et al, 2006; Burg & Kingma, 1999; Bezdicek et al. 2014). The advantage of RAVLT is that in many aspects of performance it may provide clinically relevant information such as the words recalled, errors made, and the sequence of recalled and repeated words, the steepness or flatness of the learning curve and the delayed recall performance (Burg & Kingma, 1999).

According to Strauss et al (2006) age affects the RAVLT scores, as well as gender, educational level and acculturation. A study conducted in South Africa also revealed the impact of language differences on test performance (Blumenau & Broom, 2011). Based on this we used the South African learning list.

RAVLT is a simple administered test which only takes about 10 to 15 minutes (Strauss et al, 2006). It consist of two stages; in the first stage a list of 15 unrelated nouns was read to the participant, with immediate recall of the words expected, then, in second round there was a delayed period of about 20 to 30 minutes before the participant was

requested to recall the initial list without reading it again (Burg & Kingma, 1999; Strauss et al, 2006). The test was scored based on the number of words recalled per trial.

3.2.5 Trail Making Test (TMT)

TMT assess visual search, scanning, attention, and speed of processing, executive functioning and mental flexibility (Strauss et al, 2006; Tombaugh, 2004) however for this research it is used to assess speed. It consists of two parts, Trial A and Trial B. In Part A the participant had to make a trail starting from 1 to 25 without lifting the pencil. Then in Trial B they had to do a trail but this time they alternated between numbers and letters (Kortee, Horner, Windham, 2002). It took 5 to 8 minutes to complete the test including the practice trials (Strauss et al, 2006). The scores on each stage represented the time that the participant took to complete the test (Tombaugh, 2004) and this time is expressed in seconds. Time in Part B was recorded as an increase in percentage from Part A. Number of errors for both Trail A and Trail B were also recorded.

There is a little impact by gender on performance in adults (Strauss et al, 2006). In a study conducted by Reitan (1971) no significant differences was found between the performance of boys and girls, while in the study conducted by Tombaugh (2003) performance decreased with an increase of age and lower levels of education. Culture and language also has an effect on test scores (Strauss et al, 2006). A t-test for independent samples was done so to see as to whether there is a difference between Mpondo males and females, another test that was ran was Spearman correlation between demographic variables (Age, Language and Education) and cognitive assessment test variable.

3.2.6 Controlled Oral Word Association Test (COWAT)

COWAT assesses the efficiency of semantic (words that belong to a certain category such as animals) and phonemic (of which a participant has to generate words orally that begins with a given alphabet) verbal fluency (Ross et al. 2005). It determines neurocognitive ability such as everyday verbal communication and monitor language development in children (Loonstra, Tarlow, & Sellers, 2001).

This assessment requires quick and organized word retrieval; the sum of words produced across each of three 60-second trials is calculated (Ross et al, 2005). For the Phonemic Fluency the participant is told a letter of the alphabet then he or she must say as many words that begins with that letter as quickly as he or she can. For each letter the participant is given 1 minute. For the purpose of scoring, all words will be written down including the ones that were repeated. The total score is the sum of all admissible words for the letters, excluding repeated words although they may be quantified as a measure of self-monitoring.

For the first trial, the participant was given a letter B and asked to say as many words starting with L in English. For the second trial they were given letter L and asked to give words that begin with the letter in vernacular. In the last trial the participant was asked to give a grocery list in both English and vernacular. The words said by the participant were written in the order they were produced for scoring purposes. The total correct is the sum of all admissible words for the semantic category.

3.2.7 Wisconsin Card Sorting test (WCST)

This test measures the ability to form abstract concepts, to shift and maintain set, and to utilize feedback (Strauss et al, 2006), it is one of the tests used of frontal lobe function

(Barcelo´ & Knight, 2002). There is a moderate correlation with education and IQ, while the test performance improves steadily between the ages of 6 and 19 as the pre-frontal lobe matures with age. The difference between males and females was examined using a t-test for difference and the effect of demographic variables was examined using a Spearman correlation between demographic variables and WCST outcomes.

WCST contain four stimulus cards, all placed in front of the participant. The first card has red triangles, the second one has two green stars, the third card has three yellow crosses and the fourth card has blue circles. The participant is given two packs each containing 64 response cards which have similar designs to those on the stimulus cards, they differ in colour, geometric form and number. This test was scored based on six outcomes which are Category Complete, Concept Level Response, Errors, Perseverative Response, Perseverative Error and Failure Set.

Category Complete indicates the total number of correct principles sorted, and credit is only given to the participant when they have 10 consecutive matches. Concept Level Response measures the participant's insight into the correct sorting principle and this outcome is based on consecutive responses occurring in runs of three or more. Error measures the errors that a participant made throughout the test while Perseverative Error measures the number of repeated errors. Lastly Failure Set accounts for the inability to complete the categories.

3.2.8 Stroop test

Stroop test as an executive functioning test was used to measure attention and cognitive flexibility. The Stroop effect is defined as a human failure to attend selectively to a single aspect of stimulus (Eidels, 2012). It measured cognitive control, which assessed the ease with which a person maintained a goal in mind and suppressed a habitual thought in favour of an unfamiliar one (Strauss et al. 2006).

All four trials of Delis-Kaplan version were used. For the first trial the participant asked to name the colour of the item; this is called the Colour-Naming trial. For the second trial the participant had to read the word written and this trial is referred to as the Word Reading trial. Then followed the Colour-Word interference trial in which the participant had to name the Colour of the words while ignoring the printed word. Lastly, the Switch trial, the participant had to name the colour of the ink and not read the word. For all trials participants were required to complete the trial as quick as possible.

3.3 Procedure of collecting data

Sixteen professionally trained post graduates administrated the tests. They were split into groups of four according to the Latin Square design as to minimise the effect of fatigue across the test battery. The four members were split in a way that the first tester administered the biographical questionnaire which was designed to include the LEAP-Q and acculturation questionnaire. The same administrator (tester1) administered the drawing of the person and the bicycle, and the Controlled Oral Word Association Test (COWAT). The second administrator administered the Wechsler Adult Intelligence Scale- Fourth (WAIS-IV) core test; the third administered WAIS-IV additional and the motor tests. The final administrator administered the Ray Auditory Verbal Learning Test (RAVLT), Ray Osterrieth Complex Figure Test (ROCFT), Stroop test, Trail Making Test (TMT) and Wisconsin Card Sorting Test (WCST). Each test battery took about four hours. The day was started at 08:30 until 12:30; which allowed the team to gather the test protocols from 16 individuals. On completion of the morning session the team as well as participants took a lunch break. In the afternoon only two groups of administrators worked and therefore N = 13 to N = 14 participants were tested each day giving us a total of N = 68 Participants

3.4 Data analysis

Description of the sample was presented by mean and standard deviation of Age, years of Education and Language Proficiency (percentage of English spoken at home, with friends and at school). Total number of participants stratified by gender was also determined. Normality of the data was checked using skewness and kurtosis, and as some part of the data was not normally distributed nonparametric tests were used such as Spearman Correlation.

Standardized scores that were used were age corrected (Foxcroft, 2004b). As we had this question in our minds about environmental expectant (which will be age ranged) and environmental dependent correlations analysis was ran between raw scores (i.e. non-age corrected) and age and between standard scores (age corrected) and level of education.

Standard scores, also known as z-scores, were derived from the mean of the raw scores and mean and standard deviation of standardised scores as they appear in The Handbook of Normative Data for Neuropsychological Assessment (Mitrushina et al, 2005). These scores were used to calculate the probability of the scores from the normal distribution and to compare different scores in a set in terms of the number of standard deviation they are from the mean (Forshaw, 2007). In this case Z-score will be used to compare the sample's obtained scores with the test standard scores, thus the cognitive profile when compared to the international norm.

Given the cross-cultural paradigm we examined whether the test measures the same constructs as suggested by the international literature. Confirmatory Factor analysis (CFA) was used in this regard, as it reduces the complexity of a multivariable data; it WAS used to reduce the large groups of variable to more manageable contents (Foxcroft & Roodt, 2009; Huck, 2012). It was basically a process of building ideas on top of already existing ideas (Mark, 2007), building basic measurements that underlie a set of related constructs

(Foxcroft & Roodt, 2009). It was used to check on the construct validity. To check whether the tests measure the same things in a SA population as they do internationally, and, do tests that ostensibly, according to the literature measure the same thing, load on the same factor. It would have been preferable to use Exploratory Factor Analysis (EFA) to elicit underlying relationships between measured variables (Wilson & MacLean, 2011). However, the ideal sample size for using EFA is 200 and above (Williams, Onsman & Brown, 2010) hence we resorted to CFA. This model helped investigate the underlying factor structure of WAIS-IV^{SA}.

3.5 Ethical consideration

Participants and parents were given consent forms to sign, which explained the nature of the research and foreseeable consequences. Participants were informed on the nature of cognitive assessments that was used. The consent form was written in simple English and instructions were also given in simple English.

Participation in this study was voluntary and participants were allowed to withdraw at any time without suffering any consequences. Lunch was offered and those that completed the entire test protocols were remunerated with R30 airtime, and those who withdrew from the test only got lunch and no remuneration.

Results were confidential and anonymous during the analysis of data as the completed test was coded in numbers, and the results are still kept in a safe and confidential place. Anonymity could not be maintained however during the administration of the test because the researcher was able to see the participant. No physical or psychological harm was done to the participants while administering the test and reporting the results.

The Iqangi project had suggested a school (where summer and winter classes were held) for administering the tests. Chris who is a teacher at the school, gave permission for the school to be used.

Results were therefore be stored in a secure hard drive of the researchers and once the data had been captured it was deleted. Any post-test consultation will have to occur through Chris and the head of Life Orientation who was in direct communication with the researcher and supervisor.

An extension on ethic that was approved in the prior year research on “investigating the neuropsychological profile of a group of rural South African adults previously deprived of quality formal education opportunity” (H14/05/07 project) was granted. External ethics was also applied for as we were working with minors.

3.6 Research design

The study was non-experiments ex post facto and comparative research. The research required no influence on any constructs and implications were drawn from interactions of participants on administered tests. With the use of comparative research design the researcher systematically looked for similarities and differences (Maree, 2007) between the cognitive profile measured for the international normative group, Mpondo population and South African (SA) urban school. The study was cross-sectional in nature as it observed a number of variables occurring simultaneously at the same point in time (Howell, 2014). Correlation techniques and will be used to investigate and identify any notable associations between variables. This research was conducted both within and between subjects. Within-subjects design in which all participants received the full battery of tests and a between-subjects design in which the results of each test could then be compared between the subjects of the sample and hence the overall demographics (Howell, 2014).

Chapter 4: Results

4.1. Sample characteristics

The present study gathered psychometric data from a young adult population who had been educated in post-apartheid South Africa. This set the upper age limit for participation at 24. The lower age limit was informed by the appropriateness of psychometric instruments administered. Table 1 presents not only the average age of the realised sample, but also the educational level in years and, as participant were all second language learners and tests were administered in English, the estimated percentage time speaking English.

Table 1: Demographic characteristics of the sample

Descriptive			
	N	M	SD
Age	68	19.06	2.461
Education	68	10.74	0.971
Language	68	18.11	12.84

As can be seen in Table 1 above, the mean age of the sample was $M = 19.06$ ($SD = 2.461$) years and a histogram showed a positively skewed graph towards younger age with skewness of .172 and kurtosis, 4.36. An examination of central tendency suggests a median of $M = 19$ and a mode of $M = 17$ for age with age range of 16 to 25.

As testing was conducted at the local senior secondary school, the majority of the participants were either prospective, present or past learners of this institution. With reference to Table 2, 2 participants were in grade 8, 1 was in grade 9, 11 were in grade 10, 34 were in grade 11, 4 were in matric and 3 were presently not in school.

Situated in the Mpondo tribal trust region of the Eastern Cape, the sample predominantly spoke the Mpondo dialect of IsiXhosa and took IsiXhosa as their first

language at school. These learners take English as a second language at school but, in accordance with educational policy and in preparation for the matriculation examination which are written in English, do receive academic instruction in other school subjects in English. On the language proficiency, the mean of $M = 18.11$ represents an average percent of English spoken at home, at school and with friends.

Table 2 below is a frequency table consisting of nominal data of demographic variables. Included in this table is frequencies of gender: males and females, education: those who are in school, those who finished school, those that repeated a grade or two and those who have not repeated any grade, and lastly home language: those that speak isiXhosa, isiZulu and Mpondo. A graph for those in school and those who are not in school gave us a positively skewed graph with $n=52$ participants still in school and $n=16$ participants not in school or high school to be particular.

Table 2: *Frequency table for demographic variables*

Demographics	N	F
Gender	68	
Male		33
Female		35
Education	68	
In school		52
Not in school		16
Repeated Gr		30
Not repeated Gr		38
Language	68	
IsiXhosa		66
Mpondo		1
IsiZulu		1

Despite the skeweness of other demographic data, sampling procedure did facilitate a relatively even gender split with $N=35$ female participants and $N=33$ male participants.

Almost all participants reported that isiXhosa as their home language with N = 66. Only one reported Mpondo as their home language, this may just be that Mpondo is the local Xhosa dialect and the home language syllabus offered at school is IsiXhosa. One participant reported isiZulu as their home language. This given the sample can be considered a homogenous group of Nguni language speakers

One of the challenges facing psychometric assessment in South Africa is the diversity of the population and the varying degrees of acculturation in a polyglot society. This study particularly questioned the psychometric profile of a rural population of young adults supposedly having benefitted from the advantages of a democratic South Africa. Table 3 below depicts the accessibility of access to input outside of the rural setting.

Majority of participants in the study lived their entire lives in the Baleni (Mpondo land). From a total of N = 65, N= 49.3% participants reported that they lives in the village in Baleni (the village in which tests were conducted) and N = 38.4% reported that they lived surrounding villages. Table 3 below gives a summary of sociodemographic statistics.

Table 3: Summary of Sociodemographic statistics

Variable	N	M	(%)
Electricity	64		
Access		15	23.435
No access		49	76.56
Water	64		
Access		18	28.13
No access		46	71.88
Solar power	64		
Access		47	73.43
No access		17	25
Primary caregiver	60		
primary direct relative (parents, siblings)		41	68.33
secondary direct relative (grandparents, aunt, uncle)		19	31.67

There is very little access to even the most basic of resources like water (clean reliable source) and electricity. They are dependent on the river, rain water and solar power. Only 20.5% has access to electricity, 64% have access to solar power. 24.17 %, has access to a reliable source of water while others are mostly dependent on the river and rain for water.

Table 4 below tells us how exposed the present sample is to the Western cultures.

Table 4: *Descriptive summary of acculturation factors*

	N	Yes	No
Newspaper	66	59 (89.39%)	7 (10.6%)
Television	64	38 (59.4%)	26 (40.62%)
Radio	64	58 (90.62%)	6 (9.37%)
Cell phone	62	53 (85.48%)	9 (14.52%)

Only 59.4% of our participants have access to television as compared to urban population across the country with 74.5% access to television (as reported by Censors S.A) This is by far the lowest of the access areas probably due to the availability of electricity and signal.

4.2. Descriptive summary for cognitive assessment tests

This section presents the measured performance on The WAIS-IV^{SA} and on other individually selected measures. IQ is also often taken as a parameter to be considered when using individually selected measures directed at further investigating a particular cognitive domain. Or although this is common practice, often the practitioner is faced with the dilemma of having to consider a variety of norm standards when they use a selection of tests rather than a test battery. So therefore Table 5 to Table 6 and Figure 1 and Figure 2 will be representing WAIS-IV^{SA} summary scores, while Table 7 to Table 13 will be representing the individually selected measures. Further, these individually selected measures will be

presented with international norms as well as SA urban black school norms for comparison purposes.

4.2.1 WAIS-IV^{SA} Descriptive Statistics

As discussed, the Weschler intelligence scales, or local adaptations thereof are of the most widely used cognitive tests. Table 5 below represents the performance levels achieved by Mpondo sample on the South African adaptation of the WAIS-IV^{SA}. The expected mean for the individual sub-tests is 10 with a standard deviation of 3. The composite indices and the full scale IQ have been normed to deliver a mean score of 100 with a standard deviation of 15.

Table 5: *Descriptive summary for intelligence (WAIS-IV)*

WAIS-IV Sub- tests	N	M	SD
Verbal Comprehension Index			
	6	5	2
Similarities	8	.63	.896
	6	6	1
Vocabulary	8	.31	.839
	6	5	2
Information	8	.56	.275
	6	6	2
Comprehension	8	.07	.59
Perceptual Reasoning Index			
	6	6	1
Block Design	8	.25	.919
Matrix	6	6	2
Reasoning	8	.65	.59
	6	7	2
Visual Puzzles	8	.4	.067
	6	6	3
Figure Weights	8	.5	.14
Picture	6	5	2
Completion	8	.28	.65
Working Memory Index			
	6	5	2
Digit Span	8	.45	.899
	6	5	2
Arithmetic	8	.13	.348
Letter Number	6	6	2
Sequencing	8	.57	.26
Processing Speed Index			
	6	7	2
Symbol Search	8	.97	.172
	6	8	2
Coding	8	.25	.51
Full IQ scale			
	6	7	8
FSIQ	8	4	.04

Table 6 below represents a summary of Sum of Scaled Scores, Composite Scores, Percentile and Confidence Interval. The Scaled scores in this table are derived from the total raw scores of each subtest and scaled to a metric with a mean of 10 and standard deviation of 3, they represent an individual examinee’s performance in relation to his/her peers. Confidence intervals are used to represent the participants’ true score. Percentile on the other hand is the percentage of people in a normative standardised sample that fall below a given raw score (Foxcroft & Roodt, 2009).

Table 6: *Composite Score Summary*

Scale	Sum of Scaled Scores	Composite Score	Percentile Rank	95% Confidence Interval	Qualitative Description
Verbal Comprehension	18	VCI 76	6	72-84	Low Average
Perceptual Reasoning	20	PRI 80	9	75-88	Borderline
Working Memory	11	WMI 72	4	67-84	Low Average
Processing Speed	17	PSI 89	9	84-102	Borderline
Full Scale	66	FSIQ 74	4	69-81	Borderline

Confidence Intervals are based on the Overall Average Standard Error of Measurement (SEM) Values reported in the SEM column are based on the examinee’s cumulative age.

Figure 1: WAIS-IV^{SA} Composite score summary

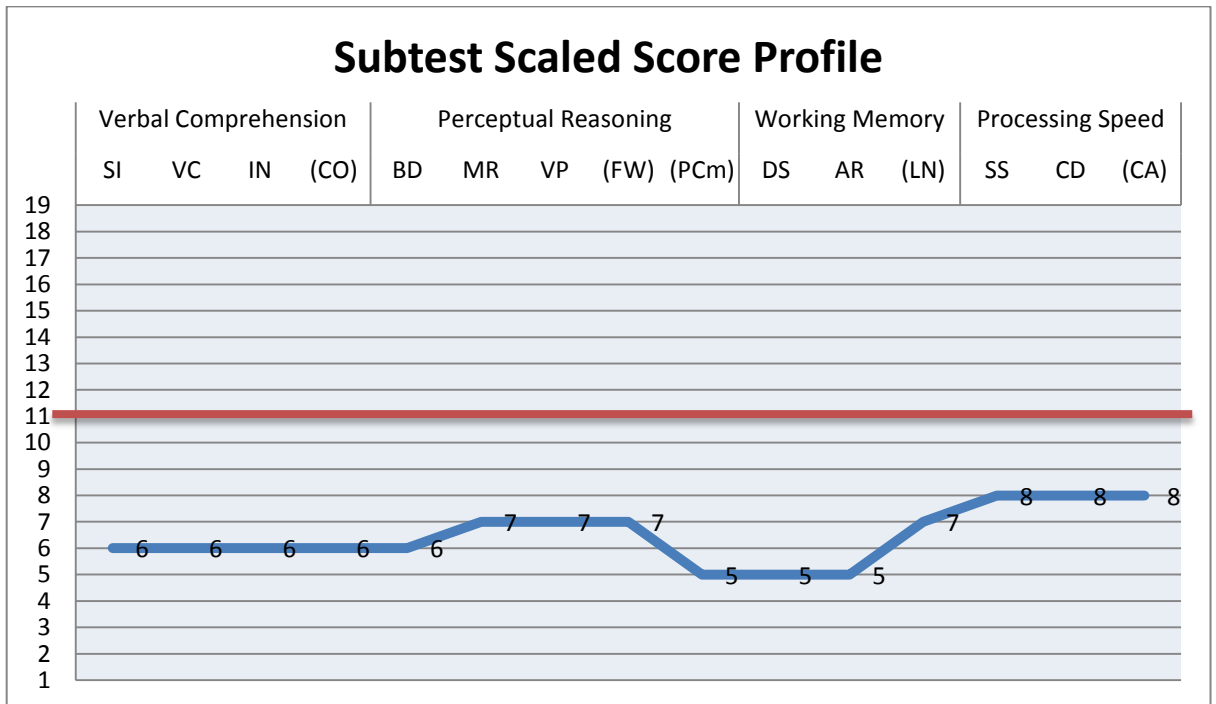
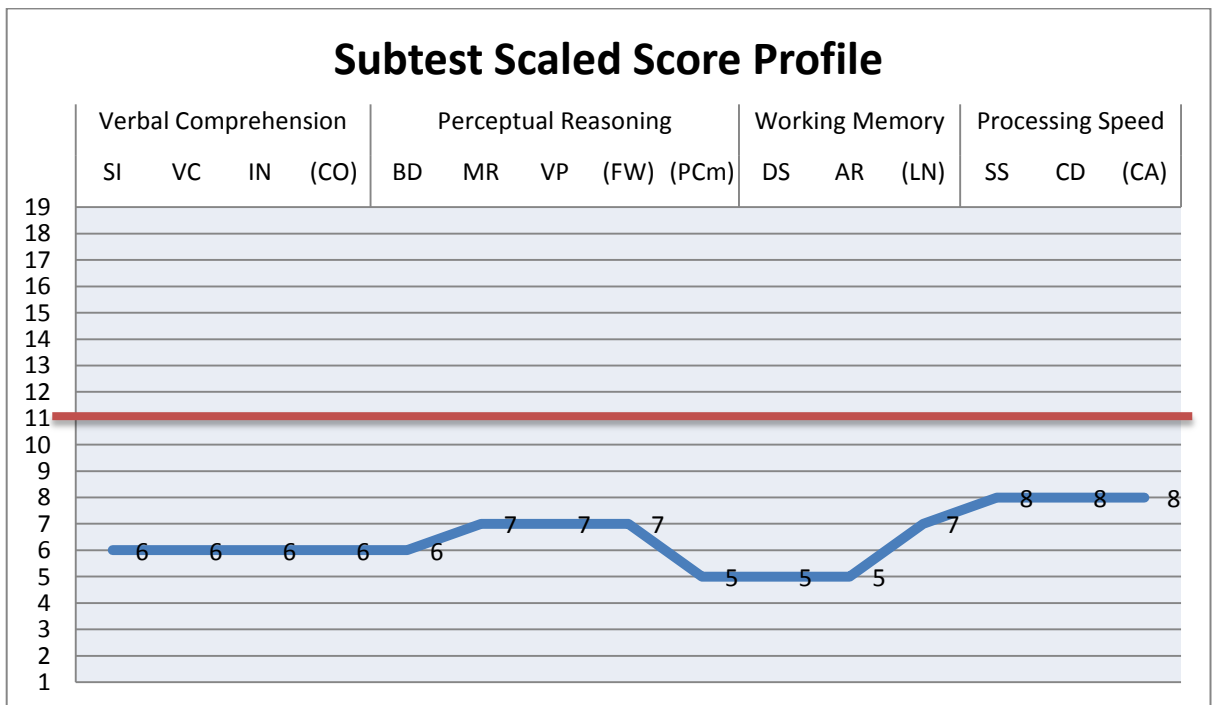


Figure 2: WAIS-IV^{SA} scaled scores summary



The VCI falls in the 6th percentile which according to the WAIS-IV qualitative description is below average based on the WAIS-IV^{SA} norm scores. The strongest

contribution to the VCI based on receptive vocabulary while the weakest performance reflected recall for general knowledge as measured by the information subtest. These two subtests would reflect crystallised intellect. Despite being the strongest of the VCI subtests, the mean performance on the Vocabulary subtest measured over 1 SD below the standardisation mean.

The measured ability on the Perceptual Reasoning (PRI) which represents non-verbal reasoning abilities fell below the 9th percentile placing the mean performance level in the low average range. As seen in Table 6 our participants scored in the low average range with Composite score of PRI = 80 and 95% confidence interval = 75-88, meaning that there is 75% to 88% chance that the confidence interval our calculations contains the true population mean. Performance on this index may be better than VCI due to the fact that it did not require in depth understanding of the items or language proficiency.

Evidently the participants' abilities to sustain attention, concentrate and exert mental control are a less developed than their non-verbal reasoning abilities. This may be due to the fact that WMI and VCI are dependent on language proficiency

Just as PRI, the PSI is also a non-verbal index, and it also falls on the 9th percentile. The PSI represent the ability to process simple or routine visual material without making errors as measured by the Processing Speed Index (PSI) (Wechsler, 2014). Score for the PSI was in the low average range of PSI = 89; 95% confidence interval = 84-102. Participants performed better on this index than on the VCI and WMI, suggesting that participants' ability to process visual material quickly is better than their verbal reasoning ability.

Relative to all the individual examinees of comparable age; this sample group of secondary school learners are currently functioning within the borderline range (FSIQ = 74) of intelligence on a standardized measure of intellectual ability.

4.2.2. Individually selected measures

As discussed in the literature review a psychometric assessment often included a variety of individually selected measure. Often the interpretations of these are based on norm standards produced for samples from different demographic backgrounds. As mentioned above Table 7 to Table 13 below presents test scores for various psychometric tests compared with township sample (Skuy et al, 2001).

Table 7 below is comprised of two samples, the Mpondo sample and Danish participants. This study was done by Nielsen et al (1989) on participants between the ages of 20 to 29 and had a sample size of 35. A t-test was done between the different ages and no statistical significance was found.

Table 7: Descriptive summary for RAVLT test

RAVLT	Mpondo Sample			Danish Participants		
	N	M	SD	N	M	SD
List A_V	52	8.4	3.33	35	12.74	1.46
List A_Delayed Recall	53	9.42	3.25	35	11.91	1.76

Table 8: Descriptive summary for RAVLT Mpondo Sample and SA urban Black school

	Mpondo Sample			SA Black Urban school	
	N	M	SD	N	M
List A_I	56	5.96	2.656	152	5.36
List A_II	56	7.23	2.427	152	6.67
List A_III	56	8	2.879	152	8.21
List A_IV	56	9.39	2.708	152	9.59
List A_V	56	8.4	3.327	152	10.16
List A_After Interference	52	4.59	2.395	152	9.47
List A_Delayed Recall	53	9.42	3.25	152	10.1

Evidently from Table 7 the Danish participants performed better than Mpondo participants with mean difference of $M = 4.34$ on the Retention trial while mean difference for the delayed recall was $M = 2.54$. Poor performance on this memory test could be associated with poor performance on the WMI.

ROCFT is a memory test which is not dependent on verbal fluency. The Mpondo Sample was compared with 21 year old undergrad students. This study was done by Meyers and Meyers (1995). Table 9 below represents mean and standard deviation of both samples.

Table 9: Descriptive summary for ROCFT test

ROCFT	Mpondo Sample			Undergraduate Students			SA Urban Black School		
	N	M	SD	N	M	SD	N	M	SD
Copy	68	31.68	3.57	30	35.5	0.9	152	26.88	4.04
Delayed recall	67	17.49	6.39	30	27.7	3.9	152	18	5.39

The Undergrad students fall in the age range of the Mpondo Sample. However as seen in Table 9, the undergrad students performed better than the Mpondo sample. This may be due to the fact that they have acquired better perceptual reasoning and memory from the

higher education. However, a study done by Taylor suggests that education had no effect on ROCFT performance (Tombaugh, Faulkner & Hubley, 1992).

For executive functioning formation and reasoning, WCST was performed. The WCST scores are compared to a Control sample from Kramer et al. (1994) with age range of 18 to 28. A comparison between these two samples was done to emphasise the dangers associated with comparing nonverbal psychometric assessment results in South Africa with established norms. These norms may be inappropriately high for South African rural population. Table 10 below represents the different means and standard deviation for the two samples.

Table 10: Descriptive summary for WCST

WCST	Mpondo Sample			Control Sample		
	N	M	SD	N	M	SD
Complete Category	65	2.69	1.79	65	5.8	0.7
Conceptual Level Response	65	42.63	20.99	65	13.3	5.2
Total Errors	65	64.54	18.19	63	21	12.4
Perseverative Response	65	47.82	32	65	11.3	7.5
Perseverative Error	65	39.91	23.98	65	9.9	5.8
Set Failure	65	0.89	1.05	65	0.6	1.1

Table 11: Descriptive summary for WCST, Mpondo sample and SA urban Black school

WCST	Mpondo Sample			SA Black Urban School		
	N	M	SD	N	M	SD
Complete Category	65	2.69	1.79	152	3.97	1.81
Conceptual Level Response	65	42.63	20.99	152	52.89	19.81
Total Errors	65	64.54	18.19	152	52.98	21.58
Perseverative Response	65	47.82	32	152	33.02	18.37
Perseverative Error	65	39.91	23.98	152	28.04	14.68
Set Failure	65	0.89	1.05	152	0.74	1.02

When compared to the international norms, it was found that the present sample achieved significantly lower scores on all measures of the WCST. The results of the Mpondo sample are better correlated with the norms for the 6.5 years old group as they appear in the WCST Administration Manual.

As language is assumed to be the major barrier for Mpondo sample, one would expect participants to perform better in non-verbal tests. TMT is non-verbal test that measures attention and concentration. Table 8 below represents TMT mean scores standard deviation for Mpondo sample and a Canadian sample from Fromm-Auch and Yeudall (1983) study. The Canadian sample had a total of N = 76 participants with age range of 18 to 23. The mean being time took (in seconds) to complete each Trails.

Table 12: Descriptive summary for TMT, Mpondo sample, Canadian Adults and SA

Urban Black School

TMT	Mpondo Sample			Canadian Adults			SA Black Urban School		
	N	M	SD	N	M	SD	N	M	SD
Trails A Time	56	64.98	25.91	76	26.7	9.4	152	56.1	26.77
Trails B Time	55	113.11	55.98	76	51.3	14.6	152	110.58	52.54

On average Trial B took 48.13 seconds longer to complete than Trial A. In addition to the visual scanning required for completion of Trails A, Trails B requires the additional skill inherent in dual mental tracking. Trial A assesses simple cognitive processing speed whereas Trial B assesses more complex executive functioning where visual attention is required as well as task switching between both letters and numbers (Tombaugh, 2004).

Studies such as one done by Horton and Roberts (2001) have reported a significant relationship between education and TMT performance. Increase in age is also reported to affect performance on TMT. As seen on Table 8 mean difference for Trial A Mpondo sample and the Canadian sample is $M = 38.28$, and mean difference for Trial B from Mpondo sample and Canadian sample is $M = 61.81$.

In addition to the contextualized memory tests, Logic Memory test was administered to support the results obtained from these tests. This test required participants to listen carefully to each story, immediately repeat the story to the administrator and repeat it again 30 minutes later. Table 13 below represents the average and standard deviation of scenes recalled for immediate recall and delayed recall for each story.

To eliminate the verbal component inherent in the Arithmetic subtest of the WAIS-IV^{SA} subtest a timed calculation of the 4 basic arithmetical operations was administered in the form of the One Minute Maths task (OMM). OMM consists of four Mathematics test (Addition,

Subtraction, Multiplication and division), each has 30 problems. Participants are given one minute to complete each test. This test is designed to give an indication of the learner's mathematic fluency (Davis, 2010). Presented in Table 9 as well is mean of problems completed in one minute for each test.

Table 13: Summary of additional cognitive assessment tests (logic memory & one min Mathematics)

	N	M	SD
<u>Logic Memory</u>			
S1_Immediate Recall	65	4.81	3.19
S1_Delayed Recall	65	3.27	3
S2_Immediate Recall	65	5.15	3.18
S2_Delayed Recall	65	4.06	3.71
<u>One Minute Maths</u>			
ADDITION	68	25.05	3.34
SUBTRACTION	68	19.45	6.04
MULTIPLY	68	12.85	4.81
DIVISION	68	10.89	5.57
TOTA	68	68.26	16.19

Participants had to freely recall detailed points from the immediate recall condition to the delayed recalled condition. Minimum points that could be obtained were 24 for both stories and each trial while minimum was 0. Low performance on these tests, as seen in Table 9, may be indicative of inadequate rehearsal and consolidation of information into long-term memory as demonstrated in the Logical Memory Test (Squire & Bayey, 2007).

4.3. Correlation between Cognitive Assessment Tests and demographic variables

Spearman Correlation was used in this section were cognitive assessment tests are correlated with demographic variables. This nonparametric measure was used as our data did not meet criteria for normality.

4.3.1. Correlation between cognitive assessment tests and demographic variable

As mentioned above the poor performance on WAIS-IV may have been affected by demographic variables such as language, age, education or gender. Table 10 represents a Spearman Correlation between WAIS-IV indices and demographic variables. The purpose of this is to support speculations that there is a relationship between performance on WAIS-IV and demographic variables.

Table 14: Spearman Correlation between Intelligence test and demographic variables

	Age	Education	Language	VCI	PRI	WMI	PSI	FSIQ
Age	1							
Education	.4**	1						
Language	0.09	0.09	1					
CVI	0.02	0.25	-.4**	1				
PRI	-0.19	-0.16	-0.01	.31*	1			
WMI	-0.14	0.07	-0.197	.3*	0.19	1		
PSI	-0.74	-0.04	0.06	0.22	.33**	.36**	1	
FSIQ	-0.13	0.15	-0.22	.66**	.59**	.59**	.60**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

As seen in Table 14 there is a significant correlation between age and education, this correlation between age and education is expected as with compulsory school entry requirement one would assume that for the most grade 10 learners would be younger than grade 12 learners. Another significant correlation is that between age and gender, to further investigate the possibility that this may have impacted on gender differences or performance thereof a correlation between males and females was run on the FSIQ and no statistical significance was found. Therefore no correlation was found between older males and younger females, nor younger males and older females.

VCI is significantly correlated with language; this makes sense and supports the hypothesis that performance on this index is affected by language proficiency. Another significant correlation that was found was between VCI and Gender, to investigate this further a t-test was run between males and females, but no statistical difference was found. As Spree et al (2006) said that gender effects are for the most part trivial. Not surprising that the FSIQ significantly correlated with the indices as they are designed to measure intelligence.

In a similar manner to what was the case with the WAIS^{sa}, individually selected measures were also correlated with demographic variables. These tests measure memory, speed, verbal fluency and reasoning and as a result may also be affected by demographic variables. COWAT, a verbal fluency, test is correlated with demographic variables.

Table: 15: *Spearman correlation between COWAT and demographic variables*

	Age	Education	Language	English B Total	Vernac L Total	Grocery Total
English B Total	0.043	0.188	-0.012	1		
Vernac L Total	0.152	0.155	0.199	.408**	1	
Grocery Total	0.071	0.091	0.051	.33**	.275**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Although Table 15 suggests a correlation between COWAT and Gender, no significant difference was found between males and females. The absence of significant difference between Males and Females is constant with a study conducted by Ruff et al (1987).

In the Table 16 below an attention and concentration test (STROOP) correlates demographic variables. Researchers such as Graf & Uttl (2008) have speculated that factors such as age have an effect on STROOP performance, and how females perform better than males (Chung, 2004). Not much is said about the effect of education on performance, however Rosselli et al (2002) reported that there was no significant difference between groups that speak different languages.

Table 16: *Spearman correlation between STROOP and demographic variables*

	Age	Education	Language	Gender	Colour Naming	Word Reading	Interference	Switch
Colour Naming	-0.107	-0.058	0.226	-0.05	1			
Word Reading	0.043	0.084	0.155	-0.164	.591**	1		
Interference	-0.057	-0.017	0.073	0.079	.434**	.554**	1	
Switch	0.091	0.122	0.029	-0.248	.489**	.533**	.545**	1

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Age is perceived as an important determinant of STROOP performance cognitive functions during adolescence (Sharma et al. 2014), however no significant correlation was found between STROOP and Age, Education, Language or Gender. Colour Naming is designed to evaluate flexibility in the control of cognitive processes and behaviour. Word Reading requires more attention and Interference evaluates the allocation of attention as inhibition of distraction is evaluated.

In Table 16 below WCST is correlated with Demographic variable to assess as to whether demographic variables have an effect on concept formation and reasoning. This correlation is substantial as it is believed that age has an effect on WCST performance (Anderson et al, 1991), as well as education (Heaton, 1981) and gender (Heaton et al, 1993).

Table 17: Spearman correlation between WCST and demographic variables

	Age	Education	Language	Gender	Category Complete	Concept Level Response	ERROR	Perseverative Response	Perseverative Error	Failure Set0
Category complete	-0.0053	-0.019	0.063	-0.186	1					
Concept Level Response	0.04	-0.059	-0.018	-0.188	.83**	1				
ERROR	-0.044	0.08	0.047	0.191	-.76**	-.94**	1			
Perseverative response	-0.041	0.051	-0.015	0.17	-.41**	-.58**	.61**	1		
Perseverative Error	-0.084	0.033	-0.028	0.181	-.43**	-.59**	.62**	.99**	1	
Failure Set	0.023	0.046	-0.135	-0.195	.078**	.50**	-.51**	-.47**	-.48**	1

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

In Table 17 above no significant correlation between demographic variables and any of the WCST outcomes is reported.

Another attention and concentration test (TMT) is correlated with demographic variables. As mentioned that TMT is highly favored for its sensitivity to the presence of cognitive impairment, the main concern for this research is to support the notion that poor performance may not necessarily be due to cognitive impairment. Hence a correlation between TMT and demographic variables is done to evaluate if low performance could be affected by demographic variable. The correlation between TMT and demographic variables is represented below in Table 14.

Table 18: *Spearman correlation between TMT and demographic variables*

	Age	Education	Language	Gender	Trial A Time	Trial A Error	Trial B Time	Trial B Error
5. Trial A Time	-0.156	-0.047	0.134	.293*	1			
6. Trial A Error	-0.008	-0.199	-0.25	0.169	.33*	1		
7. Trial B Time	0.122	0.261	0.106	-0.11	.573**	0.13	1	
8. Trial B Error	0.057	-0.041	-0.099	0.096	.27**	.72**	.23	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Although literature has indicated that performance on TMT decreased with age, no correlation was found in this study. The mean age of the sample was 19 years. There was also no significant correlation found for Education, Language and Gender.

Table 19: *Spearman correlation between ROCFT and demographic variables*

	Age	Education	Language	Gender	Copy	Delayed Recall
5. Copy	.024	.073	.027	-.147	1	
6. Delayed Recall	.044	.047	-.226	-.261*	.395**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The results in Table 19 show no correlation between ROCFT and demographic variables. Whereas Caffara et al (2002) in his study reported a significant effect of age, education and gender on the Delayed recall.

RAVLT is another memory test and as previously mentioned, it is still speculated that demographic variables have an effect on memory. A correlation is done between RAVLT and demographic variable then.

Table 20: *Spearman correlation between RAVLT and demographic variables*

	Age	Education	Language	Gender	Retention	Delayed Recall
Retention	-0.07	.06	-.14	-.15	1	
Delayed Recall	-.193	.143	.13	-.019	.69	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

No significant correlation was found between the four demographic variables and RAVLT even though an extensive literature has emphasized the effect of age on RAVLT. Although Norman et al (2000) reported females to perform better than males, this is not so for this sample.

Table 21 and Table 22 represent a Spearman correlation between demographic variables and additional tests which are Logic Memory and One Minute Maths Test.

Table 21: *Spearman correlation between Logic Memory and demographic variables*

	Age	Education	Language	Gender	Story1 Immediate recall	Story1 Delayed Recall	Story2 Immediate Recall	Story Delayed Recall
Story1 Immediate Recall	-0.13	-.28*	0.139	0.005	1			
Story1 Delayed Recall	-0.12	-.27*	0.091	-0.181	.67**	1		
Story2 Immediate Recall	0.226	-0.05	0.002	0.074	.62**	.44**	1	
Story2 Delayed Recall	0.132	-.18	-0.12	-0.076	.51**	.59**	.61**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 22: *Spearman correlation between One Minute Maths and demographic variables*

	Age	Educatio n	Languag e	Gende r	Additio n	Subtracti on	Multiplicati on	Divisio n
Addition	-.26	0.014	0.104	.247*	1			
Subtraction	0.118	0.26	-0.1	0.109	.666**	1		
Multiplicati on	0.005	0.19	-0.167	0.132	.505**	.522**	1	
Division	0.149	.13	-0.183	0.042	.418**	.52**	.676**	1

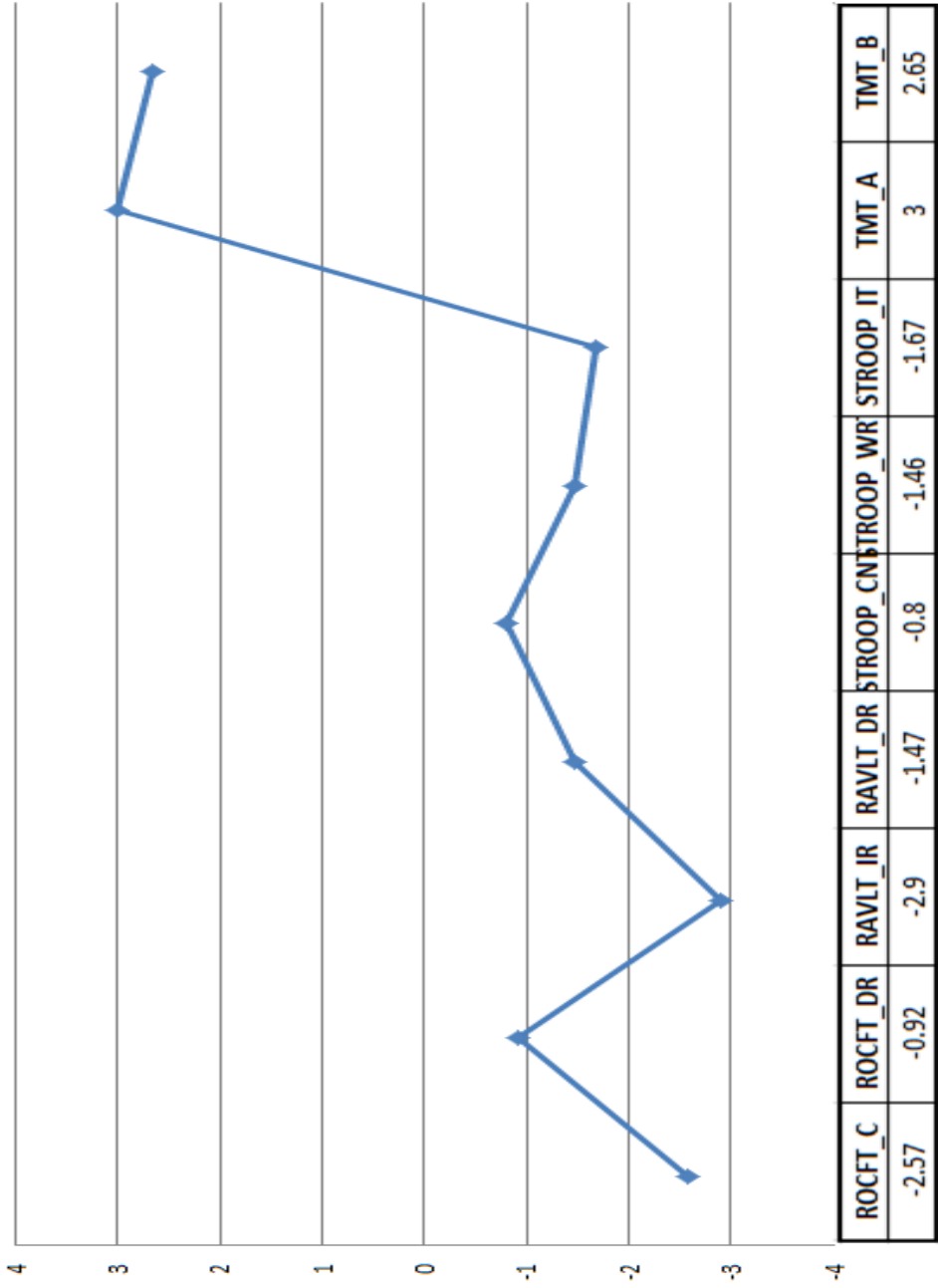
Table 22 consists of Spearman correlation between One Minute Maths Test and demographic variables. Raw scores were used in this correlation test. As seen on the table there is a positive correlation between Gender and Addition, this may be because of the different ages of the male and female groups and thus educational standard. There are no other significant correlations between the dependent variables and independent variables. However there is a correlation between the dependent variables.

4.4. Cognitive profile of the sample

Figure 3: Cognitive profile of Mpondo sample

Z-scores were created using the mean of the raw score of Mpondo sample and the mean and standard deviation of the standardised scores (Mitrushina et al, 2005). Because there was no age corrected scores that corresponded with the age range of our participants test, t-test was done between the ages the ages of 15 to 20 and 20 to 30 and no significant

difference was found in almost all tests. As a result for ROCFT mean score and standard deviation of Meyers and Meyers (1995), students on the Copy Condition and three Recall Conditions were used to create ROCFT z-score. For STROOP, mean score and standard deviation of Strickland at al (1997) were used to create STROOP z-score. Mean scores and standard deviation were pulled out of the Results of the Meta-Analysis and predicted scores for the RAVLT total recall, to construct RAVLT z-scores. Lastly, Fromm-Auch and Yeudall (1983) Data for Sample of Healthy Canadian Adults was used to create TMT z-scores.



4.5. Factor analysis

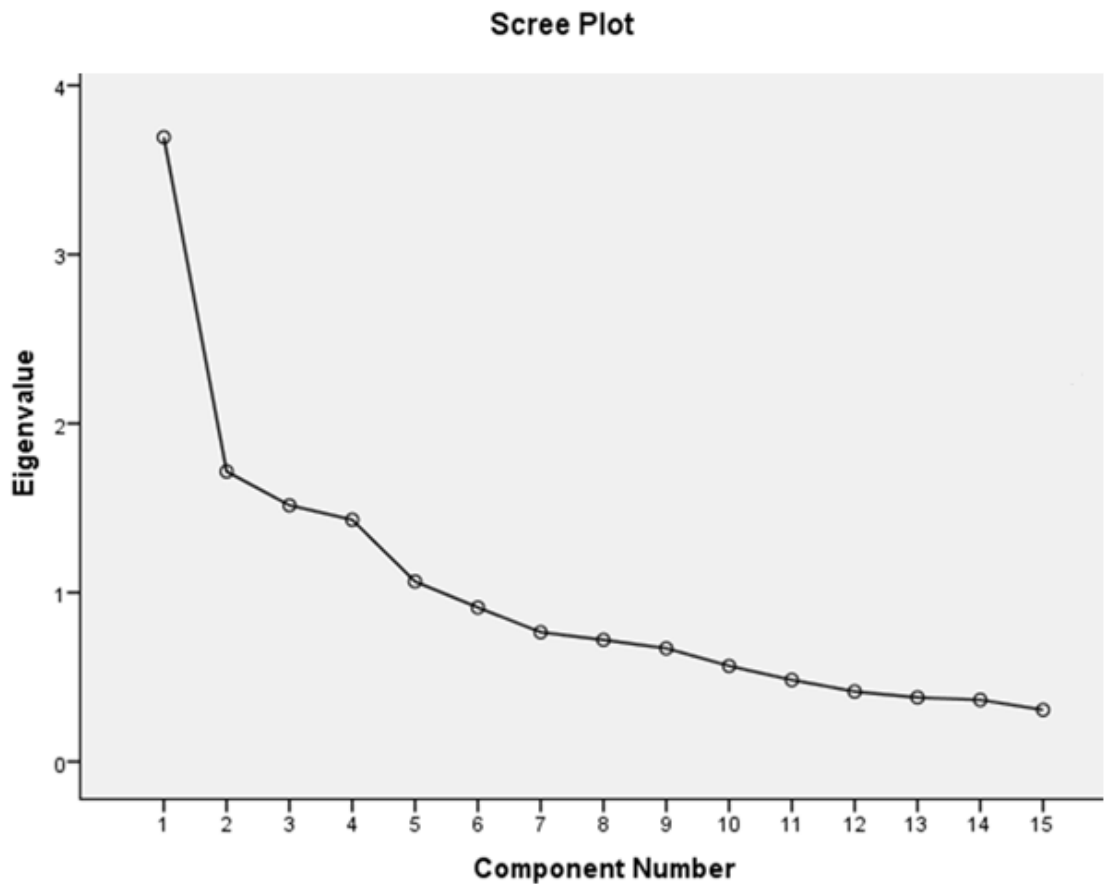


Figure 4: scree plot for the WAIS-IV factor analysis

Figure 4 is composed of WAIS-IV scaled scores. It is a scree plot designed to reveal the number of factors formed from the data. Components are generally extracted from the steep slope, while components on the shallow slope are said to contribute little to the analysis (Creswell et al., 2007). The bigger drop occurs between fifth component and as a result we selected the fifth component. This indicates the presence of five factors.

Chapter 5: Discussion

This section is aimed at interpreting the cognitive profile of the Mpondo sample based on the tests that were conducted in Mpondo land. The construct validity of WAIS-IVSA would also be discussed in terms of factors loading so to determine whether the profile of this rural South African population can be explained in terms of international knowledge.

5.1. Factor analysis

As discussed, apart from measuring individual traits, performance on the individual subtests of the Wechsler Intelligence Batteries can be computed so as to represent 4 second order factors and a full scale Intelligence quotient. It is acknowledged that no test of higher cognitive function is ever dependent on a single ability. For this reason, before moving forward with a discussion of individual subtest performance, it was important to address the question of whether in this very specific population, the same cognitive skills are employed for problem solving as reported in the larger populations reported in the literature. As can be seen in Table 22 the core subtests used to compute the composite full scale IQ, loaded heavily on general intelligence.

The factor analysis did not reveal the expected fact or loadings indicative of the composite indices. Matrix Reasoning and Letter Number Sequencing loaded together PRI, while Digit Span and Letter Number Sequencing loading together. What needs to be kept in mind is that a 5 factor model was done, meaning that there was a high positive loading which identified the factors. Block Design is a unique skill that does not depend in any way on vocabulary. Whatever skill is required for matrix reasoning, symbol search and coding, is not needed for letter number sequencing so we make the assumption that Matrix Reasoning, Symbol Search and Coding require visual feature identification but not working memory or

dual mental tracking. Letter number sequencing uses working memory but has another feature which is unique to this task.

Although PRI is made up of Block Design, Matrix Reasoning and Visual Puzzles; only matrix reasoning loads on this index. The same for WMI, which is made up of Digit Span, Arithmetic and Letter Number Sequencing, and only the Letter Number Sequencing load on it. As for VCI and PSI none of their subtests loads on them. However what In other words, as these subtests are not loading together then it means that these composites are not measuring the indices. Thus the validity of the indices is drawn into question.

The purpose of this CFA was to validate whether the WAIS-IVSA indices are meaningful, but as they seem problematic, we will therefore look at individual tests.

5.2. Cognitive profile

As explained in Chapter 3, for comparative purposes all scores were converted to z-scores based on the mean and standard deviation reported in the appropriate test manual for each measure. These z-scores were used to indicate where Mpondo population falls in a cognitive profile graph between +3 and -3, with +3 being the highest performance and -3 being the lowest performance. This was done for the individual chosen measures that are all scored on different scales. For the WAIS-IV^{SA}, South African standardised norms were used to plot the profile graph. Possibly the division of the tests under these umbrella sections works better for the organisation of the discussion of individual tests results rather than the cognitive profile. Probably in this section it may be seen that an examination of this profile suggested that test is reliant on verbal skills tended to cluster in the 0 to -3 categories. With reference to the correlation matrix, an analysis of the abilities required and the performance levels realised would suggest that the most prominent factor adversely influencing the ability to perform on tests of this nature is language and education.

As can be seen in figure 2, interpreting the performance in this way would indicate that the performance of the present sample is weaker than might be expected in the general population. This could erroneously be interpreted as implying brain damage and more specifically to imply a severe impairment in ROCFT, RAVLY and Stroop and unimpaired ability in test such as the TMT. For age corrected norms were used for z-scores this means that they performed lower as compared to their peers. Using neuropsychological knowledge these results would imply that Mpondo sample has brain injury of brain impairment.

The low scores on the cognitive profile graph are similar to the scores on the WAIS-IV^{SA} composite score graph. This graph also suggests that Mpondo sample has performed very low as compared to their peers as they fall between 89 and 72 below the mean of 100. This however does not necessarily mean that there is a possibility of intellectual disability (Wechsler, 2008), but they may struggle significantly when performing executive functioning tasks. Remediation would be of benefit for those that fall into these ranges as suggested by Wechsler (2008). This means that people should have the amenities to develop skill and an appropriate way to quantify the development of these skills. This takes us back to the assumption that a sample from such an isolated area requires equal opportunities so to make comparison fair.

South Africa is more than twenty years in democracy and the selected sample has supposedly benefited from the post-apartheid advantages, one would expect results to be in the same range as urban population scores. However, because of the inequalities that still prevail such as poor quality of education and the limited resources in the area Mpondo population has not yet acquired the same skills as the population in urban areas. Hence they appear to have low cognitive potential.

5.3. The effects of demographic variables on performance

5.3.1. Demographic variables

With reference to the above, the present sample was comparatively or relatively homogenous relative to the quality of schooling, socio-economic status, home language versus language of assessment and scholastic instruction, access to amenities such as quality education, exposure to facilities such as libraries and access to electricity. Given the homogeneity of the sample in this regard it was not possible to investigate the relative contribution of these factors and as discussed in section 5.7 is one of the limitations of the present study and something that should be addressed in future research. Relative to the test performance of the present sample, results were examined relative to the potential impact of language proficiency, gender, age and education. A significant correlation was only found between age and education, but none between demographic variables and dependent variables. This lack of correlation between variables could have been caused by extraneous variables which were not controlled for, or may be due to the homogeneous sample.

5.3.1.1 Language

As said by Shuttleworth-Jordan (1996) that although cultural experiences and education are important when evaluating cross-cultural effects, language is the most compounding demographic factor. Despite the fact that the present sample has a minimum of 10 years of formal education and the government policy that enforced English as the medium of instruction the present sample does not use English on a regular basis. As indicated in Table 1, day-to-day social interaction is chiefly conducted in the home language with participants on average using English as the language of choice for home and social interaction only 18% of the time, which interferes with the possibility of being fluent in English. What should be noted is that although participants may be exposed to English on television, radio and perhaps

conversations it will differ from the level of English expected to in academic context (Crystal, 1997).

5.4. Verbal assessment tests

Given that language fluency is essential for effective executive cognitive skills, it is likely that individuals with poor language fluency will have difficulties performing complex problem-solving tasks (Remine, Care, & Brown, 2008). Statistical analysis showed significant correlation between self-reported language efficacy and VCI. Despite initial screening for language competency, on deeper engagement with the more specific tasks of assessment it was apparent that participants battled with language. Language was deemed one of the greatest barriers as there was a need for extended instruction and practice and despite this with added complexity they misinterpreted specific items or were unable to clearly express response or whatever relative to the complexity of language. The school official policy suggest that they are adequately prepared for education in English and ability for basic conversational English but anecdotal evidence pointing to difficulties when language gaged in specific need and higher level cognitive interaction.

Language as a function of executive functioning enables the storing and retrieval of information that is known and helps with reasoning about what an individual does and does not know (Remine, Care & Brown, 2008). Based on these inferences, because our participants mainly speak Xhosa to communicate at home, at school and with friends, it is difficult to store and retrieve information received in English and as a result affects their performance

As noted in Table 6 on page 49 of chapter 4, performance on the VCI placed on the 6th percentile classifying the performance in the borderline range. Performance on this index measured over 1 SD below the standardisation mean. The possibility is raised that the

isolation of the community and the unbalanced bilingualism could be having contributed to difficulties in the conceptualisation of concrete concepts as compared to abstract concepts. The forced need for English in school environment presents a problem in a rural South Africa environment, where English is not the primary language of the individual being assessed (Parker et al., 2007).

Communication or interaction in society also qualifies as environmental factor that has an impact on the ability to express cognitive skill in an assessment. Communication exchange with immediate surroundings and the language used would affect performance on tests such as Verbal Fluency and tests that requires good general knowledge (Foxcroft, 2004). Therefore in this case the percentage of English spoken at school, at home and with friends has a role in explaining the poor performance in VCI. As seen in Table 1 the mean percentage of English spoken at school, at home and with friends is $M = 18.11\%$, this gives evidence that Mpondo sample does not often use English to communicate.

Comparison between our population and Ferrett et al., (2014) implies that the present population has below average fluency in both the languages in the COWAT. This poor performance could be explained by inferences drawn by Bialystok, & Viswanathan (2009), in their study they found that bilinguals may have poor inhibition because they may experience interference when completing a verbal fluency test. This confusion may have been caused by the exercise of thinking in different languages. Although a variety of literature suggests that a bilingual speaker has a cognitive advantage in tasks of attentional control and flexibility (e.g., Bialystok, 2009; Costa, Hernández, Costa-Faidella & Sebastián-Gallés, 2009; Martin-Rhee & Bialystok, 2008) this advantage is only evident when an individual is fluent in both languages. Bialystok (2009) further explained that on average bilinguals tend to have a smaller vocabulary size in both languages when compared to monolinguals. This in relation to our participants would mean that interference or

introduction of the other language (English) during the time of development may have limited their vocabulary in both languages.

Tests that are not culturally adapted are associated with bias and unfairness (Huysamen, 2002) and affects construct validity thereof (Wallis, 2004). Meaning that the cognitive assessment test is measuring something else in one group and another in the other group. As said by Shuttleworth-Jordan (1996) that although cultural experiences and education are important when evaluating cross-cultural effects, language is the most compounding demographic factor. Although it is expected for our participants to be fluent in English as it the medium of instruction, they mostly interact in their home language. Shuttleworth-Jordan (1995) further stipulates that language could be biased in test scores due to an individual's primary language and the language used by the assessor or test language. Evidently, from Table 1 we see that our participants only speak English at home, at school and with friends only 18.11% of the time

5.4.1. Verbal memory

Performance on WMI was as low as performance on VCI this is possibly because they are both verbal tasks and thus require an extensive understanding language. Measured at a similar level to the VCI with performance also falling on the 6th percentile and classified as borderline cognitively impaired. Digit Span and Arithmetic was the greatest contributors of the low score on the WMI as they scored 4 points below the standard deviation, whereas Letter Number Sequencing was 3 points below the standard deviation. The low score on Arithmetic could have been due to the complexity of the language used, having to remember all the information given and make calculations at the same time. The fact that it was timed may also have been a contributing factor that affected performance. In the Digit Span, switching between Forward, Backward and sequence trial may have had an impact on the

performance. As mentioned fluency in language is essential for storing and retrieving information, based on this, participants might be expected to have poor performance as English is not their primary language. When comparing WMI and PRI it is clear that participants' abilities to sustain attention, concentrate and exert mental control are less developed than their non-verbal reasoning abilities.

Our results showed no significant correlation between memory tests (WMI, RAVLT and Logic Memory) and demographic variables. Our results are also supported by Bleecker, Bolla-Wilson, Agnew & Meyers (1988) who suggested that demographic variables such as age do affect performance on RAVLT specifically on memory, the present sample was a youthful group of narrow age range and no significant correlation was found in this regard.

Given that verbal learning may strongly be associated with accumulation of learning from a scholastic perspective, in the present study the RAVLT was administered in the language of learning. Although with international migration this may be relevant to other countries this is different between home language and language, because learning is possibly more pronounced as is the case in South Africa with 11 official languages only two of which are English and Afrikaans. Literature on testing in this regard is thus limited. The overall performance of the present sample was significantly lower than the norms reported in the literature, the cognitive profile graph clearly shows this with z-scores falling below 0 on verbal memory tests. Only a non-verbal attention test was above 0 on the cognitive profile graph and on the WAIS-IV^{SA} composite graph the verbal tests and verbal memory tests were lower than non-verbal test. Comparison to the Danish participants (Nielsen et al, 1989) also shows that our participants have a weaker verbal memory. The Logic Memory test also attested to the poor memory assumption. From the total range of 0 to 24 for each Logic Memory trial Mpondo sample had a mean of $M = 4.81$ ($SD = 3.19$) for Story1 Immediate

Recall, $M = 3.27$ ($SD = 3$) for Story1 Delayed Recall, $M = 5.15$ ($SD = 3.18$) for Story2 Immediate Recall, and $M = 4.06$ ($SD = 3.71$) for Story 2 Delayed Recall. These scores suggest inadequacy in rehearsal and consolidation of information in both long-term and short term memory (Squire & Bayey, 2007) and could also be that cognition load on second language.

5.4.2. Memory skills

WAIS-IV^{SA} (2014) WMI only use verbal working memory subtests to measure memory. Thus ROCFT (Delayed Recall) was included specifically as it is a nonverbal memory test. This was performed to assess whether low test scores on these respective tests are highly associated with poor performance on phonological awareness and verbal comprehension. However the mean difference of $M = 10.21$ on the Delayed Recall between Mpondo sample and Undergrad students (Meyers & Meyers, 1995) suggest that poor memory is not only limited to verbal tasks.

The discussion relative to the performance of these second language speakers will start with contextualised word list learning. As can be seen in Table 8 participants remembered an average of $M = 5.96$ words on trial i and learning of the words improved as they remembered more words on trials that followed (trial ii to trial iv). Only after the interference, the number of words recalled decreased. Because of the gap and interference of other words, the words of the first list may have been forgotten or perhaps misplaced with words that were recently learned (words on list two). Although there was a memory error in the short-term memory, the words were transferred into long-term memory. This is evident in table 8 showing that in the delayed recall participants remembered an average of 9.42 words.

5.4.3 Attention test

Stroop as verbal assessment, tests attention, distractibility and suppression of automatic processing in fluent readers. Despite the suggestion in the literature (Van der Elst, Van Boxtel & Van Breukelen, 2006) performance on Stroop is susceptible to educational level, age and gender, as previously mentioned that present sample had a very narrow age and educational spread and drawn from a relatively homogenous socio-economic spectrum and probably based on this homogeneity of test population no significant. This may be due to the narrow range of the sample or extraneous variables. Marian et al (2013) suggested that multilingual participants performed better on tests using languages they were fluent in than in languages they were not fluent in. This applies to our sample as they had completed the Stroop test in English.

In summary, all verbal tests fell in ranges between 0 and -3 on the cognitive profile graph and they all were on the borderline on the WAIS-IV^{SA} composite graph. Participants performed poorly on the verbal tests compared to non-verbal tests. This takes us back to the issue on language being one of the ultimate barriers. In accordance with school policy participants are expected to be proficient in English, but based on our findings it is clear that this skill has not been fully required. Results on the COWAT also bring the question of proficiency in Xhosa. Based on these facts and assumptions of Mpondo sample being unbalanced bilinguals, one wonders if the introduction of English at a later stage hinders language development. Perhaps this could be because of the limited exposure to English.

5.5. Non-verbal assessment tests

Non-verbal assessment tests are deemed to be more culturally fair than verbal assessment tests. It can be said that this is true for our sample as the results shows that performance on non-verbal assessment tests was superior to performance on verbal

assessment tests. Despite this however, when compared with the mean performance of the published norm, the present sample still performed poorly on non-verbal tests. On the cognitive profile graph TMT is the only non-verbal test that had a mean above 0, ranging from 2 to 3, on both Trial A and Trial B, and the rest were below 0 ranging from 0 to -3 just as the verbal tests. On WASI-IV^{SA} non-verbal indices such as PRI and PSI were measured in the below average range while the VCI and WMI (verbal indices). The variation between verbal and non-verbal assessment tests may be due to the fact that verbal tests require participants to be fluent English.

Our sample scored low in the PRI with 20 points below the mean. On this non-verbal assessment index, Mpondo sample scored low on the 9th percentile in other words lower than 91% of population represented by South African norm sample. Although performance on this index was low it was certainly better than performance on verbal assessment tests. Variation over the cognitive profile could lead to a misdiagnosis suggesting left hemispheric fall out based on organic impairment. This difference may also impose the erroneous assumption that if you remove the verbal component when testing second language learners then testing becomes culture fair.

PSI measures the rapidity with which participants can mentally process simple or routine information without making errors (Wechsler, 2014). Although participants' scores were below average on tasks which traditionally contribute to the computation of the PSI was superior to both VCI and WMI, this suggests that participants' ability to process visual material quickly is better than their verbal reasoning ability. Based on this suggestion one would assume that reduction of cognitive load through removal of language factors may facilitates an increase in performance. However, socio-cultural variables still keep

performance on non-verbal tests below the international norms or more diverse and a culturalised South African norms.

5.6. Executive functioning

As said by Hannay, Howieson, Loring, Fischer and Lezak (2004) Executive Functioning is said to have four components which 1) Volition, which refers to a cognitive process in which an individual has a will or purposive drive to execute an action. 2) Planning, the in advance arrangement of executing action. 3) Purposive Action, the intentional actions. Lastly Effective Performance, successfully producing desired results. These four factors are demonstrated in TMT, WCST, Stroop and COWAT. Regardless of the instructions given by the administrator participants had the faculty of power to perform out of their own will. From observation on the WCST participants seemed to participate just to finish the test, as they continued to lay cards in any order even though they were told it was wrong. This is evident on the WCST results were they scored significantly low.

A good or average score on Executive Functioning Tests mean that an individual is able to perceive stimuli from his or her environment, respond adaptively, use all capacities to serve a certain purpose, and therefore use common sense to respond Strauss et al (2006). Give that our participants scored low compared to urban participants could mean that they are unable to perceive stimuli from their environment. Participants took longer to complete Trails B than Trails A, this could mean that our participant struggle to alternate between categories. Things such as relationship between numbers and alphabets could have been omitted in early schooling due to insufficient teaching resources. Such lessons helps with mental flexibility, and exclusion of such may affect performance on cognitive assessment tests.

The WCST offers mental flexibility as the participant changes set and it offers attention in the failure to maintain set. Basically a test of error related negativity derived from the anterior cingulate. The Stroop looks at attention required to suppress an over learnt parsing of letters to name the colours – inhibition and in the 4th trial it also looks at switching. Exposure to relationship between colours shapes and numbers at an early stage of schooling may have added value to the performance on Stroop and WCST. With regards to the COWT one would assume that our sample has not been exposed to variety of words due to limited reading. From these results it could be assumed that the test content is not organised in accordance to their environment and experiences or rather basic primary education. Our results in other words implies that Mpondo sample will not be able to develop new strategies or monitor their effectiveness when confront novel and unfamiliar circumstances.

Although Strauss et al (2006) claimed that executive functions are not in maximal use of the executive routine or well learned behaviour, Foxcroft and Roodt (2009) put emphasis on schooling as necessary for acquiring cognitive skill, problem solving strategies and knowledge. These are necessary for dealing with new problems such as those imposed by cognitive assessment tests. This puts emphasis on the quality of education in Mpondo land. From this it can be presumed that low performance is not only due to language barrier, but also due to the quality of teaching and learning.

5.7. Limitations

Fact is that every research has its limitation. One of the challenges that may have compromised our results is the number of tests and individual participant had to complete. Despite all attempts to control for, and accommodate for this, the number of these tests and the time they required may have caused fatigue and as such impacted on performance. Not

only could fatigue affect participants, but test administrators as well and this may have affected how they gave instructions and conducted the tests. Also the fact that our sample was drawn from the population and by virtue of this sample being a non-probability convenience based sample of volunteers, this thus limits the generalisability of the results. (Hair, Black, Babin & Anderson, 2009). Although an advantage in other ways, one of your greatest limitations is the homogeneity of the sample which prevents the further analysis of the impact of demographic variables.

According to Stangor (2011) it is not practical to draw conclusions solely on cross-sectional and correlational research design as results may be the case that neither variable caused the other, but rather a product of extraneous variables. Although this was a part of greatest strength for a homogenous sample, it is a greatest limitation as the homogenous population prevents analysis of the impact of demographic extraneous variables. This must therefore be addressed in future research.

With regards to WAIS-IV, performance can differ from day to day (Wechsler, 2002) as certain variables cannot be controlled. The fact that the participants had nothing to gain may have dampened motivation, not only for WAIS-IV^{SA} but for all tests as well. These in turn may compromise the IQ results without the administrator even being aware. Standard WAIS-IV^{SA} administration was adhered to including the discontinuation rules. Time and fatigue prevented the administration of all items as would be done during a standardisation exercise as in an unknown sample one cannot be sure of the difficulty grading of items. I think given the results of the factor analysis, to have followed standardisation procedure rather than standardised procedure would have allowed for item analysis. The importance going through all problems is based on the concern of population difference. Going through all problems would have helped to identify items that were discriminatory.

5.8. Recommendations for future research

First thing recommended for future is for such a test battery to be divided and spread over a period of days to avoid fatigue. The importance of such research is revealed in the findings and as a result it would be very useful if the same research would be conducted in various other settings of this population for comparative purposes. This would assist in dealing with issues of transferability and generalizability as it is important for implementation of necessary changes or interventions.

Since the results of the present study only indicated weak to moderate relationships, it is recommended that future studies replicate the investigation in order to find potentially strong relationships between variables. Also, given that our participants have access to television, radio and newspapers, it would be useful in the future if researchers would look into the kind of programs they watch or listen to and what is it they read about in newspapers and the kind of books they read. This will help in knowing what are they informed of and if it is useful for their cognitive development or not. What would also help is a thorough investigation in educational material they have and don't have and the methods that are used for teaching and learning. This will help in determining if they are beneficial for cognitive skills development.

Researchers must continue to investigate the link between theory and measurement which implies that theories can be tested through construct validation of the tests. This is suggested because cognitive tests have relied on common variances to diagnose participants and as seen these common variances does not apply to all kinds of populations.

Looking at our sample the mean of permanent residents which is average total number of people that lives in one house and how many rooms are shared by these residents (what is the mean and SD and what does it tell us). As said by Lewis, Freeman, Kyriakidou,

Maridaki, Kassotaki and Berridge (1996), family characteristics such as family size have an impact in cognitive development. Children in households with four or more children have lower ability scores than those with fewer or no siblings. Not only family size, but also qualifications of parents or guardians have been proved to affect performance on cognitive assessment tests (Bradshaw & Wasoff, 2009). Low household income and unemployment are also significant factors associated with poorer performance (Bradshaw & Wasoff, F, 2009). This is relative to our sample as there is not much growth or opportunities in this isolated area.

5.9. Conclusion

Majority of the tests suggests that poor performance in the tests is associated with brain injury. Thus the implications of our findings would mean that the entire sample has brain injury. For example; TMT is perceived to be highly sensitive to cognitive impairment, while poor performance in Stroop is associated with frontal system dysfunction (Mitrushina et al., 2005). It will obviously be naïve to conclude that the entire sample has mental impairment.

These results are significant in that they highlight a major problem with the popular usage of cognitive assessments in rural South African context. They also show that that studies regarding frontal lobe damage in South African rural populations are not valid due to the inappropriate nature of the international norms when applied to such populations. Due to the limited access to neuropsychological assessments, to avoid misdiagnosis, it is more sensible to evaluate cognitive abilities based on factors that are known to affect cognitive abilities.

Apart from living in a remote area that has limited resources what distinguishes our sample from urban populations is the quality of education. It is undeniable that rural area

has not yet reached the quality level of schools such in urban areas. It is a given that learners with high quality education have had more opportunities to practice skills that enhances cognitive skills. What needs to be kept in mind is that education in South Africa is a product of Western conceptualizations of achievement and learning. These methods of teaching and learning therefore come against cultural input and experiences that would make teaching and learning easier for South African learners.

It is unfair to explain Mpondo cognitive profile in terms of international norms. This is so because the WAIS-IV assessment performance is not necessarily an indication of overall indices, but rather the lack of familiarity with the content and English language proficiency, as the language of instruction, obstructs optimal performance due to a lack of understanding. Although the APA Standards Document mentions that individuals should be tested in a language that they are most proficient (Huysamen, 2002), results may still be invalid if our sample was to be tested in Xhosa. Fact is that even though they speak Xhosa half the time these learners will struggle to be fluent in either Xhosa or English due to the interference of both the languages.

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Appendix A: Demographic Questionnaire

All responses are confidential. Please answer all questions as truthfully as possible.

1) Age (years)_____

2) Gender: Male__ Female__

3) Are you currently in school? _____

If yes, what grade are you currently doing? _____

If not, highest grade passed _____

Why did you leave school? _____

Grades failed or repeated _____

4) Would you like to study further? and what would you like to study?

5) What is your home language? _____

6) Which of these Language do you know

Afrikaans____ English____ IsiNdebele____ IsiXhosa__ IsiZulu____

Sepedi (North Sotho) __ Sesotho____ Setswana____ SiSwati____ Tshivenda____

Xitsonga____ Impondo____

7) How well can you read, write and speak in each of these languages (including your home language)

Indicate (1) Very well (2) Adequately (3) With difficulty

language	Speak	Read	Write

8) On a scale of 1 to 10 how exposed are you to English in these areas:

1 as least exposed and 10 as mostly exposed

➤ Home ___

➤ School ___

➤ Friends ___

➤ Media ___

9) Do you ever buy newspaper at home?

Yes _____ No _____

If yes, how often?

10) Do you have books at home?

Yes ____ No ____

If yes, how often do you read them?

11) Do you ever listen to the radio?

Yes ____ No ____

If yes, which radio stations do you listen to? How often?

12) Do you ever watch T.V?

Yes ____ No ____

If yes, which channels do you watch? How often?

13) Have you always lived in Baleni? _____

If "NO" where did you leave previously and for what reason?

14) How would you describe your current living situation?

Alone_____ With Parents_____ With Spouse_____

With other Family members_____ With friends_____

Other (please specify)_____

15) Residents in home,

Permanent_____

Occasional_____

If occasional (please specify. e.g work away from home)

16)

People living in the house	Relations hip	Educatio n	Grants	Income

17) Have you ever suffered a head injury?

Yes _____ No _____

If yes please explain

18) Have you ever been hospitalized?

Yes _____ No _____

If yes, when? For how long? For what reason?

19) Do you take regular medication? (pills or medicine that you take every day)

Yes _____ No _____

If yes, do you know the name of medication or do you know why this was given to you?

How long have you been taking this medication?

Do you have any other medical or health problems? If so, can you describe the problems you suffer?

Thank you for your participation

Appendix B: Parent consent form and letter



School of Human and Community
Development

Private Bag 3

Wits 2050

Tel: (011) 7174521



I _____, agree to let my child take part in Enid Schutte's study examining the way South Africans may think and solve problems. I hereby give consent for my child to participate in the psychometric assessment to be conducted by her team of researchers.

I understand that:

- Participation in this study is voluntary
- My child will be busy for a period of 3 to 4 hours
- They will complete a range of tests drawn from established psychometric test batteries.
- I may withdraw my child from the study at any time.
- No information that may identify me or my child will be included in the research report, and my child's responses will remain confidential.

Signed _____



School of Human and Community
Development
Private Bag 3
Wits 2050
Tel: (011) 7174521



Dear Parent

Participation information sheet: Questioning the validity of the international knowledge for understanding the cognitive profile in a rural South African population.

My name is Enid Schutte. I will be working with a team of researchers who will help me gather information on how young South Africans remember things, solve problems and approach other thinking tasks. The tests we will use are used all over the world. We wish to understand just what they might mean in South Africa.

We would like to invite your child to come and join in the study. They will be required build or solve puzzles, to remember different things and answer different questions. This will take a total of 3 to 4 hours and will take place at the Baleni Senior Secondary School between the 29th June and the 4th July 2015. Neither yourself not your child has to agree to do this. If you choose to join in or refuse to join in this research project, there will be no consequences. If you let your child join he or she may pull out at any time without judgment.

The information collected may be used for other purposes (i.e. further study) but will stay private; no individual will be recognizable in the publication of any results that come from more use of data. No results that could recognize you as a participant will be published; only results of everyone will be published. The information collected from you will be stored in a secure place and will have no personal information or recognizing information. Only

researchers will have access to the data and recognize information of the data will be destroyed as soon as the data has been captured.

<p>If you would like to contact her researchers about any aspect of this study, please contact the Chief Investigator:</p>	<p>If you have a complaint concerning the manner in this research is being conducted, please contact:</p>
<p>Enid Schutte</p> <p>Tell: 011 717 4521</p> <p>Cell: 082 920 6731</p> <p>E-mail: enid.schutte@wits.ac.za</p> <p>Moroesi Mohlahli</p> <p>Cell: 081 233 8850</p> <p>E-mail: mohlahlim@gmail.com</p>	<p>Human Ethics Office</p> <p>Human Reseach Ethics Committee (HREC)</p> <p>Tell: 011 717 1234</p>



Mna _____, ndininka isiqiniseko sokuvuma ukukhulula umntwana wan ukuba angathatha inxaxheba kwisifundo esenziwa ngu- Enid Schutte oza kube ekhatshwa liqela lenzululwazi. Esi sifundo sivavanya yaye siphangalalisa ulwazi ngeendlela ezisetyenziswa lulutsha lwaseMzansti Afrika. xa lucinga, xa lukhumbula naxa lusombulula iingxaki. Lencwadi igunyazisa ukuba u SIPHO XHOBONGO, yena ongumntwana wam, ukuba abe yinxalenye yesisifundo sokukuhlolwa ukuphangalala kokusetyenziswa kwengqondo xa abantu besobulula iingxaki abthi bajamelane nazo.

Ndazisiwe kwaye ndacacelwa ukuba:

- Inxaxheba kweisifundo yeyokuzithandela yaye ayikhokheli ngeniso.
- Esi sifundo endivumela ukuba umntwana wam athathe inxaxheba kuso sizakuthatha iiyure ezithathu ukuya kutsho kwezine.
- Kuzakusetyenziswa uluhlu lwendlela ezisegunyazisiweyo nezivunyiweyo zokuvavanya umntwana.
- Ndingamyekisa nangaliphi na ithuba na umntwana wam koluvavanyo xa ndibon akukho imfuneko mna mzali okanye mgcini wontwana.

- Inkcukacha zesazisi sam okanye esomntwana wam aziyikuchazwa kwingxelo yolwazi oluqokelelwe koluphando, yaye impendulo zomntwana wam ziya kuqwalaselwa kwaye zizakuphathwa ngokufihlakeleyo.

Signed _____



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Mzali Othandekayo

Inkcukacha zokuthatha inxaxheba komntwana: Questioning the validity of the international knowledge for understanding the cognitive profile in a rural South African population.

Igama lam ndingu Enid Schutte. Ndizakube ndisebenza neqela lwabaphandi neenzululwazi eziza kundincedisa ukuqokelela iinkcukacha zolwaxi ngeendlela ezisetyenziswa lolutsha lwaseMzantsi Afrika. xa lucinga, xa lukhumbula naxa lusombulula imiceli mngeni ethi isebenzise ukucinga. Indlela esizisebenzisayo zokuvavanya nezokufumana olulwazi sigunyazisiwe yaye ziqinisekisiwe kwihlabathi liphela. Injongo yethu kukufuna ukwazi ukuba zisixelela ntoni apha eMzantsi Afrika.

- Sinqwenela ukucela umntwana wakho ukuba azibandakanye kwesi sifundo.

Abantwana bazakucelwa ukuba basombulule They will be required build or solve puzzle, bakhumbule izinto ezingafaniyo kwaye baphendule imibuzo eyahlukahlukeneyo. Olu hlelo luzakubanjelwa eBaleni Senior Secondary School ukusa ngomhla wamashumi amabini anesithoba (29th June) kweyeSilimela ukuya

kutsho ngomhla wesine (4th July) kweka-Yekhala yalo umiyo. Olu luhlu luzakuthatha ixesa eliqikelelwa kwii-yure ezintathu ukuya utsho kwezine kwesi sikolo sichazwe ngaphezulu. Abazali, abagcini babantwana okanye abantwana abanyanzelwa ukuba bangazibandakanya nesisifundo. Ukuthatha inxanxheba okanye ukuyihlehlisa inxaxheba leyo akunamiphumela mibi kwabo bathe bakhetha ukwenza njalo kwesisifundo. Umzali unelungelo nemvume yokumyekisa nangaliphi na ithuba umtwana wam koluvavanyo xa ndibon akukho imfuneko mna mzali okanye mgcini wontwana.

Inkcukacha zolwazi eziqokelelwe kwesisifundo zingakusetyenziselwa ukuphuhlisa ezinye iinjongo (ezinye izifundo) kodwa oku kuyakwenziwa ekhusini nangoonophelo. Abantwana abathathe inxaxheba abazukuchazwa nqo xa kubhalwa iziphumo nengxelo yoluphando lwesisifundo. Xa kufikelele ixesha lokupapashwa kweziphumo zesisifundo, abantu abathathe inxaxheba abayi kuchazwa nqo. Ezi nkcukacha zolwazi ezizakuthi ziqokelelwe kwesi sifundo zizakugcinwa zikhuselekile. Olu gcino luzakuzisusa iinkcukacha ezichaza abo bathathe inxaxheba. Zezi nzululwazi zizibandakanye nesisifundo ezizakuthi zinikwe imvume yokubona nokusebenzisa olulwazi. Ezi nkcukacha ziya kutshiswa xa sele ikhutshiwe ingxelo nempapasho yesisifundo.

<p>Ukuba unomnqweno wokunxulumana njenjongo yokuthetha ngokuntsokothileyo ngawo nawuphi na</p>	<p>Ukuba unesikhalazo ngendlela oluphando okanye oluvavanyo oluqhutywa ngalo, nceda utsalele:</p>
------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------

<p>umba ngesisifundo, nceda utsalele</p> <p>Umququzeli Ophambili:</p>	
<p>Enid Schutte</p> <p>Tell: 011 717 4521</p> <p>Cell: 082 920 6731</p> <p>E-mail: <u>enid.schutte@wits.ac.za</u></p> <p>Moroesi Mohlahli</p> <p>Cell: 081 233 8850</p> <p>E-mail: <u>mohlahlim@gmail.com</u></p>	<p>Human Ethics Office</p> <p>Human Reseach Ethics Committee</p> <p>(HREC)</p> <p>Tell: 011 717 1234</p>

Appendix C: participant consent form and letter



I _____, agree to take part in Enid Schutte's study examining the way South Africans may think and solve problems. I hereby give consent to participate in the psychometric assessment to be conducted by her team of researchers.

I understand that:

- Participation in this study is voluntary
- I will be busy for a period of 3 to 4 hours
- They will complete a range of tests drawn from established psychometric test batteries.
- I may withdraw from the study at any time.
- No information that may identify me will be included in the research report, and my responses will remain confidential.

Signed _____

Appendix c: participant consent form and letter



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Development

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Dear Participant

Participation information sheet: Questioning the validity of the international knowledge for understanding the cognitive profile in a rural South African population.

My name is Enid Schutte. I will be working with a team of researchers who will help me gather information on how young South Africans remember things, solve problems and approach other thinking tasks. The tests we will use are used all over the world. We wish to understand just what they might mean in South Africa.

We would like to invite you to come and join in the study. You will be required to build or solve puzzles, to remember different things and answer different questions. This will take a total of 3 to 4 hours and will take place at the Baleni Senior Secondary School between the 29th June and the 4th July 2015. You do not have to agree to do this, if you choose to join in or refuse to join in this research project there will be no consequences. You may pull out at any time without judgment.

The information collected may be used for other purposes (i.e. further study) but will stay private; no individual will be recognizable in the publication of any results that come from more use of data. No results that could recognize you as a participant will be published; only results of everyone will be published. The information collected from you will be stored in a secure place and will have no personal information or recognizing information. Only researchers will have access to the data and recognize information of the data will be destroyed as soon as the data has been captured.

<p>If you would like to contact her researchers about any aspect of this study, please contact the Chief Investigator:</p>	<p>If you have a complaint concerning the manner in this research is being conducted, please contact:</p>
<p>Enid Schutte</p> <p>Tell: 011 717 4521</p> <p>Cell: 082 920 6731</p> <p>E-mail: <u>enid.schutte@wits.ac.za</u></p> <p>Moroesi Mohlahli</p> <p>Cell: 081 233 8850</p> <p>E-mail: <u>mohlahlim@gmail.com</u></p>	<p>Human Ethics Office</p> <p>Human Reseach Ethics Committee (HREC)</p> <p>Tell: 011 717 1234</p>

University of the Witwatersrand, Johannesburg

Appendix D: Ethical approval