Comparative Analysis of Test Performance of South African Learners on Indexes/Scales of the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V) and the Kaufman Assessment Battery for Children, Second Edition (KABC-II)

A Research Report
Submitted in Partial Fulfilment of
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Declaration

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"An intelligence test is a neutral, inconsequential tool until someone assigns significance to the results derived from it. Once meaning is attached to a person's test scores, that individual will experience many repercussions, ranging from superficial to life-changing. These repercussions will be fair or prejudiced, helpful or harmful, appropriate or misguided—depending on the meaning attached to the test score" (Gregory, 2004, p. 240).

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My sincere and deep gratitude to

First and foremost, it is only through the grace of the Almighty (Allah), the most gracious, the most merciful, that I have been blessed with the opportunities that have allowed for a bold career change.

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"I am because we are"

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Dedication

To my daughter,

Inheriting a dysfunctional family unit – a father who was an abusive cocaine addict, a mother who was the victim of intimate partner violence and a sufferer of schizophrenia at a time and in a community where mental illness was not recognised and with an ACE score of 10 and poor social support – the odds for success were not favourable.

I was in a space of passive acceptance: allowing the life I was born into to determine my success. Asma, your birth ignited in me a consciousness of responsible parenting, which, to me, simply meant living a life that reflected courage.

This journey has been both challenging and uplifting. It has taken me a little longer than most, as the internal and external challenges have been many. But, it was only once I recognised that my greatest challenge was not what society thought or made of me, but rather what I believed about myself – "the hate within," the self-doubt, and the constant questioning of whether or not I deserved this – that I was able to conquer this mountain.

My hope is that this master's thesis will stand testimony of my courage as a parent. May it be proof that we are able to overcome our past and not be defined by it. May it give hope to all those fighting against all odds to rise above what we are born into and what we grow to believe we are worthy of – to become what we truly capable of.

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Chapter 1: Introduction

1.1 Title

Comparative Analysis of Test Performance of South African Learners on Indexes/Scales of the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V) and the Kaufman Assessment Battery for Children, Second Edition (KABC-II).

1.2 Introduction

Since the publication of the first intelligence test in the early 1900s these assessment measures have been used worldwide to predict academic functioning and identify not only difficulties related to learning and classroom performance but also giftedness (Fiorello et al., 2007; Heller & Schofield, 2008; Poletti, 2014). Such assessments are also used in combination with other measures to assess the impact of traumatic brain injuries (Fiorello et al., 2007; Heller, & Schofield, 2008; Poletti, 2014). Despite their apparent popularity, the use of intelligence tests for the purpose of identification and diagnostics has been marked by much controversy. This controversy centres on a number of concerns. These include the diagnostic utility of intelligence tests (Sotelo-Dynega, & Dixon, 2014); the manner in which intelligence tests are interpreted, for example when identifying learning difficulties (Huang, Bardos, & D'Amato, 2010); and, as aptly described by Fiorello et al. (2007, p. 3), a debate based on "the nature and structure of intellectual abilities."

In South Africa, additional concerns about the use of intelligence tests for diagnostic and identification purposes link to both the country's past and the use of these measures to enable racism and discrimination and the current shortage of reliable, unbiased and valid measures to assess children in our diverse multicultural and multilingual context (Foxcroft & Davies, 2008; Foxcroft & Roodt, 2013; Laher & Cockcroft, 2013, 2014, 2017). Despite these

concerns, a study by Foxcroft, Paterson, Le Roux, and Herbst (2004) found that 86.3% of South African educational psychologists use psychological tests in their practice. These include intelligence tests aimed at identifying learning difficulties and more broadly assessing psycho-educational and cognitive/intellectual functioning. Taking into consideration both the evident widespread use of intelligence tests in South Africa and Laher and Cockcroft's (2014, p. 312) statement that "psychological assessment can contribute meaningfully towards transforming education in the country", the concerns noted compel us to continue with research into available measures and their suitability for use in this country.

1.3 Rationale

The Wechsler Intelligence Scale for Children and the Kaufman Assessment Battery for Children rank among the 10 intelligence tests most frequently used by school psychologists worldwide (Oakland, Douglas, & Kane, 2016). Foxcroft et al.'s (2004) study listed the third edition of the Wechsler Intelligence Scale for Children (WISC-III) as one of the 25 assessment measures then most frequently administered by South African psychologists. Moreover, South African authors Shuttleworth-Edwards, Van der Merwe, Van Tonder, and Radloff (2013) claimed that the Wechsler Scales will remain, at least for the time being, one of the most prevalent assessment measures in the field of intelligence testing.

With reference to the Kaufman Assessment Battery for Children, Greenop, Rice, and De Sousa (2013) mentioned the difficulty in ascertaining its popularity amongst South African psychologists, as at the time (2013) no research had been published on this. Such research had, however, been included in the study by Foxcroft et al. (2004) as one of the assessments used by South African psychologists. Furthermore, in 2000, South African researchers Skuy, Taylor, O'Carroll, Fridjhon, and Rosenthal (2000) had also found the

Kaufman Assessment Battery for Children, first edition to be a less discriminatory test to use with South African children than the Wechsler Intelligence Scale for Children, revised (WISC-R).

To date, however, there appears to be scant published research findings on the newest version of the Wechsler Intelligence Scale for the Children, fifth edition (WISC-V) and only limited research on the Kaufman Assessment Battery for Children, second edition (KABC-II). Regarding the latter, Mitchell et al. (2017) conducted a South African study on the KABC-II in a rural area to establish its reliability and validity in that context. The study's outcome indicated both high reliability and construct validity when the originally validated structure was maintained. These findings compelled me to do further research on the KABC-II in a South African context and, as there appears to be no published research findings on the WISC-V, to conduct a comparative analysis of the test performance of South African learners on the indexes/scales of the WISC-V and the KABC-II (both UK normed). A further motivation for this study was the revision of the theoretical base of the current WISC-V and KABC-II and its potential to meet the South African population's diverse needs.

A standardisation and norming process requires widespread financial and practical efforts, which fall outside the parameters of a study of limited scope such as this one. Subsequently, this research explored the construct and concurrent validity of the theoretically similar indexes/scales of the KABC-II and the WISC-V, which could potentially add to the currently sparse body of literature on the KABC-II and WISC-V in South Africa.

In addition to this study's potential theoretical contribution, it can also make a practical contribution. As noted, assessment measures are used not only to determine scholastic potential; assess and diagnose various difficulties related to learning; and identify patterns of

cognitive strengths and weaknesses but also for the planning and adaptation of curricula (to name but a few uses). The broad scope of assessment measures in the education sphere means that when selecting a measure, assessors must ensure that it is multifaceted; measures what it claims to measure; and that its scores are consistent over time. It is thus important that assessors understand how different instruments compare in terms of multifurcates, theoretical underpinning, and quantitative scores produced (Laher & Cockroft, 2013; Olivier, 2010). The selection of an assessment measure impacts not only the learner (in terms of labelling) but also curriculum planning, learner support, and the identification of special needs (Olivier, 2010). The current trend in South Africa appears to be the use of international assessment measures that have not been normed, standardised, and adapted for the South African population. The Foxcroft et al. (2004) study indicated that approximately 56% of assessment measures used in South Africa have not been developed or adapted for use in this country. Research on the international measures available and used in South Africa is thus urgent to inform the practice of assessors and ensure that children are assisted in the best possible manner.

This study contains an unstratified within-group analysis of the scores produced by the WISC-V and KABC-II indexes/scales. This analysis was then used to explore the construct and concurrent validity of these assessment measures and their applicability in the South African context. Many test companies do validity studies as they are essential to the publishing process – understanding the validity of an assessment measure is key to establishing its applicability and usefulness. This is particularly important in the South African context as 86.3% of educational psychologists use psychological tests in their practice, which creates the ethical responsibility to ensure that the use of assessment measures is supported by research-based evidence (Foxcroft et al., 2004).

1.4 Research Aims

The main aim of this study is a comparative analysis of the test performance of South African learners on the indexes/scales of the WISC-V and KABC-II, so as to determine whether these indexes/scales yield non-significantly different average scores when administered to referred learners. More specifically, the Verbal Comprehension Index (VCI) on the WISC-V is compared to the Knowledge Scale (Gc) on the KABC-II; the Visual Spatial Index (VSI) on the WISC-V is compared to the Simultaneous Processing Scale (Gv) on the KABC-II; the Fluid Reasoning Index (FRI) on the WISC-V is compared to the Planning Scale (Gf) on the KABC-II; and the Working Memory Index (WMI) on the WISC-V is compared to the Sequential Processing Scale (Gsm) on the KABC-II the theoretical underpinning of each assessment measure indicates that these indexes/scales assess similar cognitive abilities and processes.

1.5 Research Questions

What is the nature of the relationship for the referred sample between the WISC-V Verbal Comprehension Index (VCI), Visual Spatial Index (VSI), Fluid Reasoning Index (FRI), and Working Memory Index (WMI) and the KABC-II Knowledge Scale (Gc), Simultaneous Processing Scale (Gv), KABC-II Planning Scale (Gf) and Sequential Processing Scale (Gsm)?

- Is there a statistically significant difference between the average scores of the VCI and Gc?
- Is there a statistically significant difference between the average scores of the VSI and Gv?
- Is there a statistically significant difference between the average scores of the FRI and Gf?
- Is there a statistically significant difference between the average scores of the WMI and Gsm?

1.6 Hypotheses

- Given that the VCI and the Gc are said to measure a child's knowledge and prior learning/crystallised intelligence, this index/scale should yield non-significantly different average scores.
- Given that the VSI and the Gv are said to measure a child's visual-spatial reasoning, this index/scale should yield non-significantly different average scores.
- Given that the FRI and the Gf are said to measure a child's fluid intelligence, this index/scale should yield non-significantly different average scores.
- Given that the WMI and the Gsm are said to measure a child's short-term memory, index/scale should yield non-significantly different average scores.

1.7 Concept Clarification

Construct Validity Construct validity is a central tenet of the field of psychology. It is pertinent where one assesses variables that are not directly observable (Western & Rosenthal, 2003). Simply stated, it asks the question, "Does the instrument measure what it

claims to measure?" Typically, theoretical association is used to establish construct validity (Western & Rosenthal, 2003). Based on both test development research and confirmatory factor analysis, the WISC-V and KABC-II measure similar constructs on a similar theoretical base. The test developers established construct validity through confirmatory factor analysis and by correlating these measures with a number of other measures (expanded on in Chapter 2). However, these correlation studies have mostly used sample selection guided by United States (US) census data. There is minimal data available on South African or African samples. This research therefore used statistical analysis to establish construct validity for the referred sample. Once theoretical construct validity was established (that the specific indexes/scales measure what they claim to measure theoretically), the index/scale scores could be compared to establish concurrent validity.

Concurrent Validity Concurrent validity relates to the comparison of an assessment measure to other similar scientifically validated measures (Merrell, Ervin, & Gimpel, 2006; Wechsler, 2003). To establish concurrent valildity, tests are administered consecutively or with minimal time inbetween. The test scores are then simultaneously analysed and compared to demonstrate the extent to which they correctly estimate an individual's conditions at that particular moment in time. For this research, four indexes/scales that show strong theoretical similarities were selected for administration and comparison. Gathering information on test validity, specifically concurrent validity, provides researchers with evidence to defend the use of these assessment measures within the South African context.

1.8 Outline of the Research Report

This concludes Chapter 1, which is the introduction to and motivation for the research topic. It puts forth the research aims, questions, and hypotheses.

Chapter 2 discusses the development of psychological assessment in South Africa. It investigates some detail on early theoretical models and methods developed to measure intelligence. The theoretical structure: CHC and Lurian models are detailed together with the structure of the WISC-V indexes and KABC-II scales, with a focus on the comparative indexes/scales. Important concepts – factor analysis, construct validity, cross-battery approach and concurrent validity – are defined and positioned in the research. The chapter concludes with culture-fair testing and existing local and international literature relevant to this study.

Chapter 3 describes the study's methodology and ethical considerations. It provides research design and a description of the sample selected. It then discusses the instruments (WISC-V and KABC-II) the procedure followed, and how the data was analysed.

Chapter 4 reveals the results. It firstly reveals the descriptive statistics and normality, followed by the results and statistical outputs of the Pearson correlation and paired samples t-test, which were used to answer the research questions and test the hypotheses.

Chapter 5 is a detailed discussion of the results put forward in Chapter 4. And, lastly, Chapter 6 concludes this report by highlighting this study's findings, discussing the strengths and limitations of this study, and offering recommendations for future studies.

Chapter 2: Literature Review

2.1 Introduction

This literature review comprises seven aspects. First, it provides a brief overview of the development of psychological assessment from a South African perspective. Second, the early theoretical models and methods that measure intelligence are noted. Third, it elaborates on the theoretical models that underpin the assessment measures used in this study – the Cattel-Horn-Carrol (CHC) theory and Luria's neuropsychological theory (PASS). Fourth, the literature review explores two cognitive assessment measures, WISC-V and KABC-II in some detail with focus on their comparative indexes/scales. Fifth, it outlines factor analysis, construct validity and the cross-battery approach to provide evidence for comparing the selected indexes/scales and briefly describes concurrent validity and how it relates to this study. Sixth, literature on culture-fair testing is discussed. Lastly, this section concludes with an analysis of existing local and international research in the field.

2.2 Brief Overview of Psychological Assessment in South Africa

Over the past century, the field of psychology in South Africa has transformed. Once guided by racialised ideologies of oppression and segregation, today the field is viewed with some optimism due to a heightened moral and ethical consciousness (Laher & Cockroft, 2013).

The sub-discipline of psychological assessment was introduced to South Africa as early as 1915 through, among others, the works of Martin in 1915; Leipold in 1916; and Quintin in 1923. Psychological assessment has played a significant role, both positive and negative, in the development of psychology as a scientific discipline (Foxcroft & Roodt, 2013). The early use of psychological assessment in South Africa focused predominantly on the needs of white

South Africans. When tests were administered to black South Africans, the lower scores were used to erroneously substantiate the notion of inferior native intellect based on racial category (Foxcroft & Davies, 2008). Thus, the results of psychological tests were unethically used to provide a premise for the Bantu Education System, whereby lower test scores were used to legitimise segregated education curricula and subsequently implement job reservation practices that favoured the white population to the detriment of other races (Nzimande, 1995).

The advent of democracy in 1994 brought about the recognition of the unethical role psychological assessment had played in promoting the apartheid agenda. This resulted in not only a decline in research and development in the field of psychological assessment but also a general aversion to the field (Donald, Thatcher & Milner, 2014; Nzimande, 1995). Initial efforts to protect against illegitimate practices were promulgated in the Employment Equity Act (Act 55 of 1998), which prohibited the use of psychological assessment for recruitment purposes. After much debate and lobbying by professional bodies, concession was made for tests that are proven to be reliable, valid, unbiased, and fair to all employees (Foxcroft & Roodt, 2013). In the sphere of education, school readiness assessments and group tests were banned as these were viewed as a perpetuation of the cycle of oppression and discriminatory practices (Foxcroft & Roodt, 2013).

Bearing institutionalised inequality in mind, the newly elected democratic government made painstaking efforts to regulate, legislate, and ensure that psychological assessment be used within the framework of the country's constitution – premised on upholding human rights, human dignity, equality, and fairness (O'Malley, 2016).While progress has been made in the field, conditions remain far from ideal. In terms of ethical processes, the Health Professions Council of South Africa in association with researchers, authors, and testing

companies established guidelines to ensure that appropriate measures are in place; certain criteria are met; and the individual being assessed is not harmed or disadvantaged in any way (Health Professions Amendment Act 29, 1997). However, gaps in the field remain prevalent as many of the assessment measures are still internationally developed and imported for local use. As the appropriate population normative data is unavailable for interpretation, this practice ignores the diverse set of challenges that exist in South Africa.

When broaching the topic of diversity in relation to psychological assessment in the South African context, the challenges are many. The most prevalent challenges include language, socio-economic status, and quality of education. The arguments relating to test norms are complexly layered and somewhat polarised. Some practitioners hold that South African population dynamics are too diverse for the development of population norms, as the extracted sample within any population group is far too diverse and can therefore not sufficiently reflect the broader population (Shuttleworth-Edwards, 2016). Other practitioners argue that there is value in normative data and that while specific diversity traits can be acknowledged at an individual level the broader norms remain relevant (Taylor, 2016). Both sides of the argument have merit – an interim solution is thus required as test development that meets individualistic needs is far from that which is required.

It is thus important to be resourceful and work within the current reality. The current reality calls for the recognition and understanding of how internationally developed standardised assessments work; their underlying theoretical frameworks; their scoring criteria; how the tests measure general intelligence; and their validity – all of which are significant in ensuring ethical practice and transformation (Kanjee, 2013). As schools across the country become increasingly reliant on cognitive assessment measures for diagnostic purposes and the shift toward inclusive education becomes widespread (Department of

Education, 2001), the use of fair psychological assessments directly influences the identification of future educational needs of millions of children and youth in South Africa.

2.3 The Development of Theoretical Models and Methods Measuring Intelligence

Francis Galton is the founder of differential psychology, which is rooted in the exploration of the differences between people. As early as the 1800s, he explored reaction time and its relationship to sensorimotor stimuli, which resulted in the development of a test to measure the differences in the intellectual ability of individuals (Kaufman, Kaufman, & Plucker, 2013). In 1904, Charles Spearman – psychologist, renowned statistician, and pioneer of factor analysis – published his extremely influential article that proposed the concept of general intelligence or (*g*) factor as the primary factor of intelligence (Sternberg, 2003). Spearman's theoretical model and concept of general intelligence form the theoretical foundation for some of the most influential tests used today.

Amongst these are adaptations of the original Wechsler-Bellevue Scale, including the Wechsler Adult Intelligence Scale and the Wechsler Intelligence Scale for Children (Boake, 2002).Spearman's (*g*) factor theory also influenced test development in South Africa: the 1964 New South African Individual Scale (NSAIS), later revised as the Senior South African Individual Scale Revised (SSAIS-R), was premised on this factor (Cockroft, 2013). Parallel to Spearman's theoretical conceptualisations, JP Guilford published the Structure of Intellect model (SI) in 1969, which was contradictory to the Spearman conceptualisation and not as influential. In the South African context, SI also influenced test development and forms the theoretical foundation for the Junior South African Individual Scale (JSAIS) (Theron, 2013). SI, which rejects Spearman's (*g*) factor theory, is premised on the idea of intelligence as a combination of operations, contents, and products. Guilford researched and developed a

range of psychometric tests to measure specific abilities and used factor analysis to determine which tests assessed the same or different abilities. The SI theory proposes six types of products and operations and five contents. These are independent dimensions that result in 180 different components of intelligence.

The Cattel-Horn-Carrol (CHC) theory of intelligence built on Spearman's 1904 (*g*) factor theory and is, to date, considered the most empirically sound and comprehensive arrangement of intellectual elements (McGrew, 2005; Schneider & McGrew, 2012). CHC theory fused the Cattel-Horn theory of fluid and crystallised intelligence and Carroll's 1993 three-stratum theory (Sternberg, 2003) – both of which had developed from the (*g*) factor theory. They had followed different paths to both conclude in comprehensive theories (Kaufman, 2009). CHC theory forms "the foundation for most contemporary IQ tests" (Kaufman, 2009, p. 91). The Woodcock-Johnson Battery, third edition (WJ-III); Stanford-Binet Intelligence Scale, fifth edition (SB5); and the Kaufman Assessment Battery for Children, second edition (KABC-II) all incorporate elements of CHC theory. In recent years, the CHC model has also influenced the Wechsler intelligence scales: the Wechsler Preschool and Primary Scale of Intelligence, fourth edition (WPPSI-IV); the Wechsler Adult Intelligence Scale, fourth edition (WAIS-IV); and the Wechsler Intelligence Scale for Children, fourth and fifth editions (WISC-IV and WISC-V) (Kaufman, 2009).

The Planning, Attention, Simultaneous, Successive (PASS) theory, rooted in Luria's 1966, 1973, and 1980 research, conceptualises the idea of human intelligence from a neuropsychological perspective and challenges Spearman's (*g*) factor on the grounds of brain structure (Das, Naglieri, & Kirby, 1994). The PASS theoretical model forms the base for the interpretation of the KABC-II Mental Processing Index (MPI). Section 2.4 explores this in some detail.

2.4 Luria's Neuropsychological Theory

A.R. Luria, a Russian neuropsychologist, focused predominantly on the brain's structure; its functional aspects; and its role in complex behavioural processes (Kaufman & Kaufman, 2004). At the base of Luria's theory lie three separate but related functional units that interact in varying degrees to allow for the production of complex behaviour (Naglieri & Das, 2005). Unit 1 is responsible for the regulation of arousal and attention. Unit 2 encompasses the use of one's senses for the analysis, coding, and storage of information through the use of simultaneous or successive processing. Unit 3 is responsible for executive functions such as monitoring behaviour, planning, and programming (Kaufman & Kaufman, 2004).

Each of these three functional units is linked to brain regions. They are referred to as "functional" units to emphasise that neuropsychological mechanisms work in separate but interrelated systems (Luria, 1973, as cited in Naglieri & Das, 2005). Unit 1 lies below the cerebral cortex in the area commonly known as the reticular activating system. Unit 2 occupies the posterior region of the neocortex, including the parietal, occipital, and temporal lobes. It plays a critical role in carrying auditory, olfactory, vestibular, gustatory, and general sensory information into the cortex (Luria, 1974, as cited in Naglieri & Das, 2005). Unit 3 is linked to the anterior region of the frontal lobe. Neural activity passes through this area to reach the primary motor cortex where impulses are transmitted into speech patterns and motor routines (Luria, 1974, as cited in Naglieri & Das, 2005). Luria argued against the notion of localisation. He stated that the functional units account for higher cognition biological and cultural factors. Luria stated "…perception and memorising, gnosis and praxis, speech and thinking, writing, reading, and arithmetic, cannot be regarded as isolated or even indivisible faculties…" (Luria, 1973, p. 29, as cited in Princiotta & Goldstein, 2015, p. 185).

Luria's theory of functional units coupled with the theories of Broadbent in 1958 and Hunt in 1980 provided the foundation for PASS theory, which proposes four basic psychological processes. The four processes – planning, attention, simultaneous and successive processing – form the building blocks of human cognitive function (Naglieri & Das, 2005). Planning is linked to Luria's third functional unit, which accounts for executive processing and planning. Planning has been identified as a frontal lobe function with emphasis on the prefrontal cortex. This area of the brain distinguishes humans from primates: it has many functions and plays a central role in the setting and execution of goals and the solving of problems. Attention is linked to Luria's first functional unit, which is responsible for arousal and attention. Attention comprises three components: focused attention (which is attention directed toward stimuli); sustained attention (which is one's ability to remain focused); and selective attention (which is the ability to ignore other external stimuli) (Naglieri & Das, 2005).

Successive and simultaneous processing link to Luria's second unit, which involves the use of one's senses. Simultaneous processing refers to the recognition of patterns or the grouping of objects to form a whole – this often involves the use of visual-spatial skills. Successive processing is the arrangement of stimuli in a specific order. It also recognises and organises the arrangement of sound, which plays a critical role in early reading (Naglieri & Das, 2005).

PASS theory presents an alternative perspective to the traditional view on intelligence. It provides an expansive view of which abilities to measure together with basic psychological processes but precludes verbal achievement. In the context of cognitive assessment measures, the KABC-II scales that directly relate to the Lurian model are Sequential Processing, Simultaneous Processing, Planning, and Learning – with specific emphasis on attention

(Kaufman, Lichtenberger, Fletcher-Jansen & Kaufman, 2005). On the WISC-V, this includes the Working Memory Index, which measures focused, selective, and sustained attention. Subtests that heavily rely on the child's ability to sustain attention include Block Design, Matrix Reasoning, Figure Weights, Visual Puzzles, Coding, Symbol Search, and Cancellation (Kaufman et al., 2005).

2.5 Cattell-Horn-Carrol (CHC) Theory

The Cattell-Horn-Carroll (CHC) model theoretically underpins both the WISC-V and the KABC-II. Cattell put forth an intelligence dichotomy comprised of fluid intelligence (Gf) and crystallised intelligence (Gc). Fluid intelligence (Gf) represents the ability to apply reasoning to solve new problems. It is influenced by biological and neurological factors, which makes it susceptible to the effects of aging (Flanagan & Dixon, 2014). Crystallised intelligence (Gc) represents prior learning and experiences: a knowledge base influenced by cultural experiences, education, and the process of acculturation. It is thus untainted by the effects of aging. John Horn expanded on this dichotomous model in the 1960s – creating the extended Gf-Gc theory. Horn identified additional broad cognitive abilities: visual perception or processing (Gv); short-term acquisition and retrieval (Gsm); long-term storage and retrieval (Glr); speed of processing (Gs); auditory processing ability (Ga); reaction time and decision speed (Gt); quantitative reasoning (Gq); and broad reading-writing factors (Grw) (Flanagan & Dixon, 2014).

The second major development phase of the CHC model was in the 1990s. John B. Carroll launched a factor analytic inquiry of over 460 data sets, which led to the development of his three-stratum theory. In contrast to the Cattell and Horn structure, Carroll's arrangement is a hierarchical model with three levels/stratums. Stratum 1 (the base)

consists of highly specialised narrow abilities. Stratum 2 consists of broad abilities, and Stratum 3 (the uppermost stratum) represents the (*g*) factor, which shows Carroll's acceptance of Spearman's concept of overarching general intelligence. Due to the similarities of the theories of Cattell-Horn and Carroll, McGrew (1997) proposed an integrated model to consolidate the congruences of their work. The proposed integrated model underwent two revisions: McGrew and Flanagan (1998) and Flanagan, McGrew, and Ortiz (2000). The revisions were accepted by John Horn and John Carrol. It thus became known as the Cattell-Horn-Carroll (CHC) theory (Oritz, 2015).

The CHC model is an important theoretical concept for this research, as it has influenced the development of both the WISC-V and the KABC-II indexes/scales. The WISC-V continues to inculcate the Wechsler tradition of the (*g*), as new indexes that directly reflect CHC theory have been adopted (Comier, Kennedy, & Aquilina, 2016). The WISC-V measures the following broad abilities: crystallised intelligence (Gc); visual processing (Gv); fluid reasoning (Gf); short-term memory (Gsm); processing speed (Gs); long-term storage and retrieval (Glr); quantitative reasoning (Gc, Gq); and reading and writing (Grw) (Kaufman, Raiford, & Coalson, 2016). The KABC-II scales measure the following broad abilities from a CHC model perspective: long-term storage and retrieval (Glr); short-term memory (Gsm); visual processing (Gv); fluid reasoning (Gf); and crystallised ability (Gc) (McGill, 2015). The CHC model also forms one of the two theoretical frameworks that underpin the interpretation of KABC-II results the other being the Lurian model (McGill, 2015).

In addition, the CHC model is the foundation for the Cross-Battery Assessment Method (often referred to as XBA) (Flanagan, Alfonso, & Ortiz, 2012). Cross-battery assessment is a dynamic approach to assessment that allows the practitioner to more adequately estimate the

total range of broad cognitive abilities. This research used the cross-battery approach to identify subtests within the WISC-V and KABC-II that measure similar constructs.

2.6 Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V)

The Wechsler Intelligence Scale for Children, fifth edition (WISC-V) is an individually administered test that assesses the cognitive ability of children between the ages of six years and 16 years, 11 months (Wechsler, 2014). The WISC-V produces results in the form of a full-scale IQ (FSIQ) score with indexes that present functioning in different domains. Table 1 reflects the test structure of the WISC-V. The WISC-V has five primary index scales – the Verbal Comprehension Index, Visual Spatial Index, Fluid Reasoning Index, Working Memory Index, and the Processing Speed Index. It also encompasses five Ancillary Index Scales and three Complementary Index Scales. The Ancillary Index Scales are Quantitative Reasoning, Auditory Working Memory, Non-verbal, General Ability, and Cognitive Proficiency (Kaufman et al. 2016). The Complementary Index Scale consists of Naming Speed, Symbol Translation, and Storage and Retrieval. These index scales provide additional information on an individual's performance and cognitive abilities. The WISC-V index scores are domain specific and provide valuable information for diagnostic purposes. The WISC-V contains 21 subtests of which 13 were retained from the WISC-IV: Arithmetic, Block Design, Digit Span, Coding, Cancellation, Comprehension, Information, Letter Number Sequencing, Matrix Reasoning, Picture Concepts, Similarities, Symbol Search, and Vocabulary (Wechsler, 2014). The eight subtests that have been added are Delayed Symbol Translation, Immediate Symbol Translation, Recognition Symbol Translation, Figure Weights, Naming Speed Literacy, Naming Speed Quantity, Picture Span, and Visual Puzzles. The subtests complement the index scales and allow practitioners to identify the strengths and weaknesses of the learners being tested/assessed (Wechsler, 2014).

Table 1

The WISC-V Indexes, Subtests, and Categories

Index	Subtest	Category
Verbal Comprehension Index	Similarities	Primary (FSIQ)
	Vocabulary	Primary (FSIQ)
	Information	Secondary
	Comprehension	Secondary
Visual Spatial Index	Block Designs	Primary (FSIQ)
	Visual Puzzles	Primary (FSIQ)
Fluid Reasoning Index	Matrix Reasoning	Primary (FSIQ)
	Figure Weights	Primary (FSIQ)
	Picture Concepts	Secondary (FSIQ)
	Arithmetic	Secondary
Working Memory Index	Digit Span	Primary (FSIQ)
	Picture Span	Primary (FSIQ)
	Letter-Number Sequencing	Secondary
Processing Speed Index	Coding	Primary (FSIQ)
	Symbol Search	Primary (FSIQ)
	Cancellation	Secondary
Complementary Index	Naming Speed Literacy	Complementary
	Naming Speed Quantity	Complementary
	Immediate Symbol Translation	Complementary
	Delayed Symbol Translation	Complementary
	Recognition Symbol Translation	Complementary

Note. FSIQ = full-scale intelligence quotient, From Wechsler (2014). Copyright 2014 NCS Pearson.

2.7 Kaufman Assessment Battery for Children, Second Edition (KABC-II)

The KABC-II was developed by Kaufman and Kaufman in 2004. It is an individually administered assessment that can be used for individuals from the age of three to the age of 18 years. The KABC-II is premised on a dual theoretical method – the interpretation of test scores therefore varies. The Mental Processing Index (MPI) is premised on the Lurian Model – it thus ignores the Knowledge Scale. The Fluid Crystallised Index (FCI), however, represents the CHC model and therefore includes the Knowledge Scale. As the FCI structure for ages 7-18 years, is applicable to this study, it is the only test format the study describes in detail. The KABC-II comprises five scales when one employs the FCI interpretation method and four scales when one applies the MPI interpretation method. The whole assessment consists of 18 subtests, of which 10 are core subtests for the FCI interpretation and eight are for the MPI interpretation. The remaining subtests are supplementary. Table 2 provides a brief description of the KABC-II subtests: including the 18 subtests and a clarification of which are core and which supplementary.

Table 2

The KABC-II Scales, Subtests and Categories

Scale	Subtest	Category
Sequential (Gsm)	Number Recall	Core (FCI) & (MPI)
	Word Order	Core (FCI) & (MPI)
	Hand Movements	Supplementary
Simultaneous (Gv)	Rover	Core (FCI) & (MPI)
	Triangles	Core (FCI) & (MPI)
	Block Counting	Supplementary
	Gestalt	Supplementary
	Conceptual Thinking (age 3-6 years)	Not applicable to the research
	Face Recognition (age 3- 4 years)	Not applicable to the research
Learning (Glr)	Atlantis	Core (FCI) & (MPI)
	Rebus	Core (FCI) & (MPI)
	Atlantis Delayed	Supplementary
	Rebus Delayed	Supplementary
Planning (Gf)	Story Completion	Core (FCI) & (MPI)
	Pattern Reasoning	Core (FCI) & (MPI)
Knowledge (Gc)	Verbal Knowledge	Core (FCI)
	Riddles	Core (FCI)
	Expressive Vocabulary	Supplementary

Note: FCI = Fluid Crystallised Index, MPI = Mental Processing Index, From Kaufman & Kaufman (2004). Copyright 2014 NCS Pearson.

The KABC-II produces results on a range dependent on the child's age (Kaufman & Kaufman, 2004). For children aged three, the KABC-II produces only a global score (FCI or MPI). For children ages four to six years, the scales are arranged in accordance with the theoretical model applied. Luria's model produces three scales while the CHC model produces four scales (Kaufman et al., 2005). Simultaneous and Sequential Processing appear

on both the CHC and Luria models, while the Knowledge Scale is only produced on the CHC model. Finally, for children aged seven to 18 years, a Planning Scale is included, which results in an additional scale on both the CHC and Luria models. In addition to the FCI and MPI, the KABC-II allows for a Non-Verbal Scale (NVI), which is used to assess children with language difficulties, speech difficulties, and limited English proficiency (Kaufman et al., 2005). Table 3 provides a summary of the Luria and CHC interpretive paradigms to serve as a guideline on when to administer each model. Table 4 provides a breakdown of the dual theoretical model: detailing the scales associated with each model and the global scale produced.

Table 3

KABC-II Interpretive Guidelines on when to Administer FCI or MPI

The CHC model is preferred **FCI**	**The Luria model is preferred** **MPI**
In the majority of cases.	If a child is from a bilingual background.
If a child has (or is suspected to have) a disability in reading, written expression, or mathematics.	If a child's non-mainstream cultural background may have affected his/her knowledge acquisition and verbal development.
If a child has a severe cognitive delay.	If a child has (or is suspected to have) a language disorder (expressive, receptive, or mixed).
If a child has ADHD.	If a child has (or is suspected to have) autism.
If a child has an emotional or behavioural disturbance.	If a child is deaf or hard of hearing.
If a child may be gifted.	If the assessor is firmly committed to Luria's processing approach and believes that acquired knowledge should be excluded from any cognitive score.

Note. FCI = Fluid Crystallised Intelligence; MPI = Mental Processing Index, From Kaufman et al. (2005, p. 3). Copyright 2005 John Wiley & Sons.

Table 4

The Dual Theoretical Foundation for the KABC-II Scales and the Global Scales

	Lurian Term	**CHC Term**	**Name of KABC-II Scale**
	Sequential processing	Short-term memory (*Gsm*)	Sequential/*Gsm*
	Simultaneous processing	Visual processing (*Gv*)	Simultaneous/*Gv*
	Learning ability	Long-term storage and retrieval (*Glr*)	Learning/*Glr*
	Planning ability	Fluid reasoning (*Gf*)	Planning/*Gf*
		Crystallised ability (*Gc*)	Knowledge/*Gc*
Name of KABC-II Global Scale	**Mental Processing Index (MPI)**	**Fluid-Crystallised Index (FCI)**	

Note. From Kaufman and Kaufman (2004, p. 2). Copyright 2004 NCS Pearson.

2.8 Factor Analysis and Construct Validity

Factor analysis is integral to test development, as it allows for construct validation (Kaufman & Kaufman, 2004). It is employed during the test development phase to identify theoretical constructs that could account for observed patterns of correlation; the degree to which the test is able to measure each construct; and how the constructs theoretically relate to

one another. There are two fundamental types of factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA is commonly used in the investigation of construct validity where the relationships between variables are ambiguous or unknown. CFA is preferred when the underlying theory (CHC, Luria, or Spearman's (*g*) factor) is known or well established. CFA determines construct validity by extracting commonalities from the data to reduce the overall number of observed constructs into latent factors. Test developers of both the WISC-V and KABC-II relied mainly on CFA. The CFA findings as reported in the WISC-V Technical and Interpretive Manual are assumed to be "reliable and valid measures of the primary cognitive constructs they intend to represent" (Weschler, 2014, p. 149).

The construct validity of a measure is further explored by examining the measure's relationship to other measures and variables – their correlation. Correlation studies were conducted on the KABC-II's relationship to the original K-ABC, WISC-IV, WISC-III, Wechsler Preschool & Primary Scale of Intelligence (WPPSI-III), Kaufman Adult Intelligence Test (KAIT), and the Woodcock-Johnson III Tests of Cognitive Abilities (WJ-III-COG) (Kaufman & Kaufman, 2004). In correlation studies, a correlation coefficient is produced via a Pearson correlation – it is represented by an *r* value that ranges from +1 to -1. An *r* value greater than zero indicates a positive association: as the value of one variable increases so does the value of the other variable. An *r* value larger than 0.7 indicates a strong correlation. The KABC-II correlation studies indicated a strong correlation between the KABC-II and the other tests of cognitive ability that were part of the study (Lane et al.,2017). Strong correlations were identified between the Knowledge Scale and other measures of verbal ability; the Simultaneous and Planning Scales and the performance or non-verbal composites of other instruments; and the Sequential Scale and scales related to freedom from distractibility and working memory. Interestingly, it was found that the FCI correlates higher

than MPI in most cases, which indicates a substantial reliance on verbal ability for other assessment measures (Kaufman & Kaufman, 2004).

Similarly, test developers of the WISC-V examined its construct validity. Correlation studies were done between the WISC-V and other similar assessment measures – the KABC-II, Kaufman Test of Educational Achievement 3 (KTEA-3), and the Wechsler Individual Achievement Test, third edition (WIAT-III). The overall conclusion was that a strong correlation (Wechsler, 2014) exists between the WISC-V and those measures that profess to measure similar intellectual functioning. As the WISC-V was published after the KABC-II, the WISC-V test developers could also do correlation studies between these two measures.

The sample used for the correlation study comprised participants who were non-clinical, with a balanced number of males and females and a race distribution of 47% white, 35% Hispanic, 10% African American, 2% Asian, and 6% other (WISC-V Efficacy Research Report, 2018). The correlations between the WISC-V FSIQ and the KABC-II FCI and MPI were reported as 0.77 and 0.81 respectively (*strong* correlation). Correlations between corresponding sub-scores ranged from 0.50 to 0.74 (*moderate to strong* correlation). This reflects an overall *positive* correlation between assessment measures (WISC-V Efficacy Research Report, 2018). Test developers place emphasis on utility, applicability, and generalisability and consider these measures in the context and region of development. As such, the WISC-V test developers relied on census data for the US, while standardisation in the United Kingdom (UK) was done by utilising UK census data. The sample thus reflected minority groups within the US/UK: African American, Hispanic, Asian, etc.

The KABC-II developers went a step further: they explored the test's ability to meet emerging assessment needs such as assessing individuals with specific learning disabilities,

of cultural minorities, and of linguistic divergences (Kaufman & Kaufman, 2004). Based on these considerations, the KABC-II developers hail the KABC-II as being a more culturally fair assessment measure. Although these efforts to increase generalisability and fairness are commendable, none of the measures explore applicability in the African context and, more specifically, in the South African context. Furthermore, both test development and current literature are limited in their reflection of the relationship between the WISC-V and KABC-II indexes/scales when administered to culturally diverse samples.

2.9 Cross-Battery Approach

The cross-battery approach was introduced in the early 1990s through the works of Flanagan and McGrew (1997); Flanagan, McGrew and Ortiz (2000); Flanagan, Ortiz, and Alfonzo (2013); McGrew and Flanagan (1998). It allows practitioners to identify the specific abilities to be assessed and to then select specific assessments to provide the most appropriate information of an individual in a specific testing situation (Flanagan, Ortiz, & Alfonso, 2013). The cross-battery approach is premised on the CHC theoretical model – broad and narrow abilities (as identified by the CHC model) are recognised within the test structure. This allows practitioners to choose specific assessment indexes, subtests, or sections within an assessment battery to provide information on a specific ability (Flanagan, Ortiz, & Alfonso, 2013). This process of deconstruction enables the identification of subtests within the WISC-V and KABC-II that assess similar constructs. It, therefore, allowed this research to examine the nature of the relationship between the indexes/scales on the WISC-V and KABC-II.

Based on construct validation literature, extant factor analysis, and the CHC model, Table 5 presents some of the broad and narrow constructs that form the foundation for the

CHC model. This list is not exhaustive, as the model includes 10 broad abilities and over 70 narrow abilities. Only those relevant to this study were included in Table 5 – with some additions for illustration purposes.

Table 5 also lists indexes/scales on the WISC-V and KABC-II that represent broad abilities and the subtests designed to measure narrow abilities that contribute to the broad abilities. The broad abilities supported by narrow abilities form the basis for construct validity analysis between the WISC-V and KABC-II.

Table 5

Subtest-specific CHC Narrow Abilities

Crystallised Ability (Broad Ability)				
Narrow Abilities		**Lexical Knowledge**	**General Information**	**Language Development**
WISC-V (VCI)	Subtests	Vocabulary Similarities Riddles		
KABC-II (Gc)		Verbal Knowledge	Verbal Knowledge	Riddles
Visual Processing (Broad Ability)				
Narrow Abilities		**Visualisation**	**Spatial Relation**	**Spatial Scanning**
WISC-V (VSI)	Subtests	Visual Puzzles Block Design Block Counting		
KABC-II (Gv)		Triangles	Triangles	Rover
Fluid Reasoning (Broad Ability)				
Narrow Abilities		**Induction**	**General Sequential Reasoning**	**Quantitative Reasoning**
WISC-V (FRI)	Subtests	Matrix Reasoning Pattern Reasoning		Figure Weights
KABC-II (Gf)		Story Completion	Story Completion	
Short-Term Memory (Broad Ability)				
Narrow Abilities		**Memory Span**	**Working Memory**	
WISC-V (WMI)	Subtests	Digit Span Forward	Digit Span Backward Digit Span Sequencing Picture Span	
KABC-II (Gsm)		Number Recall Word Order (without colour interference)	Word Order (with colour interference)	

Note. From Kaufman and Kaufman (2004, p. 15) Copyright 2004 NCS Pearson.

From Kaufman et al. (2016, p. 257) Copyright 2016 John Wiley and Sons.

2.10 Concurrent Validity

Concurrent validity refers to the comparison of a new test with an existing test of the same theoretical nature that claims to measure the same constructs. Concurrent validity indicates whether the two tests produce similar results. It also assesses the extent to which the test scores produced correctly estimate an individual's present condition and/or provides evidence for the use of a particular measure to predict other outcomes. This research used concurrent validity to determine whether the indexes/scales that claim to assess the same underlying construct on the WISC-V and KABC-II produce similar scores. To date, little research has been done on the concurrent validity of the WISC-V and KABC-II. The research that does exist either focuses on the influence of external factors, such as socio-economic status, language, and gender (as influencing factors), or on earlier versions of the WISC-V and KABC-II.

A 1984 study by Naglieri and Haddad set out to determine the concurrent validity of the K-ABC, first edition and the WISC-R, Peabody Individual Achievement Test (PIAT), and the Wide Range Achievement Test (WRAT). The results indicated significant differences between the mean K-ABC Mental Processing Composite and mean WISC-R FSIQ, despite the significantly high correlations among these scores (Naglieri, & Haddad, 1984). However the mean K-ABC Achievement Score did not differ significantly from the PIAT or any of the WRAT subtests, which led the researchers to conclude that the WISC-R and KABC-II may be used interchangeably by practitioners.

A later study by Mcknown (2010) compared the KABC-II (FCI and MPI) to the WISC-IV (FSIQ) to determine if the tests produce similar results when administered to the same learner.

The results of the t-test used to compare the KABC-II (FCI) and the WISC-IV (FSIQ) were not significant. Similarly, the results of the t-test used to compare the WISC-IV FSIQ and the KABC-II MPI were not significant. Non-significant results suggest that the assessment measures may be used interchangeably for the sample population.

Similar to the Mcknown (2010) study, this research explored the index/scale scores on the WISC-V and KABC-II to determine if the scores produced within the South African context are similar or different. Four specific indexes/scales were selected based on factor analysis and construct validity evidence that reflect high correlation. The index/scales selected for this study are VCI/Gc. VSI/Gv, FRI/Gf and WMI/Gsm. The results could then provide evidence to either accept or reject the interchangeable use of these measures.

2.11 Verbal Comprehension Index (VCI)/Knowledge Scale (Gc)

The VCI/Gc index/scale aims to measure crystallised intelligence that, according to the underlying CHC theoretical model, is a broad ability that comprises numerous narrow abilities, such as general verbal information, language development, lexical knowledge, listening ability, communication ability, and grammatical sensitivity (Kaufman et al., 2016).

As summarised in Table 5, of the numerous narrow abilities that CHC theory outlines the WISC-V core subtests, Vocabulary and Similarities, assess one narrow ability – lexical knowledge (Kaufman et al., 2016). The KABC-II core subtests assess three narrow abilities – lexical knowledge, general information and language development. During the development process and when decisions were taken on the inclusion of narrow abilities, test developers of the KABC-II focused on the process of item selection.

They included only general items: knowledge that is acquired through general familial experiences rather than knowledge specific to culture, customs, traditions, sex, ethnic groups, socio-economic status, or geographic region (Kaufman & Kaufman, 2004).

2.12 Visual Spatial Index (VSI)/Simultaneous Processing Scale (Gv)

The VSI/Gv index/scale aims to measure visual spatial reasoning. According to the underlying CHC theoretical model, Gv is a broad ability that consists of numerous narrow abilities, such as visual memory, spatial relations, visualisation, spatial scanning, closure speed, serial perceptual integration, length estimation, and perceptual illusions to name a few (Kaufman & Kaufman, 2004).

Although CHC theory outlines many narrow abilities, the WISC-V core subtests assess only one – visualisation (Kaufman et al., 2016). The KABC-II core subtests, however, assess three narrow abilities – visualisation, spatial relations, and spatial scanning (Kaufman & Kaufman, 2004).

As the KABC-II test developers wanted to develop a comprehensive assessment measure, problem solving is assessed in various contexts and incorporates degrees of complexity under different conditions. As an example, the Rover subtest on the KABC-II is a primary measure of Gv visualisation, but an element of Gf (a reasoning component) has been added for complexity (Kaufman & Kaufman, 2004).

2.13 Fluid Reasoning Index (FRI)/Planning Scale (Gf)

The FRI/Gf index/scale aims to measure fluid intelligence. According to the underlying CHC theoretical model, Gf is a broad ability that consists of numerous narrow abilities, such as induction, general sequential reasoning, and quantitative reasoning (Kaufman & Kaufman, 2004). Although CHC theory outlines many narrow abilities, the WISC-V core subtests assess two narrow abilities – induction and quantitative reasoning (Kaufman et al. 2016). Similarly, the KABC-II core subtests also assess two narrow abilities – induction and general sequential reasoning (Kaufman & Kaufman, 2004). On the KABC-II, the Gf subtests – Story Completion and Pattern Reasoning – form part of the non-verbal index. This eliminates the verbal element and allows the assessment of various mental operations (Kaufman & Kaufman, 2004).

2.14 Working Memory Index (WMI)/Sequential Processing Scale (Gsm)

The WMI/Gsm index/scale aims to measure working memory, which is the ability to take in and hold information and then use it within a few seconds. According to the underlying CHC theoretical model, Gsm is a broad ability that consists of many narrow abilities, such as memory span and working memory (Kaufman & Kaufman 2004; Wechsler, 2014). As reflected in Table 5, the core subtests on the WISC-V that measure these narrow abilities are Digit Span and Picture Span. The KABC-II core subtests also assess both narrow abilities, but differ from the WISC-V: the WISC-V includes both Digits Forward and Digits Backward while the KABC-II uses Number Recall, which is the recall of digits forward only (Kaufman & Kaufman 2004; Wechsler, 2014). Research has shown that Digit Span Forward and Digit Span Backward assess different cognitive processes (Reynolds, 1997). The forward method measures sequential and successive processing. The backward method measures

visuo-spatial elements and its results vary significantly according to ethnic differences (Reynolds, 1997).

2.15 Biases and Fairness in IQ Testing

Test developers and users are tasked with the responsibility of analysing test scores to ensure cultural neutrality and reduce bias. The argument does exist that the achievement of bias-free and culture-fair test development is idealistic, as test development is significantly influenced by the individual's involvement in the process, which thus imposes the investigator's view on the process (Sternberg, 2004). Nonetheless, developers do make every effort to ensure a statistically significant level of cultural fairness and reduced bias.

This research explored bias in terms of Van de Vijver and Tanzer's (2004) taxonomy, which encompasses three kinds of bias – construct bias, method bias, and item bias. Emphasis was on construct bias and item bias, as these relate directly to this study. Fairness and other forms of biases were reported in line with the WISC-V Technical and Interpretive Manual (Wechsler, 2014) and the KABC-II Manual (Kaufman & Kaufman, 2004).

Concurrent validity and the reduction of construct bias (discussed in Section 2.9 of this chapter) also relate to construct validity. Where test developers employed CFA, the analysis was based on CHC theory, which is accepted as theoretically sound for investigating the (*g*) factor and is universally applicable. Employing CFA in such a manner thus ensures that each test item measures what it claims to measure. Construct biases in a test item are identified when the construct measured varies across cultures or when the behaviours that characterise the construct deviate across cultures.

The WISC-V Technical and Interpretive Manual (Wechsler, 2014) reports not only that the analysis of construct validity was consistent with the test's hypothesised structures but also that the hypotheses are rooted in contemporary universal cognitive theory. This provides support and evidence for its validity and use as a measure of cognitive ability. In contrast to the test developers' claims, a study conducted by Canivez, Watkins, and McGill (2018) found the information provided in the Technical and Interpretive Manual to be inadequate for the CHC-based five-factor model (Verbal Comprehension, Visual Spatial, Fluid Reasoning, Working Memory, and Processing Speed). Their study found that the EFA conducted did not support the proposed five-factor model, as the Matrix Reasoning subtest had revealed no statistically significant loadings on the fifth factor (Fluid Reasoning). In addition, test developers have been accused of purposely ignoring critiques levelled against previous measures, which brings the validity of the test structure into question.

The developers of the KABC-II reported three main findings in relation to CFA and construct validity (Kaufman & Kaufman, 2004). Firstly, they found that the core subtests generally have high loadings, which indicate a strong measure of ability. Secondly, all loadings of ability factors on the general factor were high, which is consistent with Carroll's three-stratum theory. Lastly, the core subtests for each age group had, overall, an extremely good fit, which means that the test structure correlates strongly with the underlying theory (Kaufman & Kaufman, 2004). A study conducted by Mitchel, Tomlinson, Bland, Stein, and Rochat (2017) – *Confirmatory Factor Analysis of the Kaufman Assessment Battery in a Sample of Primary School-Aged Children in Rural South Africa* – further supports these findings. The results of their confirmatory factor analysis confirmed the validity of the original structure of the KABC-II ($\chi^2 = 16.30$, $p = .432$).

Additionally, a study that assessed the construct validity of the KABC-II on a sample of 65 Ugandan children concluded that the KABC-II could, with a few modifications, be used to assess the cognitive ability of Ugandan children, as the test has good construct validity *(*Bangirana et al., 2009). Similarly, a longitudinal study carried out on a sample of 199 Sowetan children also supported findings on the robust nature of the factor structure of the KABC, first edition. This was due to its factor structure remaining constant when administered to varied population groups (Jansen & Greenop, 2008). I can thus conclude that the statistical data from research conducted both locally and internationally supports the construct validity of the KABC and KABC-II over that of the WISC-V. This also suggests that the KABC/KABC-II is a more robust and culturally fair assessment measure.

Sample bias, instrument bias, and administration bias are three forms of method bias. Sample bias reduces the probability of certain population groups being selected and included in the sample population. Instrument bias refers to the poor calibration of an instrument, which then produces either higher or lower results for certain population groups rather than reflecting the actual or true scores. Administration bias affects the way in which the test is administered (Foxcroft & Roodt, 2013). This section discusses these three forms of bias collectively as per the WISC-V Technical and Interpretive Manual and KABC-II Technical Manual (Wechsler, 2014; Kaufman & Kaufman, 2004).

The WISC-V test developers took the following steps during the test development process to reduce biases and ensure the test's cross-cultural applicability. Firstly, they selected nationally representative samples that matched census data across 11 age groups in the US (WISC-V Efficacy Research Report, 2018). This ensured countrywide representation and reduced the over-representation of specific groups that are concentrated in specific locations or regions.

Choosing samples in such a manner thus reduced the overall possibility of region or location-based biases. For statistical analysis, variance techniques were employed. Regression modelling was used to analyse stratified data, which indicated the influence of key demographic factors (race/ethnicity, parents' level of education, and socio-economic status) on differential IQ performance. The reported results were consistent with the hypothesised structure of the test, which is rooted in contemporary intelligence theory. This then supports the WISC-V's valid use as a measure of cognitive ability in the US (WISC-V Efficacy Research Report, 2018).

Selecting large representative samples enhances the validity of interpretation and forms the base for generalisable claims. In addition to norms based on larger representative samples, developers selected samples of special groups. These included not only individuals identified as intellectually gifted but also individuals with varied intellectual disabilities, specific learning disorders, traumatic brain injuries, autism spectrum disorder, etc. (Wechsler, 2014). The analysis result showed consistency across scores for diagnostic categories. In addition, the WISC-V Technical and Interpretive Manual (Wechsler, 2014) provides detailed administration and scoring guidelines and encourages test administrators to familiarise themselves with the material, instructions, and method of scoring so as to not place the test taker at a disadvantage. Administration and scoring are standardised according to age-specific criteria and guidelines (Wechsler, 2014).

Measures to ensure reduced bias and cultural applicability were also employed by test developers of the KABC-II. The KABC-II was standardised on a sample of 3 025 children who were chosen to closely match 2001 US census data on variables of age, gender, geographic region, ethnicity, and parental education. The sample was divided into 18 age groups of 100-200 children.

The sample was split equally between boys and girls (Kaufman & Kaufman, 2004). In conjunction with the standardisation of the KABC-II, clinical validity studies to assess the performance of nine different groups were also conducted. These groups included students with learning disabilities in reading, mathematics, and written expression; intellectual disability; autistic spectrum disorder; attention-deficit/hyperactivity disorder; emotional disturbances; hearing loss; and children who are considered gifted. The results of these studies reflected statistical significance and, as expected, were lower for the clinical group. This indicates the test's strong usability for diagnostic purposes (Kaufman & Kaufman, 2004). Furthermore, the inclusion of a non-verbal component coupled with the theoretical formulation of measuring cognitive processing rather than crystallised intelligence, has resulted in the KABC-II being deemed more culturally appropriate than other similar assessment measures (Mitchell et al., 2017).

In conclusion, while these efforts are commendable, they have been limited to specific developed "western" ideals. This attracts criticism where the WISC-V/KABC-II are used in geographical locations not included in their development analyses or used in varied cultural contexts not represented in the sample. Such use is particularly problematic in underdeveloped and developing countries. It should be noted that these norms are only applicable to the context from which the data is drawn. Generalised use of these assessment measures in the absence of country or location specific norms combined with a lack of consideration of external factors, accommodations, and qualitative analysis of specific item responses, therefore lead to irresponsible and unfair testing procedures – and, hence, invalid scores.

In accordance with this study's aim, which was an unstratified within-group analysis of the WISC-V and KABC-II indexes/scales, exploring the construct and concurrent validity of these assessment measures would enable either the support or rejection of claims related to bias-free testing using the WISC-V and/or the KABC-II. It is also crucial to not claim complete compatibility with the South African context in the absence of national standardisation and norming efforts.

2.16 Research in the Field

The WISC series of assessment measures consistently dominates the market as the most favourable assessment measure for assessing intellectual ability in emerging, less developed, and developed countries (Oakland, Douglas & Kane, 2016; Shuttleworth-Edwards et al., 2013). Information was gathered from 64 countries on the 10 tests most frequently used by school psychologists for the assessment of children and youth. The data showed that 80% of practitioners preferred the use of the WISC series of assessment measures compared to 11% of practitioners who preferred the KABC (Oakland et al., 2016). Bearing in mind the disproportion of preference, the dearth of local and international information and research on comparative studies comes as no surprise. Thus, the research reported in the next section was not limited to a specific version of the test series. It includes previous versions of both the WISC and KABC series of assessment measures. Although this study did not focus on stratified samples, the inclusion of such research sheds light not only on the external influences on the assessment process but also the need for qualitative data when administering intelligence assessment measures.

International studies. ***Midwestern Metropolitan: K-ABC and WISC-Revised.*** This 1986 study by Smith, Lyon, Hunter, and Boyd examined the relationship between performance on the K-ABC and the Wechsler Intelligence Scale for Children, revised (WISC-R). Their sample consisted of 67 referred students who were being considered for placement in a private school for students with severe learning disabilities in a Midwestern metropolitan area. In accordance with their study's research aims and diagnostic process, each learner was assessed once on the K-ABC and once on the WISC-R. The research results showed a *strong* correlation between the students' performance on the global standard scores on both instruments.

State of Michigan: KABC, WISC-R, and Peabody Individual Achievement Test (PIAT). This study, conducted by Clarizio and Bennet (1987), compared the K-ABC, as a then new measure on the market, with the then widely used WISC-R and Peabody Individual Achievement Test (PIAT). Their aim was to determine each measure's adequacy as a diagnostic tool for the classification of learning disabilities. The sample group comprised 86 learners (residing in the US state of Michigan) who had been referred for assessment. The study compared the following subtests: (a) full-scale IQ-PIAT Arithmetic with Mental Processing Composite (MPC) – K-ABC Mathematics; (b) full-scale IQ-PIAT Reading Recognition with MPC – KABC Reading Decoding; (c) full-scale IQ-PIAT Reading Comprehension with MPC – K-ABC Reading Understanding; and (d) full-scale IQ-PIAT Total with MPC – K-ABC Achievement.

The researchers relied on four methods of statistical calculation to determine the difference in scores for the questions (a-d). Method 1 used a z-score difference. Method 2 employed an estimated true score difference. Method 3 utilised a regression procedure where only errors of estimates were considered.

Method 4 was a regression procedure that included adjustment for unreliability. The results in each case reflected a significant difference between FSIQ and PIAT scores as compared to MPC – K-ABC scores. The MPC – K-ABC scores identified 1-7 times more learners than those of FSIQ and PIAT. The study concluded that the significant difference in scores between tests (to identify learners with severe discrepancy between ability and achievement) supports the notion that the selection of tests is fundamental to the assessment process and significantly impacts the decision-making process.

The underlying theoretical base of each subtest is also significant in identifying and assessing specific cognitive skills. A 1984 study by Naglieri, with a sample of 35 Navajo children, also found a significant difference between the mean WISC-R full-scale scores and the K-ABC MPC. This study also suggested that the K-ABC may be a better instrument of intellectual assessment in linguistically and culturally different children. Naglieri (1984) partially explained the discrepancy as rooted in both the influence of the English language on the WISC-R and the acquired knowledge component on the Wechsler scale.

Ohio and West Virginia: Wechsler Intelligence Scale for Children, **fourth ed*ition – General Ability Index (WISC-IV GAI) and Kaufman Assessment Battery for Children,* second edition – *Fluid Crystallised Index (FCI)/Mental Processing Index (MPI).*** Oliver's (2010) study was conducted on a sample of 30 Caucasian students between the ages of 6 years, 7 months and 16 years, 11 months. The study compared the WISC-IV GAI scores with the KABC-II FCI and MPI scores. Oliver (2010) found a strong positive correlation between the scores, which suggests that were these tests to be administered to students with similar characteristics, they would yield similar results. A study by Mcknown (2010), which utilised the same sample, supports Oliver's findings. The conclusion can thus be drawn that the WISC-IV and KABC-II are highly correlated.

African studies. Much of the research done in the African context explored stratified data. One such study was done in South Africa by Taylor (1998). It examined the performance of black and white learning-disabled children on the Wechsler Intelligence Scales for Children, revised edition and third edition (WISC-R/WISC-III) and the Kaufman Assessment Battery for Children (K-ABC). The K-ABC and WISC-R/WISC-III were administered to a sample of 55 children: 34 white and 21 black children. The age range of the sample was 6-11 years and it was extracted from private remedial schools. The statistical analysis showed significantly lower scores for the black children (84.19 (SD = 7.41)) on the WISC-R/WISC-III in comparison to those of the white children (93.97 (SD = 11.13)). The score difference between black and white children on the K-ABC was not significant. Scores for the analysis of verbal subscales and subtests that assess prior learning (Vocabulary and Information) were found to be significantly higher for white children on the WISC-R/WISC-III. The researcher's conclusion (supported by statistical evidence and qualitative teacher ratings) was that in the South African context the K-ABC is better suited (than WISC-R/WISC-III) as a non-discriminatory instrument and is an equitable measure of intelligence for black and white South African learners.

2.17 Conclusion

The literature review provides not only a historical account of psychological assessment in the South African context but also the context for this study within the current educational climate. An overview of old and new theoretical concepts with emphasis on the relationship between theory and test development provided background to the study. This chapter also explores measurement instruments: structurally and in relation to concepts of construct validity, biases, and fairness.

The literature review concludes with the available literature on international and African studies, which highlights some of the disparities in the test scores of (mostly) stratified samples. This chapter also indicates the current local and international gaps in the literature.

Chapter 3 focuses on the methods this study employed in data collection and the analysis process employed to answer the research questions. This is followed by details of the instruments used in relation to the subtest and administration processes.

Chapter 3: Methodology

3.1 Introduction

This study forms part of a bigger research project that investigated the utility of the WISC-V and KABC-II in identifying South African children with specific learning disorders – reading and written expression (SLD-RW). The broader study investigated the cognitive profiles of children from various mainstream and remedial schools in Johannesburg to establish whether the WISC-V and KABC-II can identify children with SLD-RW. Learners with SLD-RW were included in the sample provided they did not present with severe cognitive or developmental delays, severe physical or neurological difficulties and or severe emotional or other significant disorders such as moderate /severe Autism Spectrum Disorder or severe visual / hearing difficulties. However, given the high comorbidity between SLD and Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD) learners who presented with comorbid ADD and ADHD were not excluded from the sample.

As part of the larger study, each learner was assessed once on the WISC-V and once on the KABC- II. I formed part of the data collection team on the broader study and thus gained first-hand experience on data collection and testing observations.

3.2 Research Design and Methods

As this study forms part of a larger research project for which data had been collected, this study used archival and collected data to compare the index/scale results across the two cognitive assessment measures. These comparisons were done to determine whether the assessment measures yield similar results across the indexes/scales said to assess similar underlying cognitive skills/abilities.

The index/scale scores were abstracted from the administered assessments for comparison. Table 6 reflects the WISC-V and KABC-II indexes/scales and subtests selected for comparison in this study.

Table 6

A Breakdown of the WISC-V and KABC-II Indexes/Scales to Include

WISC-V Indexes and Subtests	**KABC-II Scales and Subtests**
Verbal Comprehension Index	Knowledge Scale
Similaries	Riddles
Vocbulary	Verbal Knowledge
Visual Spatial Index	Simultaneous Processing Scale
Block Design	Rover
Visual Puzzles	Triangles
	Block Counting
Fluid Reasoning Index	Planning Scale
Matrix Reasoning	Story Completion
Figure Weights	Pattern Reasoning
Working Memory Index	Sequential Processing Scale
Digit Span	Number Recall
Picture Span	Word Order

As established, the aim of comparing these indexes/scales was to determine whether these indexes/scales, said to focus on specific cognitive abilities correlate in terms of construct validity, i.e. the theoretical foundation and concurrent validity which were to yield similar results when administered to children bearing similar characteristics. The research design was therefore a non-experimental, within-group, correlation quantitative study (Field, 2013).

Non-experimental research involves variables that are not manipulated by the researcher, they are instead studied as they exist (Lapan & Quartaroli, 2009). One reason for using non-experimental research is that many of the variables of interest in social science cannot be manipulated, as they are attribute variables, such as gender, intelligence, socio-economic status, learning style, or any other personal characteristic (Lapan & Quartaroli, 2009). For this study, I correlated specific index/scale scores on the WISC-V and the KABC-II, as these indexes/scales claim to measure the same underlying functions.

Studies using stratified data show the influence of external factors (such as race, socio-economic status, and quality of education) on test scores (Taylor, 2008). Since these factors cannot be manipulated, a within-group correlation study was conducted. For the study, 50 learners were tested on the WISC-V and then on the KABC-II. The learners were assessed over a period of two days. A comparison of each learner's scores allowed for the control of factors such as race, age, economic-status, and quality of education (as each learner was compared to themself). Although within-group design allows for a degree of control over extraneous variables, it does have limitations. These include changes in the behaviour and/or performance of learners (on the second test) due to their participation in the first test. Leaners could display a level of boredom, tiredness, or lack of interest during the second testing process, which can result in a deterioration in test performance. The converse of that would be improved test scores on the second test due to test-wiseness or practice. Taking these limitations into consideration, the design and methods opted for in this study were still best suited to achieve its aims (Babbie & Mouton, 2014).

Within-group design not only makes it easier to detect differences across tests but also reduces the influence of the external factors found to affect test scores (Lane et al., 2017). Employing a quantitative method of data collection via the administration of two standardised assessment measures (the WISC-V and KABC-II) allowed for an objective, structured, and replicable process (Lane et al., 2017). The test scores (in the form of numerical data) were statistically computed and analysed.

This research aimed to establish construct and concurrent validity on the WISC-V and KABC-II indexes/scales and thus adopted a correlational research design. This design employs correlational statistical analysis to measure the degree of association between two or

more variables. The results produced – the correlation coefficient – range between -1 and +1. A zero correlation indicates no relationship (Simon & Goes, 2011).

Correlation research does not allow for the establishment of causality through the manipulation of independent variables. It thus differs significantly from experimental or quasi-experimental research designs (Simon & Goes, 2011).

3.3 Sample and Sampling

This study conducted within-group analyses of the results gathered from the indexes/scales of the WISC-V and KABC-II. As this research forms part of a broader study, which investigated the utility of the WISC-V and KABC-II in identifying South African children with SLD-RW, the sample had already been selected and recruited for participation in this project.

The broader study employed purposive, non-probability sampling. The sample of participants was drawn from one private remedial school and one mainstream private school – both in the Johannesburg area (Babbie & Mouton, 2014). A limitation of this sampling technique is that sample selection is based on the judgement and/or convenience of the researcher. This limits the odds of any member of the population being selected, which makes it difficult for the researcher to know the extent to which the sample reflects the broader population (Field, 2013). This sampling technique did, however, allow for the minimisation of cost. It was also the most time-effective method of sampling.

For this study, only the data collected at the private remedial school was used. Although private remedial education is not reflective of the general South African population, use of this sample minimised the influence of external factors (such as socio-economic status and quality of education). The learners who participated had already been identified by their teachers and parents as experiencing some form of specific learning difficulty (SLD). Many of the participants (Grades 4-8) had, however, not been formally assessed prior to this study.

It is common practice (for educators, parents, and other development practitioners) to refer children with challenges rather than develop them for assessment. This added value to the research process: it allowed for the exploration of the assessment measures in the context in which they would most likely be used – referral for remedial education, individual intervention planning, concessions, etc. The exclusion of Grades 1-3 reduced the risk of including second language learners who have not developed basic interpersonal communication skills (as these are developed during the first three years of schooling) (Jang, Cummins, Wagner, Stille, & Dunlop, 2015).

The total sample consisted of 60 learners in Grades 4-8 from two schools. These learners had agreed to participate in the broader research project. As stated, this study only included participants from one of the schools. The sample for this study was thus 50 learners, aged 10-14 years, in Grades 4-8. According to Van Voorhis, Wilson, and Morgan (2007), generally, a sample size of 30 participants is needed to detect differences and maintain adequate power to determine statistical significance. Larger samples, however, more accurately represent the characteristics of the populations from which they are drawn, which minimises the possibility of sampling error (Babbie & Mouton, 2014).

3.4 The School

The private remedial school that participated in this study is based in the South of Johannesburg. It is an independent remedial school that caters for children of average intelligence who are unable to reach their full potential in mainstream classrooms. The school is well-resourced and provides specialised instruction to children with specific learning difficulties, which include Dyslexia, Dysgraphia, Dyscalculia, Visual Processing Disorder, Auditory Processing Disorder, Attention Deficit Disorder, Attention-Deficit/Hyperactivity

Disorder, and other general scholastic difficulties. Class size is limited to 15 learners and learners have access to a range of resources. These include, among others, specialised instruction, individual remedial therapy, speech and language therapy, and occupational therapy. School fees are approximately R56 000 per annum with participants belonging to the middle-class or upper-middle-class socio-economic brackets. The effect of differing socio-economic status was thus minimised.

3.5 Instruments

This study focused on four of the five primary indexes/scales on the WISC-V and KABC-II. Only the eight subtests (on the WISC-V and KABC-II) that are necessary to calculate construct and concurrent validity were included.

Wechsler Intelligence Scale for Children, fifth edition (WISC-V). The Wechsler Intelligence Scale for Children, fifth edition (WISCV) was published in 2014 and is the most recent addition in the series of Wechsler intelligence scales. The test assesses cognitive ability and is appropriate for use on children aged 6-16 years, 11 months (Wechsler, 2014). Although it has not been standardised for use in South Africa, UK standardisation data (which employed a sample of UK children aged 6-16 years, 11 months) indicates overall reliability (Wechsler, 2014).

Reliability estimates on the WISC-V were derived using internal consistency, test re-test, and inter-scorer. The overall reliability coefficients for the WISC-V primary index scores range from 0.88-0.93 (a *good* to *excellent* range) and are generally higher than the individual subtest coefficients that contribute to them (Wechsler, 2014).

The WISC-V consists of 21 subtests and yields 15 composite scores. There are five primary index scores: Verbal Comprehension Index (VCI); Visual Spatial Index (VSI); Fluid Reasoning Index (FRI); Working Memory Index (WMI); and Processing Speed Index (PSI). Two subtests must be administered to obtain each of the primary index scores: a total of 10 subtests are thus primary subtests (Wechsler, 2014).

The full-scale IQ score is derived from seven of the primary subtests: both Verbal Comprehension subtests; one Visual Spatial subtest; two Fluid Reasoning subtests; one Working Memory subtest; and one Processing Speed subtest. Of these, Verbal Comprehension and Fluid Reasoning are weighted more heavily to reflect the importance of crystallised and fluid abilities in modern intelligence models (Wechsler, 2014).

Verbal Comprehension Index (VCI). The VCI is an overall measure of a child's ability to verbally reason (i.e., verbal concept formation). It is influenced by semantic knowledge that is derived from the Similarities and Vocabulary subtests. The VCI subtests are as follows (Wechsler, 2014):

- Similarities (primary, FSIQ) asks the child how two words are alike/similar.
- Vocabulary (primary, FSIQ) asks the child to define a provided word.
- Information (secondary) asks the child general knowledge questions.
- Comprehension (secondary) asks the child questions about social situations or common concepts.

Visual Spatial Index (VSI). The VSI is a measure of visual-spatial processing and is derived from the Block Design and Visual Puzzles subtests. These subtests are as follows (Wechsler, 2014):

- Block Design (primary, FSIQ) — children put together red and white blocks in a pattern as per a displayed model. This is timed, and some of the more difficult puzzles award bonuses for speed.
- Visual Puzzles (primary) — children view a puzzle in a stimulus book and choose from among pieces which three could construct the puzzle.

Fluid Reasoning Index (FRI). The FRI is a measure of inductive and quantitative reasoning. It is derived from the Matrix Reasoning and Figure Weights subtests. The FRI subtests are as follows (Wechsler, 2014):

- Matrix Reasoning (primary, FSIQ) — children are shown an array of pictures with one missing square. From five options, they select the picture that fits the array.
- Figure Weights (primary, FSIQ) — children view a stimulus book that displays shapes on one side of a pair of scales. The other side is empty. They select the option that would balance the scales.
- Picture Concepts (secondary) — children are provided with a series of pictures presented in rows (either two or three rows). They must determine which pictures go together – one from each row.
- Arithmetic (secondary) — arithmetic questions are orally administered and children's responses are timed.

Working Memory Index (WMI). The WMI is a measure of working memory ability. It is derived from the Digit Span and Picture Span subtests. The WMI subtests are as follows (Wechsler, 2014):

- Digit Span (primary, FSIQ) sequences of numbers are orally given. Children are asked to repeat them – either as heard or in reverse order.
- Picture Span (primary) children view pictures in a stimulus book and then select from among options to indicate the pictures they saw – in order if possible.
- Letter-Number Sequencing (secondary) children are provided a series of numbers and letters and asked to repeat them back to the assessor in a predetermined order.

Test scoring. The test is scored using the standardised UK or USA norms that are published by age. This study employed the UK norms.

Kaufman Assessment Battery for Children, second edition (KABC-II). The Kaufman Assessment Battery for Children, second edition (KABC-II) is a clinical instrument for assessing cognitive development and information processing. The initial K-ABC was developed by Alan S. Kaufman and Nadeen L. Kaufman in 1983. It was revised in 2004, which led to publication of the KABC-II (Kaufman & Kaufman, 2004). The assessment is an individually administered measure of the cognitive processing and cognitive abilities of children and adolescents aged 3-18 years. Its construction incorporates several recent developments in both psychological theory and statistical methodology (Kaufman & Kaufman, 2004).

KABC-II has a dual theoretical foundation: the Cattell-Horn-Carroll (CHC) psychometric model of broad and narrow abilities and Luria's neuropsychological theory of processing (Kaufman, 2004). This is discussed in Section 2.6 of this study.

The KABC-II consists of 18 subtests, which are divided into core and supplementary subtests. The subtests are grouped dependent on the test taker's age and the interpretive model chosen by the assessor (Kaufman & Kaufman, 2004). Luria's model consists of four scales: Sequential Processing Scale, Simultaneous Processing Scale, Learning Ability Scale, and Planning Ability Scale. The CHC model consists of: Short-Term Memory (Gsm), Visual Processing (Gv), Long-Term Storage and Retrieval (Glr), and Fluid Reasoning (Gf) with the additional, fifth scale being Crystallised Ability (Gc) (Kaufman & Kaufman, 2004). The assessor must therefore decide between the Lurian or CHC model prior to the testing. Only the scales that were compared in this research are discussed in this section.

Knowledge Scale (Gc). The Knowledge Scale aims to assess the child's ability to receive and process information. This is the ability to communicate one's knowledge and to reason using previously learned experiences or procedures. The subtests are as follows (Kaufman & Kaufman, 2004):

- Riddles (ages: 4-6/7-18) — The assessor relays several characteristics of a concrete or abstract verbal concept and the child is required to point to it or name it.
- Expressive Vocabulary (ages 4-6) — This subtest measures the child's ability to say the correct names of objects and illustrations.
- Verbal Knowledge (ages 7-18) — The child selects from an array of six pictures the one that corresponds to a vocabulary word or answers a general information question.

Simultaneous Processing Scale (Gv). The aim of this scale is to assess the child's ability to perceive, store, manipulate, and think with visual patterns through a range of subtests. The subtests are as follows (Kaufman & Kaufman, 2004):

- Triangles (ages: 4-6/7-12) The child assembles several foam triangles to match a picture.
- Face Recognition (age 4) The child looks at photographs of one or two faces for 5 seconds and then (from a selection) chooses the correct face/faces shown in a different pose.
- Block Counting (ages 13-18) The child counts the number of blocks in a picture of a stack of blocks, in which some of the blocks are partially hidden.
- Conceptual Thinking (ages 4-6) The child selects the odd picture out from a set of four or five pictures.
- Rover (ages: 6/7-18) The child moves a toy dog to a bone on a grid that contains several obstacles – trying to find the quickest path to the bone.
- Gestalt Closure (ages: 4-6/7-18) The child mentally fills in the gaps in a partially completed inkblot drawing and names or describes the object/action depicted in the drawing.
- Pattern Reasoning (Ages 5-6) The child is shown a series of stimuli that form a logical linear pattern with one stimulus missing. The child selects the missing stimulus from several options.

Planning Scale (Gf). This scale assesses the broad ability to reason, form concepts, and solve problems using unfamiliar information or novel procedures. The subtests are as follows (Kaufman & Kaufman, 2004):

- Story Completion (ages 7-18) The child is shown a row of pictures that tell a story, but some pictures are missing. The child chooses the several pictures (from a selection) that are needed to complete the story and places them in the correct location.
- Pattern Reasoning (ages 7-18) The child is shown a series of stimuli that form a logical linear pattern with one stimulus missing. The child selects the missing stimulus from several options.

Sequential Processing Scale (Gsm). The aim of this scale is to assess the child's ability to take in and hold information, and then use it within a few seconds. The subtests are as follows (Kaufman & Kaufman, 2004):

- Word Order (ages: 4-6/7-18) The assessor reads out the names of common objects. The child then touches a series of silhouettes of these objects in the same order as read by the assessor.
- Number Recall (ages: 4-6/7-18) The assessor reads a string of numbers and the child repeats the string in the same order. The strings range from two to nine digits.
- Hand Movements (ages: 4-6/7-18) The child copies a series of taps the assessor makes on the table with the fist, palm, or side of the hand.

Reliability. The internal consistency reliability coefficient for core and supplementary subtests demonstrates that the KABC-II has *good* reliability. The median reliability for the 3-6 age band is 0.85 (range 0.69-0.92) and for the age band 7-18 it is 0.87 (range 0.74-0.93). Retest reliabilities of the global scales ranged from 0.72-0.94. In this case, retest stability increases with age (Kaufman & Kaufman, 2004).

Test scoring. The test is scored using the standardised UK or USA norms that are published by age. This study employed the UK norms.

3.6 Procedure

Ethical clearance was obtained for the broader research project (Protocol Number H16/02/37) (see Appendix A). In addition, written consent was obtained from the school principal and the parents/guardians of the participants, as well as assent from the participants. Ethical clearance was also obtained for this study (Protocol Number H19/05/02) (see Appendix B). Data was collected for the purpose of the broader research project. This study then statistically analysed the raw data and answered the research questions specifically posed by this research study.

3.7 Data Analysis

The data was analysed quantitatively. The Pearson correlation was computed and a paired sample t-test used. The Pearson correlation measures the strength and direction of the association that exists between two variables. The t-test is a statistical procedure used to determine whether the mean difference between two sets of observations is zero (Field, 2013). The Statistical Package for the Social Sciences (IBM SPSS Statistics 25) was used for the analysis.

3.8 Ethical Considerations

Ethics form the foundation of the research process: creating accountability on the part of the researcher and protection for the participants (Foxcroft, 2011).

As noted, ethical clearance for the broader research project had already been obtained from the University of the Witwatersrand Human Research Ethics Committee – Non-Medical (Protocol Number H16/02/37) (Appendix A). The same ethical principles to which the broader project adhered, also guided this study H19/05/02 (Appendix B). These include informed and written consent/assent; a consideration of risks and benefits; protection from harm; anonymity and confidentiality; voluntary participation; the right to withdraw; and access to results.

The broader research project adhered to the following ethical considerations (which are also relevant to this study). An information booklet detailing the broader project was issued to the principal and parents detailing the aims of the project (Appendices C and D). Subsequently, written consent was obtained from the principal of the school and the parents/legal guardians of each of the participants (as they were minors) (Appendices E and F). In addition, each participant was required to give assent in either verbal or written form, depending on each participant's age (Appendix G). Permission to use the collected data was obtained from the researcher on the broader project (Appendix H), the principal of the school (Appendix I) and the parents/legal guardians (Appendix J).

Given that the participant age range was 10-14 years, the participants were considered a vulnerable sample. Consent from parents/legal guardians was thus essential. In addition, the participants were not coerced or forced to participate in this study: all participation was done on a voluntary basis only.

All participants were informed of the right to withdraw at any point – free from consequence. Where participants felt uncomfortable with the testing process, questions asked, or tasks, they were free to withdraw from the research at any time.

All participants and parents/legal guardians received an information booklet detailing the aims and objectives of the study; the testing procedure; time frames; and researcher expectations. All participants were afforded the opportunity to raise concerns and ask questions relating to any aspect of the research.

When data collection requires face-to-face interaction, it can be a challenge to ensure anonymity. The name of the school and names of the participants are protected through the use of codes or pseudonyms. The names of participants and the identity of the school involved in this study are not mentioned in this research report. In this manner, confidentiality was maintained as was guaranteed to all participants, their parents/legal guardians, and the school.

It should be noted that the assessment measures employed could potentially identify learning barriers in the assessed participants. The parents/legal guardians of the participants were made aware of this and feedback was offered to all parents/legal guardians. With the permission of the parents/legal guardians, the school involved was also guided with specific recommendations to support the participants.

The raw data that was electronically captured for analysis as well as all paper-based data/results was stored at the University of Witwatersrand in a protected, locked cupboard and/or a password protected computer. The data was retained for use in the broader project and for further publications/conference proceedings that may arise from this study.

As noted, the results of this study were (and will continue to be) made available to parents/legal guardians. This was viewed as beneficial, as many of the leaners have never been assessed. The assessments could help identify a child's strengths and weaknesses – which would otherwise have gone unidentified. Apart from access to results and the identification of participant strengths and weaknesses, no additional risks or benefits were foreseen regarding participation in this study, nor did any manifest during the process. In addition, no potential harm to the participants was foreseen – with caution taken in terms of school hours and the participants' involvement in school and learning activities.

The outcome of the analysis done for this research study was recorded in this research report, which, as indicated to parents/legal guardians, may be published in the form of a peer-reviewed article or be presented at a conference. The research report is also to be made available to the university community on the library website.

3.9 Conclusion

This methodology section focuses on the methods employed in the data collection and analysis processes, which were necessary to answer the research questions. The research process was not without its challenges, some of which are highlighted in this chapter and are explored in some detail in Chapter 6 (limitations). Details of the instruments used in the subtest and administration process are also explored. This chapter concludes with the ethical considerations protocols and procedures that were followed to ensure that no harm was caused by, or unethical practices used in, the research process.

Chapter 4 presents the statistical results that were produced by the IBM SPSS Statistics 25 (for the parametric tests, Pearson correlation, and paired sample t-test).

Chapter 4: Reporting Results

4.1 Introduction

This chapter presents the statistical results of this study. Firstly, using descriptive statistics, the sample of learners is described in terms of gender, age, and grade. Thereafter, the distribution of the data in terms of parametric/non-parametric assumptions is discussed. These assumptions were crucial to determining the appropriate types of analyses to address the research questions pertaining to this study. Lastly, this chapter discusses the inferential statistics used to answer the research questions and test the hypotheses. In this regard, the appropriate statistical analysis of the parametric tests, the Pearson correlation, and a paired samples t-test were computed. The statistics was produced by IBM SPSS Statistics 25.

4.2 Descriptive Statistics

The sample. The average age of the participants was 11.9 years. The age of participants ranged from 10 to 14 years (M = 11.9, SD = 1.18). Age was normally distributed with skewness of -0.11 (SE = 0.33) and kurtosis of -0.72 (SE = 0.66). The sample consisted of 31 male participants and 19 female participants. The grade distribution was as follows: Grade 4: six participants, Grade 5: 11 participants, Grade 6: 17 participants, Grade 7: 10 participants, and Grade 8: six participants.

Assumptions. Prior to producing the parametric statistics, common assumptions had to be met. For the Pearson correlation and paired samples t-test, the data captured was in the form of index/scale scores. The data was thus numerical and measured on an interval scale, which met the assumption for both the Pearson correlation and paired samples t-test. The data within the sample was independent and there were no significant outliers. Skewness reflects the degree of symmetry or asymmetry in a statistical distribution: in an asymmetrical

distribution the curve appears distorted to either the left or the right. Skewness coefficients should generally fall between 1 and -1, which indicates a relatively normal distribution (Lane et al., 2017). As can be seen in Table 7, the skewness coefficient for all the scales and subscales were between 1 and -1. The data was therefore relatively normally distributed. Kurtosis was also calculated. Kurtosis is a measure of tailedness where a *low* kurtosis value is indicative of a light-tailed distribution or fewer outliers, and a *high* kurtosis value is indicative of a heavy-tailed distribution or outliers. The kurtosis values for the data in this study were all relatively close to zero and within the 3 to -3 range, which indicates that the data was not heavily skewed. This was further supported by the histograms that were constructed (Appendix K), which suggested that all the variables followed a sufficiently normal distribution and were thus suitable for parametric analysis. Lastly, according to the Central Limit Theorem, sample sizes greater than and equal to 30 can be considered as normally distributed (Babbie & Mouton, 2014). The sample size of the present study was 50 participants (n = 50) – thus meeting this requirement. The data in this study sufficiently met the various assumptions, as such, parametric analytic techniques were utilised.

Table 7

Results of Descriptive Statistics/Normality of Main Variables of the WISC-V Indexes and KABC-II Scales

Variable	N	Mean	Standard deviation	Min	Max	Skewness	Kurtosis
WISC-V *VCI*	50	80.82	13.694	50	113	-0.044	-0.343
KABC-II *Gc*	50	83.46	10.889	63	109	-0.066	-0.669
WISC-V *VSI*	50	86.06	16.687	49	119	0.002	-0.435
KABC-II *Gv*	50	87.76	16.905	43	124	-0.176	-0.012
WISC-V *FRI*	50	86.14	15.265	55	118	0.293	-0.637
KABC-II *Gf*	50	87.52	14.269	51	128	0.049	0.477
WISC-V *WMI*	50	84.38	14.801	60	120	0.627	-0.268
KABC-II *Gsm*	50	90.42	13.898	66	115	-0.13	-1.08

4.3 Research Questions and Hypothesis Testing

As highlighted in the literature review, CHC theory forms the theoretical base of the WISC-V and KABC-II. It has been theoretically stated that the WISC-V indexes and KABC-II scales can be grouped as equivalent measures that assess the same underlying constructs. Table 5 (Chapter 2) shows the legitimacy of this claim as established for the current sample.

This study used Pearson correlation coefficients to test the degree of the linear relationship between variables. The results of this analysis were presented using coefficients *r* and *p*-values. The coefficient *r* can range in value from -1 to 1. An *r*-value of +1 indicates a perfect positive linear relationship, whereas an *r*-value of -1 indicates a perfect negative linear relationship (Lane et al.,2017). Therefore, the closer the *r*-value is to +1, the stronger the linear relationship between the variables. Conversely, the closer the *r*-value is to zero, the weaker the association between the variables. The *p*-value represents the level of statistical significance: a *p*-value of less than 0.05 is considered to be statistically significant (Lane et al., 2017). Based on theoretical foundation, it was hypothesised that the indexes/scales being compared would have strong positive relationships and thus produce statistically significant correlations. A statistically significant, strong positive relationship would confirm that similar patterns were present for the current sample. This would thus confirm construct validity and allow the comparison of scores.

The hypotheses were tested using a paired sample t-test, which is a statistical procedure used to determine whether the means of two metric variables (in this case two indexes/scales designed to measure the same/similar underlying constructs of intelligence) are equal in the sample population. A larger *t*-value represents a more pronounced difference between index/scale scores.

Research Question 1. What is the nature of the relationship between the WISC-V Verbal Comprehension Index (VCI) and the KABC-II Knowledge Scale (Gc)? The Pearson correlation was computed to assess the relationship between the VCI of the WISC-V and the Gc, Gv, Gf and Gsm of the KABC-II. The results are summarised in Table 8.

Table 8

Results of Pearson Correlation of WISC-V VCI with KABC-II Gc, Gv, Gf and Gsm Scales

		(Gc)	(Gv)	(Gf)	(Gsm)
WISC-V VCI	(*r*)	0.837	0.473	0.487	0.287
	p-value	0.000	0.001	0.000	0.043

As can be seen from the results presented in Table 8, there was a positive relationship between the VCI and all four scales. The relationship between the VCI and Gc was the strongest with an *r*-value closest to +1 ($r = 0.84$, $n = 50$, $p = 0.00$), which is a very strong positive relationship.

The results of this correlation confirmed *good* construct validity and provided evidence that the VCI and Gc index/scale measure similar underlying constructs of knowledge and prior learning/crystallised intelligence on the same/similar theoretical base.

The research hypothesis states that as the VCI and Gc are said to measure a child's knowledge and prior learning/crystallised intelligence, these indexes/scales should yield similar scores. A paired samples t-test was computed to determine whether the VCI and Gc produced similar scores. The results are summarised in Table 9.

Table 9

Results of t-tests and Descriptive Statistics WISC-V VCI, KABC-II Gc, and VCI/Gc Index/Scale Scores

	VCI			Gc			95% CI for Mean Difference				
	M	SD	n	M	SD	n	Lower	Upper	T	Df	Sig
VCI/Gc	80.82	13.694	50	83.46	10.889	50	-4.776	-.504	-2.484	49	0.016

The *t*-test results showed a statistically significant difference between the WISC-V VCI and KABC-II Gc scores. The KABC-II Gc scores were higher than the WISC-V VCI scores (t_{49} = -2.48; p = .016). It can therefore be concluded that participants' scores on the KABC-II Gc were significantly higher than the participants' scores on the WISC-V VCI.

Thus, according to the outcome of the analyses, the Pearson correlation coefficients showed a very strong positive relationship, that is *good* construct validity between the WISC-V VCI and the KABC-II Gc. This indicated that (in answer to Research Question 1) theoretically the VCI and Gc measure similar constructs. The results of the paired samples *t*-test, however, showed that the participants scored significantly higher on the KABC-II Gc than on the WISC-V VCI. This indicated that despite their shared underlying theoretical base these tests did not produce the same/similar test scores concurrent validity was not achieved within the South African context and may not be used interchangeably to measure knowledge and prior learning/crystallised intelligence in learners.

Research Question 2. What is the nature of the relationship between the WISC-V Visual Spatial Index (VSI) and the KABC-II Simultaneous Processing Scale (Gv)? The Pearson correlation was computed to assess the relationship between the VSI of the WISC-V and the Gc, Gv, Gf and Gsm of the KABC-II. The results are summarised in Table 10.

Table 10

Results of Pearson Correlation of WISC-V VSI with KABC-II Gc, Gv, Gf and Gsm Scales

		(Gc)	(Gv)	(Gf)	(Gsm)
WISC-V *VSI*	(*r*)	0.651	0.814	0.697	0.057
	p-value	0.000	0.000	0.000	0.0696

As can be seen from the results presented in Table 10, there was a positive relationship between the VSI and all four scales. The relationship between the VSI and Gv was the strongest with an *r*-value closest to +1 ($r = 0.81$, $n = 50$, $p = 0.00$), which is a very strong positive relationship.

The results of this correlation confirmed *good* construct validity and provided evidence that the VSI and Gv index/scale measure similar underlying constructs of visual spatial reasoning on the same/similar theoretical base.

The research hypothesis states that as the VSI and Gv are said to measure a child's visual special reasoning, these indexes/scales should yield similar scores. A paired samples t-test was computed to determine whether the VSI and Gv produced similar scores. The results are summarised in Table 11.

Table 11

Results of t-tests and Descriptive Statistics WISC-V VSI, KABC-II Gv, and VSI/Gv Index/Scale Scores

	VSI			Gv			95% CI for Mean Difference				
	M	SD	N	M	SD	N	Lower	Upper	t	df	Sig
VSI/Gv	86.06	16.687	50	87.76	16.905	50	-4.611	1.211	-1.173	49	0.246

The t-test results showed that the KABC-II Gv scores were higher than the WISC-V VSI scores. The score difference was, however, not statistically significant (t_{49} = -1.17; p = 0.25). It can therefore be concluded that the participants' scores on the KABC-II Gv were not significantly higher than the participants' scores on the WISC-V VSI.

Thus, according to the outcome of the analyses, the Pearson correlation coefficients showed a very strong positive relationship *good* construct validity between the WISC-V VSI and the KABC-II Gv. This indicated that (in answer to Research Question 2) theoretically the VSI and Gv measure similar constructs. The results of the paired samples t-test showed that the participants' scores on the KABC-II Gv were not significantly higher than their scores on the WISC-V VSI. This indicated that the construct validity held true: these indexes/scales share an underlying theoretical base and measure similar constructs concurrent validity was achieved. The VSI and Gv produce the same/similar scores within the South African context and may therefore be used interchangeably to estimate visual spatial reasoning.

Research Question 3. What is the nature of the relationship between the WISC-V Fluid Reasoning Index (FRI) and the KABC-II Planning Scale (Gf)? The Pearson correlation was computed to assess the relationship between the FRI of the WISC-V and the Gc, Gv, Gf and Gsm of the KABC-II. The results are summarised in Table 12.

Table 12

Results of Pearson Correlation of WISC-V FRI with KABC-II Gc, Gv, Gf and Gsm Indexes/Scales

		(Gc)	(Gv)	(Gf)	(Gsm)
WISC-V FRI	(*r*)	0.514	0.696	0.769	-0.009
	p-value	0.000	0.000	0.000	0.950

As can be seen from the results presented in Table 12, there was a positive relationship between the FRI and three (Gc, Gv and Gf) of the four scales. The relationship between the FRI and Gf was the strongest with an *r*-value closest to +1 ($r = 0.77$, $n = 50$, $p = 0.00$), which is a very strong positive relationship.

The results of this correlation confirmed *good* construct validity and provided evidence that the FRI and Gf index/scale measure similar underlying constructs of fluid intelligence on the same/similar theoretical base.

The research hypothesis states that as the FRI and Gf are said to measure a child's fluid intelligence, these indexes/scales should yield similar scores. A paired samples t-test was computed to determine whether the FRI and Gf produced similar scores. The results are summarised in Table 13.

Table 13

Results of t-tests and Descriptive Statistics WISC-V FRI, KABC-II Gf, and FRI/Gf Index/Scale Scores

	FRI			Gf			95% CI for Mean Difference				
	M	SD	N	M	SD	n	Lower	Upper	t	df	Sig
FRI/Gf	86.14	15.265	50	87.52	14.269	50	-4.245	1.485	-0.968	49	0.338

The t-test results showed that the KABC-II Gf scores were higher than the WISC-V FRI scores. The score difference was, however, not statistically significant ($t_{49} = -0.968$; $p = 0.338$). It can therefore be concluded that the participants' scores on the KABC-II Gf were not significantly higher than the participants' scores on the WISC-V FRI.

Thus, according to the outcome of the analyses, the Pearson correlation coefficients showed a very strong positive relationship, that is *good* construct validity between the WISC-V FRI and the KABC-II Gf. This indicated that (in answer to Research Question 3) theoretically the FRI and Gf measure similar constructs. The results of the paired samples t-test showed that the participants' scores on the KABC-II Gf were not significantly higher than their scores on the WISC-V FRI. This indicated that the construct validity held true: these indexes/scales share an underlying theoretical base and measure similar constructs concurrent validity was achieved. The FRI and Gf produce the same/similar scores within the South African context and may therefore be used interchangeably to estimate fluid intelligence.

Research Question 4. What is the nature of the relationship between the WISC-V Fluid Reasoning Index (FRI) and the KABC-II Sequential Processing Scale (Gsm)? The Pearson correlation was computed to assess the relationship between the WMI of the WISC-V and the Gc, Gv, Gf and Gsm of the KABC-II. The results are summarised in Table 14.

Table 14

Results of Pearson Correlation of WISC-V WMI with KABC-II Gc, Gv, Gf and Gsm Scales

		(Gc)	(Gv)	(Gf)	(Gsm)
WISC-V WMI	(*r*)	0.531	0.462	0.425	0.511
	p-value	0.000	0.001	0.002	0.000

As can be seen from the results presented in Table 4.8, there was a positive relationship between the WMI and all four scales. The relationship between the WMI and Gc was the strongest with an *r*-value closest to +1 ($r = 0.53$ $n = 50$, $p = 0.00$), followed by WMI/Gsm ($r = 0.51$ $n = 50$, $p = 0.00$), which is a very strong positive relationship.

The results of this correlation confirmed *good* construct validity and provided evidence that the WMI and Gc and WMI and Gsm index/scale measure similar underlying constructs of knowledge and prior learning/crystallised intelligence in conjunction with short term memory on the same/similar theoretical base.

The research hypothesis states that as the WMI and Gsm are said to measure a child's short-term memory, these indexes/scales should yield similar scores. A paired samples t-test was computed to determine whether the WMII and Gsm produced similar scores. The results are summarised in Table 15.

Table 15

Results of t-tests and Descriptive Statistics WISC-V WMI, KABC-II Gsm, and WMI/Gsm Index/Scale Scores

	WMI			Gsm			95% CI for Mean Difference				
	M	SD	N	M	SD	n	Lower	Upper	t	df	Sig
WMI/Gsm	86.38	14.801	50	90.42	13.898	50	-10.077	2.003	-3.007	49	0.004

The t-test results showed that the KABC-II Gsm scores were higher than WISC-V WMI scores. The score difference was statistically significant (t_{49} = -3.01; p = 0.004). It can therefore be concluded that the participants' scores on the KABC-II Gsm were significantly higher than the participants' scores on the WISC-V WMI.

In the context of this research, the relation between WMI and Gsm was expected to be the strongest and most significant – based on the theoretical foundation, factor analysis, and cross-battery approach. However, for this sample (n = 50) the relationship between WMI and Gc showed a stronger correlation (r = 0.53, $p < 0.05$). This did not rule out the WMI/Gsm

correlation: the fourth hypothesis was still analysed and the strong correlation between the WMI and Gc index is explored in the discussion section.

Furthermore, the results of the paired samples t-test showed that the participants' scores on the KABC-II Gsm were not significantly higher than their scores on the WISC-V WMI. This indicated that the construct and concurrent validity must be further investigated. As per the underlying theoretical base, these tests measure similar constructs somewhat differently and produced significantly different scores within the South African context and may therefore not be used interchangeably for estimating short-term memory.

Thus, according to the outcome of the analyses, the Pearson correlation coefficients showed a very strong positive relationship *good* construct validity between the WISC-V WMI and the KABC-II Gc and Gsm. This indicated that (in answer to Research Question 4) theoretically the WMI and Gsm measure similar constructs. The results of the paired samples t-test showed that the participants' scores on the KABC-II Gf were not significantly higher than their scores on the WISC-V FRI. This indicated that the construct validity held true: these indexes/scales share an underlying theoretical base and measure similar constructs concurrent validity was achieved. The FRI and Gf produce the same/similar scores within the South African context and may therefore be used interchangeably to estimate fluid intelligence.

4.4 Conclusion

The statistical Pearson correlation (*r*) values for each index/scale comparison showed strong positive relationships between the indexes/scales. This supported strong construct validity that allowed the comparison of the WISC-V indexes with the KABC-II scales, as they theoretically measure the same/similar underlying constructs – with the exception of WMI and Gsm.

The results produced by the paired samples t-tests allowed the testing of each of the four hypotheses. Hypotheses 2 and 3 were confirmed. The results produced by the participants were similar on the indexes/scales compared and concurrent validity was achieved. The results for Hypotheses 1 and 4 were significantly different for the indexes/scales being compared, they thus did not yield statistically non-significant results despite having a similar theoretical base as hypothesised concurrent validity was not achieved. The results are discussed in detail in Chapter 5.

Chapter 5: Discussion

5.1 Introduction

This research examined the construct and concurrent validity of the WISC-V and KABC-II indexes/scales in the South African context. Construct validity was used to explore the nature of the relationship of the indexes/scales that are premised on the same/similar theory. Construct validity thus assessed the specific underlying constructs of the indexes/scales. Concurrent validity was used to examine the difference in scores between the indexes/scales that measure similar/same underlying constructs. The nature of the relationship of these indexes/scales was analysed using parametric statistical analysis: Pearson correlations and a paired samples t-test was computed to examine the difference in scores between the indexes/scales that measure similar/same underlying constructs.

The results supported three main findings. First, the Pearson correlation coefficients showed a strong positive relation between the indexes/scales on the WISC-V and KABC-II. The VCI and Gc, VSI and Gv, FRI and Gf, and WMI and Gsm correlated. This means that theoretically, in the South African context, these indexes/scales assess the same/similar underlying constructs utilising the same/similar theoretical base showing *good* construct validity. Second, the results of the Pearson correlation presented a strong correlation between the WMI and Gc. This was unexpected as WMI is designed to measure short-term memory and Gc is designed to measure prior learning/crystallised intelligence. Third, despite the strong positive relationship and *good* construct validity of these indexes/scales, learners in this sample performed differently across all the indexes/scale comparisons (VCI/Gc, VSI/Gv, FRI/Gf, and WMI/Gsm). Of the four comparisons, two showed statistically significant differences (VCI/Gc and WMI/Gsm) and concurrent validity was not achieved.

The conclusion was reached that despite the theoretical base, which creates a strong positive relationship between indexes/scales, the WISC-V and KABC-II may not be used interchangeably in the South African context by practitioners for a referred learner population with academic problems. This chapter discusses each of these findings in some detail – drawing on theory, test structure, and other research studies.

5.2 Pearson Correlation Findings

This study was conducted to establish construct validity across four indexes/scales on the WISC-V and KABC-II with a referred learner population in the South African context. The results of the Pearson correlation showed significant positive correlations. This confirmed construct validity for the following indexes/scales: the VCI and Gc, VSI and Gv, FRI and Gf, and WMI and Gsm/Gc in the sample of 50 learners.

The only other data available for comparison was found in the WISC-V Technical and Interpretive Manual (Weschler, 2014). This data is summarised in Table 16. During the norming process of the WISC-V, its indexes were correlated with the KABC-II scales. These correlations match some of this study's research findings: the *r*-value in both samples show a strong positive relationship between the VCI and Gc. The *r*-value of the normative sample showed a strong positive relationship between VSI and Gc and FRI and Gc. This study, however, indicated a stronger correlation between VSI and Gv and FRI and Gf. For the South African sample used in this study, WMI correlated with Gc, but in the normative study WMI correlated strongly with Gsm.

Table 16

Results of Pearson correlation of WISC-V VCI, VSI, FRI and WMI with KABC-II Gc, Gv, Gf and Gsm Indexes from the WISC-V Technical and Interpretive Manual

		RGc	NGc	RGv	NGv	RGf	NGf	RGsm	NGsm
VCI	(*r*)	0.84	0.74	0.47	0.34	0.49	0.44	0.29	0.36
VSI	(*r*)	0.65	0.55	0.81	0.53	0.70	0.51	0.06	0.20
FRI	(*r*)	0.51	0.52	0.70	0.41	0.77	0.50	-0.01	0.17
WMI	(*r*)	0.53	0.38	0.46	0.27	0.43	0.23	0.51	0.63

Note. R = research sample statistics, N = normative sample statistics, From Wechsler (2014). Copyright 2014 NCS Pearson.

The design and CHC theoretical base of the WISC-V and KABC-II allow for the inclusion of a wide range of narrow abilities to assess/measure broader abilities, which are then reflected in a single score. The greater the range of narrow abilities, the more accurately the index/scale scores reflect broader abilities (Kaufman & Kaufman, 2004). Although the inclusion of a wide variety of narrow abilities creates rigour, test selection is important as the inclusion of tests that assess different underlying concepts could skew results or produce conflicting results.

One of the criticisms of the WISC-V structure is the inclusion of the Digits Backward subtest in the WMI. According to a review by Ramsey and Reynold (1995), the differences noted between the Digits Forward and Digits Backward tasks have significant neurologic and diagnostic implications. As long ago as 1975, De Renzi and Nichelli found the Digits Forward task to have a verbal element while the Digits Backward task includes visuospatial elements. This difference could account for the lower correlation between the WMI and Gsm, as a strong verbal element combined with visuospatial elements could produce different results in diverse settings.

In support of De Renzi and Nichelli's 1975 study, research that looked at the effect of education and culture on the Digit Span task by Ostrosky-Solı´s and Lozano (2006) found that learning to read and write/level of education affects the development or usage of the abilities measured by the Digit Span task, and that cultural variables, such as language and quality of education, might also contribute to the differences found between countries.

The significant positive correlations found in this study supported the theoretical underpinnings and affirmed the notion that certain indexes/scales assess the same/similar underlying constructs. Although these positive correlations also lent support to the interchangeable use of these assessment measures, further analysis indicated that Gc has a marked influence on all scales. This is further supported by the norm results as summarised in Table 16. As Gc is premised on language development; general knowledge and crystallised intelligence; and mainstream culture, students with deficits in these areas may perform lower on the WISC-V than on the KABC-II.

Language plays a significant role in the testing process. A study by Taylor (1998), which compared the performance of white and black children on the K-ABC, WISC-R, and WISC-III, found that scores on the WISC Verbal Scale were significantly lower for black children than for white children. This suggests that the differences in WISC IQ scores were likely the result of acquired knowledge and language rather than IQ or intelligence. This is further evidenced by Skuy et al.'s (2000) study that assessed white and black South African learners with learning disabilities on the WISC-R and K-ABC. The study found significant differences between black and white learners' scores on the WISC-R. The evidence supported the use of the K-ABC over the WISC-R in culturally and linguistically diverse communities (Skuy et al., 2000).

Although the WISC-V and KABC-II assessment measures may appear to assess the same underlying constructs theoretically, the inclusion of specific subtests (that rely on verbal knowledge, prior learning, and crystallised intelligence) was shown to influence overall scores and result in significant differences. Therefore, when practitioners select assessment measures, knowledge of subtests and awareness of factors (such as language and its influence on test performance), are imperative.

5.3 T-Test Findings

Paired samples t-tests were conducted to determine whether the intelligence indexes/scales yielded similar results. The scores obtained on the WISC-V VCI, VSI, FRI and WMI differed from the KABC-II Gc, Gv, Gf and Gsm scale scores. Although the indexes/scales measure similar underlying constructs (as revealed by the Pearson correlation coefficients), the t-tests indicated that assessing the same individual learner once on the WISC-V followed by once on the KABC-II may result in significantly different scores. This then further indicates that the WISC-V and KABC-II may not be used interchangeably in the South African context by practitioners for a referred student population with academic challenges.

Statistically significant index/score differences. ***Verbal Comprehension Index (VCI) and Knowledge Scale (Gc).*** The findings of the t-test coupled with the mean index/scale scores for VCI and Gc (Figure 1) showed that learners scored significantly higher on the KABC-II Gc than on the WISC-V VCI.

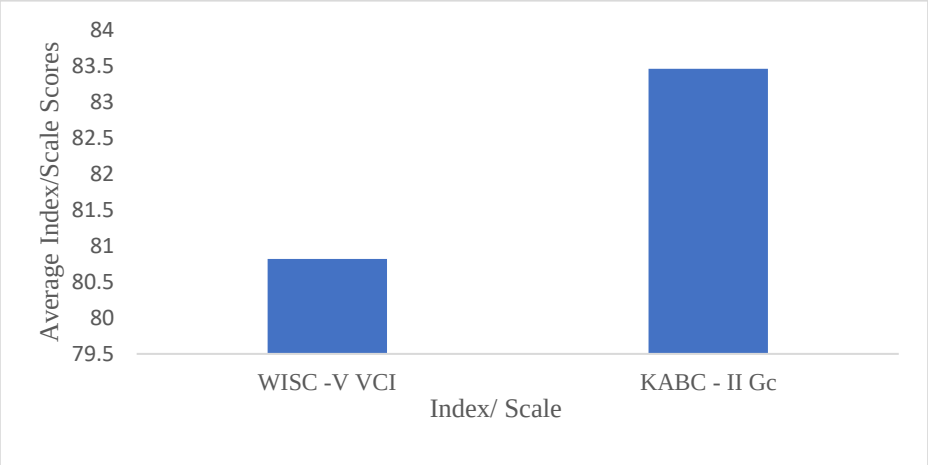


Figure 1. Index/scale scores of learners on the WISC-V (VCI) and KABC-II (Gc).

The *VCI* score comprises the Similarities and Vocabulary subtests. The Gc scale score comprises the Verbal Knowledge and Riddles subtests. A significant difference between the VCI and Gc is that the Gc includes verbal and pictorial stimuli, which allows either a verbal or pointing response, thus resulting in less emphasis on language (Lichtenberger & Kaufman, 2010). In comparison, the VCI depends solely on verbal responses. An example of each of these subtests is provided.

WISC-V Similarities Subtest. An example of this subtest would be (WISC-V Administration and Scoring Manual [ASM], 2014, p 89):

The learner is asked:

Item 1: “In what way are RED and GREEN alike?” (WISC-V ASM, 2014, p. 92).

Item 20: “In what way are ALLOW and PREVENT alike? (WISC-V ASM, 2014, p. 109).

WISC-V Vocabulary Subtest. An example of this subtest would be (WISC-V ASM, 2014, p. 132):

The assessor says, “I am going to say some words. Listen carefully and tell me what each word means.”

Item 5: “SOAP. What is soap?” (WISC-V ASM, 2014, p. 138).

Item 19: “TRANSPARENT. What is transparent?” (WISC-V ASM, 2014, p. 152).

KABC-II Verbal Knowledge Subtest. An example of this subtest would be (Kaufman & Kaufman, 2004, Easel 3, p. 10):

The learner is shown a picture and is instructed, “Look at the picture, I’ll say a word or ask a question. If I say a word, point to the picture that shows what the word means. If I ask a question, point to the picture that shows the best answer.”

Item 21: “Cheer.”

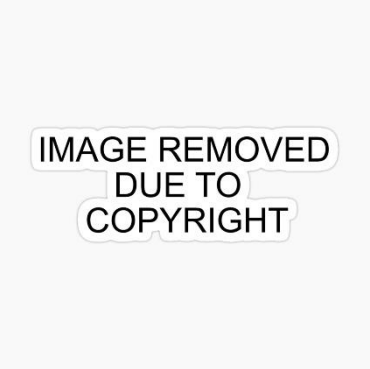


Figure 2. Example picture as used in the KABC-II Verbal Knowledge subtest.

Item 51: “What Thomas Edison invented?”

Figure 3. Example picture as used in the KABC-II Verbal Knowledge subtest.

KABC-II Riddles Subtest. An example of this subtest would be (Kaufman & Kaufman, 2004, Easel 4, p. 18):

The learner is instructed, "I'll ask you some questions. Each answer is just one word."
Item 12: "What is fluffy, white and you see it in the sky?"
Item 45: "What is very hard, is smooth, and is part of each tooth?"

The developers of the KABC-II made efforts to reduce verbal load and emphasised the inclusion of subtests that were intrinsically interesting across all ages (Lichtenberger & Kaufman, 2010). These factors coupled with the inclusion of a broader scope of narrow abilities as indicated in Table 5 (Chapter 2) – Gc includes Lexical Knowledge, Verbal Knowledge, and Language Development, whereas VCI includes only Lexical Knowledge – may account for higher Gc scores. The results of this study also support suggestions by Clauss-Ehlers (2010, p. 557), that the "K-ABC's theoretical underpinnings and its fairness in assessing children from diverse minority groups sets it apart from traditional IQ tests, notably those developed from the Binet and Wechsler traditions." In addition, studies conducted by Skuy et al. (2000) provided evidence that the previous version of the KABC-II had greater cultural relevance and usefulness in the South African context than the WISC-R.

Despite the KABC-II developers' efforts to reduce verbal load and cultural relevance, the measure is not without criticism. A recent study by Seedat (2019) compared the performance of English first language (EFL) and English additional language (EAL) children on the KABC-II Knowledge Scale. Seedat (2019) found significant differences between EFL and EAL children on the Knowledge Scale and all three of its subtests. The inclusion of specific test items presented as language bias items, which allowed the EFL learners to perform significantly better than the EAL learners on these items.

Working Memory Index (WMI) and Sequential Processing Scale (Gsm). The findings of the t-test coupled with the mean index/scale scores for WMI and Gsm (Figure 4) showed that learners scored statistically significantly higher on the KABC-II Gsm than on the WISC-V WMI.

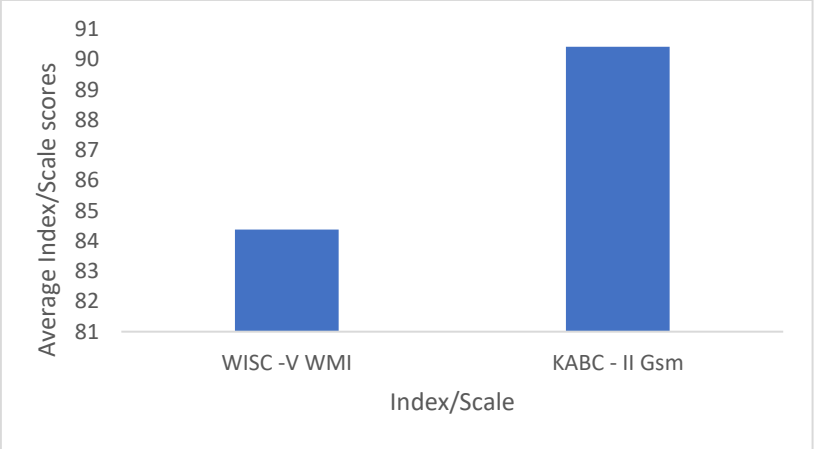


Figure 4. Index scores of learners on the WISC-V (WMI) and KABC-II (Gsm)

As discussed in Section 5.2, according to the Pearson correlation for the sample in this study, WMI correlated more strongly with Gc than with Gsm, which suggests that the Working Memory Index on the WISC-V features a heavier reliance on verbal input than the Sequential Processing Scale on the KABC-II. The WMI score includes various subtests: Digit

Span Forward, Digit Span Backward, Digit Span Sequencing, and Picture Span (Wechsler, 2014). The Gsm scale includes the subtests Number Recall and Word Order (with and without colour interference). A brief example of each of these subtests is provided in this section (Kaufman & Kaufman, 2004).

WISC-V Digit Span Forward. An example of this subtest would be (WISC-V ASM, 2014, p. 120):

The assessor says, "I'm going to say some numbers. Listen carefully, I can only say them one time. When I stop, you say them back to me in the same order. Just say what I say."

Item 1a) "2, 9" Item 1b) "5, 4"

Item 6a) "2, 1, 8, 9, 4, 3,7" Item 6b) "7, 8, 5, 2, 1, 6, 3"

WISC-V Digit Span Backward. An example of this subtest would be (WISC-V ASM, 2014, p. 121):

The assessor says, "Now I'm going to say some more numbers, but this time when I stop you say the numbers backward. If I say 9, 4 what would you say?"

Item 1a) "2, 1" Item 1b) "1, 3"

Item 6a) "2, 1, 7, 9, 4" Item 6b) "5, 6, 3, 8, 7"

WISC-V Digit Span Sequencing. An example of this subtest would be (WISC-V ASM, 2014, p. 124):

The assessor says "Now I'm going to say some more numbers, but this time when I stop, you say the numbers in order, starting with the smallest number. If I say 3, 1, what would you say?"

Item 1a) "4, 1" Item 1b) "3, 2"

Item 6a) "8, 5, 2, 5, 3, 7" Item 6b) "6, 1, 4, 7, 9, 3"

WISC-V Picture Span. An example of this subtest would be **(**WISC-V ASM, 2014, p. 173):

A stimulus page is exposed, and the learner is instructed, “Look at this picture.” The assessor begins timing for 3 seconds. A response page is exposed, and the assessor says, “Point to the picture I just showed you.”

Item 3:

Stimulus Page

Response Page

Figure 5. Stimulus and response pages from the WMI Picture Span subtest on the WISC-V.

Item 11:

Stimulus Page

Response Page

Figure 6. Stimulus and response pages from the WMI Picture Span subtest on the WISC-V.

KABC-II Number Recall. An example of this subtest would be (Kaufman & Kaufman, 2004, Easel 4, p. 5):

The assessor says, "I'm going to say some numbers. Say them just as I do."

Item 8: "4, 1, 9, 6" Item 16: "4, 2, 5, 8, 6, 3, 10"

KABC-II Word Order. An example of this subtest would be (Kaufman & Kaufman, 2004, Easel 4, p. 14):

An A5-object card as per Figure 7 is placed in front of the child. The assessor says, "Look at these pictures and point to the star, cup, key…" The learner is expected to name all the objects. The learner is corrected where necessary and required to repeat until the correct associations are made. Thereafter the assessor says, "I am going to say some names of some of the pictures. Then you touch the pictures in the same order I named them." (The assessor covers the objects.)

Item 9: "Cup, key, bird"

Figure 7. A5-object card from the Gsm Word Order subtest on the KABC-II.

The assessor says, “Now we will use these pictures.”

Item 14: “Cat, ball, shoe, moon, hand”

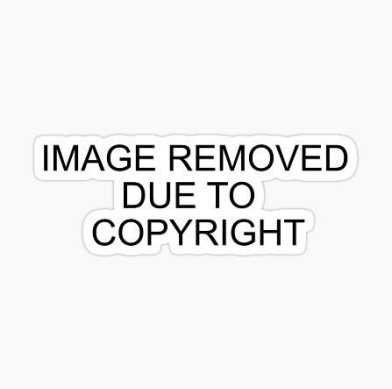


Figure 8. A5-object card from the Gsm Word Order subtest on the KABC-II.

The WMI and Gsm test structures assess the same underlying narrow abilities as shown in Table 5 (Chapter 2). WMI assesses memory span through the Digits Span Forward subtest, and Gsm uses the subtests Number Recall and Word Order without colour interference. The working memory narrow ability is assessed using the Digit Span Backward, Digit Span Sequencing, and Picture Span subtests on the WMI (Wechsler, 2014), whereas the Gsm uses the subtest Word Order with colour interference (Kaufman & Kaufman, 2004). There are clear differences between these: firstly, the inclusion of Digit Span Backward (which is discussed in Section 5.2) and secondly, the inclusion of Word Order without colour interference to assess memory span. The inclusion of the Word Order subtest allows for the linking of motoric non-verbal responses with auditory input, which keeps verbal inputs on mental processing to a minimum. Furthermore, the Word Order subtest assesses auditory motor sense and auditory visual integration, which is a more complex and integrated skill than basic working memory (Lichtenberger & Kaufman, 2010; Kaufman & Kaufman, 2004).

Statistically insignificant index/scale score differences. The findings of the t-test showed a statistically insignificant difference between the VSI and Gv and the FRI and Gf indexes/scales. Although the differences in this sample were insignificant, it is imperative to recognise that there was a difference (as reflected in Figures 9 and 10): the participants scored higher on the KABC-II Gv/Gf than on the WISC-V VSI/FRI.

Visual Spatial Index (VSI)/Simultaneous Processing Scale (Gv) and Fluid Reasoning Index (FRI)/Planning Scale (Gf)

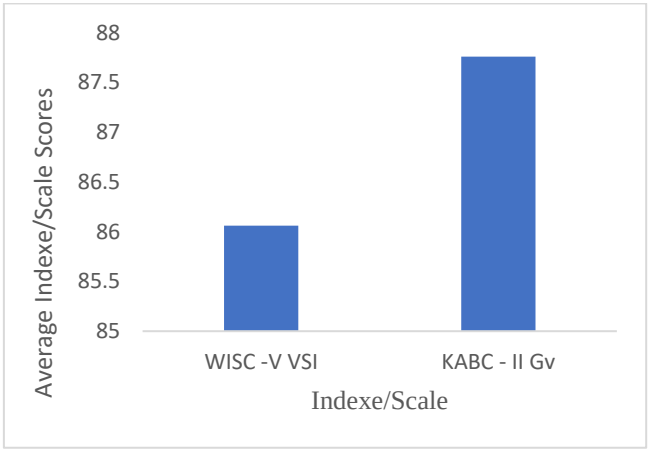


Figure 9. Index/scale scores of learners on the WISC-V (VSI) and KABC-II (Gv).

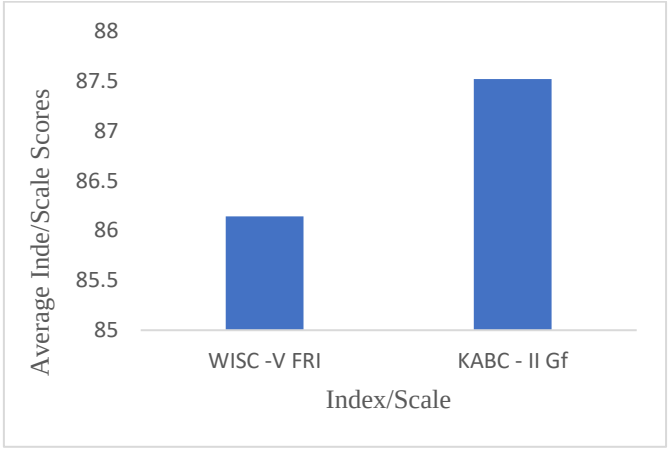


Figure10. Index/scale scores of learners on the WISC-V (FRI) and KABC-II (Gf).

Learners scored significantly higher on the KABC-II Knowledge Scale than on the WISC-V Verbal Comprehension Index and much of the research on establishing the cultural fairness and applicability of the K-ABC/KABC-II found it an appropriate measure to use in a cross-cultural context (Greenop et al., 2013). De Sousa et al. (2010) conducted a comparitive study regarding linguistic and cultural applicability to assess the performance of mono- and bi-lingual children on the K-ABC Simultaneous and Sequential Processing scales. They found the K-ABC to be culturally and linguitically appropriate (De Sousa et al., 2010). However, a recent study by Seedat (2019) found the KABC-II Knowledge Scale to contain specific items of linguistic bias and items that were challenging for both EFL and EAL South African children.This indicates the need for test adaptations in diverse settings prior to use. A study by Malda, van de Vijer, Srinivasa, Transler, and Sukum (2010) (that assessed the validity of the KABC-II adaption in India) and Bangirana et al.'s (2009) Ugandan study (that examined the construct validity of the KABC-II) both suggested that prior to using the KABC-II in culturally diverse settings, adequate quantitative and qualitative adaptations need to occur.

5.4 Conclusion

This study found that three of the four WISC-V indexes correlated with their corresponding scales on the KABC-II. The exception was the WMI and Gsm. The WMI correlated more closely with the Gc scale, which suggests a higher demand for verbal input. The mean score differences showed higher mean scores on the KABC-II scales when compared to similar indexes on the WISC-V. The inclusion and/or exclusion of specific subtests to measure narrow abilities that contribute to the overall index/scale score can thus significantly influence overall scores that estimate the learners' broader abilities (as was seen with the inclusion of the Digit Span Backward and Colour Interference subtests). Although

developers recommend the inclusion of a wider range of narrow abilities to produce more accurate scores that reflect underlying constructs, care must be taken not to include conflicting narrow abilities that measure constructs that do not relate to the broader abilities and that may skew results. This research suggested that the inclusion of the narrow abilities such as Digit Span Backward and language-heavy subtests may be factors that lead to reduced correlation and significant mean score differences. The findings of this study coupled with other stratified studies (Mandy, 1998; Skuy et al., 2000) indicated that practitioners may not use the WISC-V and KABC-II interchangeably within the South Africa context for a referred student population with academic problems. Furthermore, appropriate measures should be taken when administering the KABC-II in diverse settings. Although research suggests that the K-ABC/KABC-II is a more appropriate measure to use in linguistically and culturally diverse settings, the studies by De Sousa, Greenkop, and Fry (2010) and Seedat (2019) showed score differences between EFL and EAL learners on specific items that contain language biases which suggests that these assessment measures require adaptations prior to use. Recommendations for adaptation and use are explored in the Chapter 6.

Chapter 6 Summary, Recommendations and Limitations

6.1 Introduction

In light of the important role that psychological assessments and, more specifically, intelligence tests can play in the future of the South African education system, this study examined the construct and concurrent validity of two internationally developed assessment measures that are commonly used in the South African context, despite the absence of local normative data and standardisation efforts.

Construct validity examines the nature of the relationship between individual indexes/scales. The *r*-value is an estimate of variance in the measure, which reflects variance in the underlying construct. Test developers have done extensive research on the theories that relate to intelligence and the measurement of IQ. This enabled the design of detailed test structures in which subtests measure narrow abilities that are combined to reflect broad abilities and overall IQ. The WISC-V and KABC-II are premised on CHC theory: they comprise subtests that measure narrow abilities and combine to reflect an estimate of a candidate's broad ability.

The Pearson correlations computed in this study evidenced strong positive relationships between the WISC-V indexes and KABC-II scales that are theoretically similar and measure similar underlying constructs. These strong correlations led to the hypothesis for this study: based on theory and the structure of these indexes/scales, they should produce similar scores when administered to the same learner. A paired samples t-test was used to test these hypotheses. The statistical analysis reflected score differences for all four comparative analyses: with two of the four being statistically significant. An analysis of the subtests that delivered scores that were significantly different revealed the contributing factors to be the

inclusion of the Digit Span Backward subtest (on the WISC-V); crystallised intelligence; vocabulary; and a significant reliance on verbal input.

The choice of assessment measure has far-reaching implications not only in the education sphere but also for individual learners in the South African context. A statistically significant score difference could result in, among others, improper treatment plans; incorrect identification of patterns of strength and weakness; incorrect diagnosis and placement; poor curricular planning; and ineffective interventions. It is therefore essential to utilise measures that are culturally and linguistically equitable in order to obtain reliable, valid, and meaningful assessment results. The findings of this study bring to light the importance of this and the responsibility of practitioners to thoroughly understand and assess the assessments that are selected for use in a diverse context such as South Africa.

The concluding chapter of this study reflects on the strengths and limitations of this research. This chapter also presents recommendations both for future studies and for practitioners.

6.2 Strengths of the Research

As highlighted in Chapter 2, the literature available on the WISC-V and KABC-II, both locally and internationally, is limited. This research aimed to highlight the gaps in the literature. This study focused on construct and concurrent validity and its importance in the assessment selection process and assessed the utility of the WISC-V and KABC-II in the South African context. The available literature brought to light the importance of ethical test selection in the South African context and the impact of test scores on academic success (as stated above).

The research was premised on test awareness and the importance of understanding test structures, theory, and different forms of validity. As reflected in the finding of this study, although the construct validity was high, calculating the concurrent validity revealed significant score differences. A significant index/scale score difference can have an overall effect on FSIQ and FCI. A learner may score within the average range on one measure, but low or below average on another: where these results are one of the determining factors in terms of school placement in South Africa, this would have long-term repercussions for the learner.

This study identified a strong positive relationship between the WMI and Gc, which emphasised the role of acquired knowledge, crystallised intelligence, and language and its effect on overall scores. An enquiry into the influence of language during the assessment process (using studies carried out on black and white children on the WISC-R and K-ABC) suggested that the KABC-II is culturally and linguistically more appropriate (Skuy et al., 2000). The study by Seedat (2019) found, however, that in the South African context the KABC-II knowledge scale does contain language biases for specific items. This then raises the question, “What types of adaptation are necessary, prior to using these measures in the South African context?”

The findings of this study identified opportunities for other research in this field. These include: factor analytic studies with larger samples to explore validity; stratified research to explore the influence of language, quality of education, socio-economic status, and gender differences; and more research to explore the performance of learners on specific indexes/scales in the South African context.

6.3 Limitations

This study faced limitations in each research phase: from data collection to interpretation. These challenges may have had a direct or indirect impact on the results of the study and must therefore be highlighted.

Firstly, the initial sampling criteria specified the selection of learners from a peri-urban government school. This would have been more reflective of the broader South African population. However, challenges in terms of access to government schools, time constraints, and parent/guardian consent resulted in many delays. The sampling and data collection processes were revised to accommodate the researcher's time constraints.

Secondly, the sample size of this study was small (n = 50). A larger sample would allow for confirmation of the validity of the research results and more generalisability to the broader population. Selecting a sample from a private remedial school in the South of Johannesburg allowed for a level of control of external factors, but this selection was also exclusionary. Only a specific population group was represented in this study. The sample thus lacked in overall representation of the broader South African population.

Thirdly, the literature used (to position this study, understand the varied score discrepancies, and substantiate the accuracy of the current results) was mostly on previous versions of current tests, was outdated, and/or was applicable to foreign populations. The literature discussed underlying test structures and population characteristics that differ from those in the current study sample. Therefore, the rationale supporting the results may not be similar for all samples. Nevertheless, the literature offered a foundation in understanding the underlying test structures, which provided a base for understanding the relationships between the variables under study.

Finally, the comparison looked exclusively at indexes/scales. The exclusion of the FSIQ and FCI somewhat limited the overall utility, predictability, and interchangeability of the diagnostics.

6.4 Recommendations for Future Studies

On completion of this study, various recommendations for future studies can be made. First, a comparative analysis between the WISC-V WMI – adapted to exclude the Digit Span Backwards subtest – and the KABC-II Gsm scale.

Future studies that employ larger representative samples and investigate the KABC-II and WISC-V's psychometric properties are recommended (as this study only examined the construct and concurrent validity on a sample of n = 50). Furthermore, a comparison between the FCI and FSIQ scores may prove beneficial to understanding how the instruments differ and whether the overall score may or may not be used interchangeably for diagnostic or other purposes.

Factor analytic studies coupled with broader index/scale analysis and full-scale comparisons specific to the South African context would allow in-depth understanding of the theoretical structures of, and score discrepancies between, intelligence tests.

Comparative analysis between the WISC-V, KABC-II, SSAIS-R and other widely used, popular assessment measures in the South African context would allow practitioners to select more appropriate and culturally fair assessment measures.

6.5 Recommendations for Practitioners

Prior to administration, practitioners should scrutinise the subtests, as this would allow the identification of specific items that are biased – as reflected in the findings of Seedat's (2019) study. Based on such analysis, practitioners may then omit items that reflect biases – as recommended *by* Bangirana et al. (2009)*: the* omission of culturally inappropriate items did not negatively affect subtests in their Ugandan study.

To reduce the effect of language and crystallised intelligence (as identified in the findings of this research), the translation and back-translation of instructions and relevant, culturally sensitive modifications to the standardised test would allow for some limitations to be overcome – as noted by Bangirana et al. (2009).

It can also be recommended that practitioners employ the cross-battery approach in their selection of assessment measures. Rather than focusing on a single score, a variety of assessment measures/tests/indexes/subtests/ can be utilised to assess specific functions. This can then produce a holistic picture of the learner through the utilisation of appropriate measures.

The use of observation schedules and checklists during test administration can facilitate the capture of qualitative data during the assessment process, which can be used to supplement and/or explain specific scores and permit a more individualistic approach to the assessment process.

Practitioners should familiarise themselves with the standardised assessment and administration procedure. Practitioners must invest in continuous personal upskilling in terms of test administration proficiency and learner engagement on different tasks. A knowledge

and application of standardised administration procedures and scoring are essential to the objectivity and validity of the results (Ellingsen, 2016).

References

Babbie, E., & Mouton, J. (2014). *The practice of social research*; South African edition. Cape Town: Oxford.

Bangirana, P., Seggane-Musisi, P., Allebeck, P., Giordani, B., Chandy, C. J., Opoka, O. R., ... & Boivin, M. J. (2009). A preliminary examination of the construct validity of the KABC-II in Ugandan children with a history of cerebral malaria. *African health sciences*, 9(3).

Boake, C. (2002). From the Binet–Simon to the Wechsler–Bellevue: Tracing the history of intelligence testing. *Journal of Clinical and Experimental Neuropsychology*, 24(3), 383-405.

Canivez, G. L., Watkins, M. W., & McGill, R. J. (2019). Construct validity of the Wechsler Intelligence Scale for Children–Fifth UK Edition: Exploratory and confirmatory factor analyses of the 16 primary and secondary subtests. *British Journal of Educational Psychology*, 89(2), 195-224.

Clarizio, H. F., & Bennett, D. E. (1987). Diagnostic utility of the K-ABC and WISC-R/PIAT in determining severe discrepancy. *Psychology in the Schools*, 24(4), 309-315.

Clauss – Ehlers, C.S. (Ed.). (2010). *Encyclopedia of cross – cultural school psychology*. Springer Science & Business Media.

Cockroft, K. (2013). The Senior South African Individual Scales – Revised: a review in S. Laher & K. Cockcroft (Eds.), *Psychological assessment in South Africa: Research and applications* (pp. 48-57). Johannesburg, South Africa: WITS University Press

Comier, D.C., Kennedy, K.E., & Aquilina, A.M. (2016). Test Review. *Canadian Journal of School Psychology 31*(4) 322–334

Das, J.P., Naglieri, J.A., & Kirby, J.R. (1994). *Assessment of Cognitive Processes*: The PASS Theory of Intelligence. Boston, MA: Allyn and Bacon.

De Renzi, E., & Nichelli, P. (1975). Verbal and non-verbal short-term memory impairment following hemispheric damage. *Cortex,* 11(4), 341-354.

De Sousa, D., Greenkop, K. & Fry., J (2010). Simultaneous and sequential cognitive processing in monolingual and bilingual children in South Africa. *South African Journal of Psychology*, 40(2), 165-173

Department of Education. (2001). Education White Paper 6 Special Needs Education. Building on inclusive education and training system. Pretoria, South Africa: Department of Education.

Donald, F., Thatcher, A., & Milner, K. (2014). Psychological assessment for redress in South African organisations: is it just? South African Journal of Psychology, 44(3), 333-349.

Ellingsen, K. M. (2016). Standardized assessment of cognitive development: Instruments and issues. In A. Garro (Ed.). *Early childhood assessment in school and clinical child psychology* (p. 25–49). Springer Science + Business Media. https://doi.org/10.1007/978-1-4939-6349-2_2

Employment Equity Act (Act 55 of 1998),Retrieved from https://www.gov.za/documents/employment-equity-act

Field, A. (2013). *Discovering statistics using IBM SPSS statistics (*4th Ed). London: Sage.

Fiorello, F.A., Hale, J.B., Holdnack, J.A., Kavanagh, J.A., Terrell, J., & Long, L. (2007). Interpreting Intelligence Test Results for Children with Disabilities: Is Global Intelligence Relevant? *Applied Neuropsychology*, 14(1), 2-12.

Flanagan, D.P., & Dixon, S.G. (2014). The Cattell-Horn-Carroll theory of cognitive abilities. In C.R. Reynolds, K.J. Van nest, & E. Fletcher-Janzen (Eds.), *The Encyclopedia of Special Education*. John Wiley & Sons Online Library. doi: 10.1002/9781118660584.ese0431

Flanagan, D. P., Alfonso, V. C., & Ortiz, S. O. (2012). The cross-battery assessment approach: An overview, historical perspective, and current directions. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (p. 459–483). The Guilford Press.

Flanagan, D. P., McGrew, K. S., & Ortiz, S. O. (2000). *The Wechsler intelligence scales and CHC theory: A contemporary approach to interpretation*. Boston, MA: Allyn & Bacon

Flanagan, D. P., Ortiz, S. O., & Alfonso, V. C. (2013). Essentials of cross-battery assessment (Vol. 84). John Wiley & Sons.

Foxcroft, C.D., & Davies, C. (2008). Historical perspectives of psychometric testing in South Africa. In C. Van Ommen & D. Painter, Interiors: *A history of psychology in Southern Africa* (pp. 148-178). Pretoria, South Africa: UNISA Press.

Foxcroft, C. & Roodt, G. (2013). Introduction to psychological assessment in the South African context (4thed). Cape Town, South Africa: Oxford University Press

Foxcroft, C. D. (2011). Ethical issues related to psychological testing in Africa: What I have learned (so far). *Online readings in psychology and culture*, 2(2), 7.

Foxcroft, C., Paterson, H., Le Roux, N., &Herbst, D. (2004). Psychological assessment in South Africa: A needs analysis. The test use patterns and needs of psychological assessment practitioners. *Human Sciences Research Council*.

Greenop, K., Rice, J., & de Sousa, D. (2013). The Kaufman Assessment Battery in South Africa in S. Laher & K. Cockcroft (Eds.), *Psychological assessment in South Africa: Research and applications* (pp. 86-103). Johannesburg, South Africa: WITS University Press

Gregory, R. J. (2004). *Psychological testing: History, principles and applications* (3rd ed.). Boston: Allyn and Bacon

Health Professions Amendment Act 29, 1997. (1997). Retrieved from https://www.hpcsa.co.za/?contentId=0&menuSubId=52&actionName=Professional%20Boards

Heller, K.A., & Schofield, N.J. (2008). Identification and Nurturing the Gifted from an International Perspective. In S.I. Pfeiffer (Ed), *Handbook of Giftedness in Children: Psychoeducational Theory, Research, and Best Practices* (pp. 93-114). New York, NY: Springer Science+Business Media, LLC.

Huang, L.V., Bardos, A.N., D'Amato, R.C. (2010). Identifying students with learning disabilities: Composite profile analysis using the Cognitive Assessment System. *Journal of Psychoeducational Assessment*, 28(1), 19-30.

Jang, E. E., Cummins, J., Wagner, M., Stille, S., & Dunlop, M. (2015). Investigating the homogeneity and distinguishability of STEP proficiency descriptors in assessing English language learners in Ontario schools. *Language Assessment Quarterly*, 12(1), 87-109.

Jansen, P., & Greenop, K. (2008). Factor analyses of the Kaufman Assessment Battery for Children assessed longitudinally at 5 and 10 years. *South African Journal of Psychology*, 38(2), 355-365.

Kanjee, A. (2013). Large-scale assessment studies in South Africa: trends in reporting results to schools. In S. Laher& K. Cockcroft (Eds.), *Psychological assessment in South Africa: Research and applications* (pp. 516-531). Johannesburg, South Africa: WITS University Press

Kaufman, A.S., & Kaufman, N.L. (2004). *KABC-II: Kaufman Assessment Battery for Children, Second Edition*. San Antonio, TX: Pearson Clinical Assessment.

Kaufman, A.S., Lichtenberger, E.O., Fletcher-Janzen, E., & Kaufman, N.L. (2005). Essentials of KABC-II Assessment. New Jersey, NJ: John Wiley & Sons, Inc

Kaufman, A. S. (2009). *IQ testing 101*. New York: Springer Publishing.

Kaufman, J. C., Kaufman, S. B., & Plucker, J. A. (2013). *Contemporary theories of intelligence. Oxford Handbook of Cognitive Psychology*, Oxford University Press, Oxford.

Kaufman, A. S., Raiford, S. E., & Coalson, D. L. (2016). *Intelligent testing with the WISC-V.* Hoboken, New Jersey: John Wiley

Laher, S. & Cockroft, K. (2013). Current and future trends in psychological; assessment in South Africa: Challenges and opportunities. In S. Laher & K. Cockcroft (Eds.), *Psychological assessment in South Africa: Research and applications* (pp.535-552). Johannesburg, South Africa: WITS University Press

Laher, S., & Cockcroft, K. (2017). Moving from culturally biased to culturally responsive assessment practices in low-resource, multicultural settings. *Professional Psychology: Research and Practice*, 48(2), 115.

Laher, S., & Cockcroft, K. (2014). Psychological assessment in post-apartheid South Africa: The way forward. *South African Journal of Psychology*, 44(3), 303-314.

Lane, D. M., Scott, D., Hebl, M., Guerra, R., Osherson, D., & Zimmer, H. (2017). Introduction to statistics, online edition.

Lapan, S. D., & Quartaroli, M. T. (2009). *Research essentials: An introduction to designs and practices*. San Francisco, CA: Jossey-Bass.

Lichtenberger & Kaufman, 2010); Kaufman Assessment Battery for Children Second Edition (KABC-II). In C. S. Clauss-Ehlers (Ed.), *Encyclopedia of Cross-Cultural School Psychology,* Springer Science+Business Media LLC 2010. DOI 10.1007/978-0-387-71799-9,

Malda, M., van de Vijver, F. J., Srinivasan, K., Transler, C., & Sukumar, P. (2010). Traveling with cognitive tests: testing the validity of a KABC-II adaptation in India. *Assessment,* 17(1), 107-115.

McGill, R. J. (2015). Interpretation of KABC – II scores: An evaluation of the incremental validity of Cattell – Horn – Carroll (CHC) factor scores in predicting achievement. *Psychological assessment,* 27(4),1417.

McGrew, K. S. (1997). Analysis of the major intelligence batteries according to a proposed comprehensive Gf-Gc framework. In D. P. Flanagan, J. L. Genshaft, & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues*. New York, NY: Guilford Press.

McGrew, K. S., & Flanagan, D. P. (1998). *The Intelligence Test Desk Reference (ITDR): Gf-Gc cross battery assessment*. Boston, MA: Allyn & Bacon.

McGrew, K. S. (2005). The Cattell-Horn-Carroll theory of cognitive abilities: Past, present, and future. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (2nd ed., pp. 136–182). New York, NY: Guilford Press

McKown, D.M. (2010). A Comparison Study: Kaufman Battery for Children, Second Edition (KABC-II) and Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) with Referred Students (*Master's Thesis*). Retrieved from Marshall University Electronic Thesis and Dissertations.

Merrell, K. W., Ervin, R. A. & Gimpel, G.A. (2006). *Psychology for the 21st Century: foundations and practices*. New York: The Guildford Press

Mitchell, J. M., Tomlinson, M., Bland, R. M., Houle, B., Stein, A., & Rochat, T. J. (2018). Confirmatory factor analysis of the Kaufman assessment battery in a sample of

primary school-aged children in rural South Africa. *South African Journal of Psychology*, 48(4), 434-452.

Naglieri, J.A., & Das, J.P. (2005). Planning, Attention, Simultaneous, Successive (PASS) Theory: A revision of the concept of intelligence. In D.P. Flanagan & P.L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (2nd ed.). New York, NY: Guilford Press

Naglieri, J. A. (1984). Concurrent and predictive validity of the Kaufman Assessment Battery for Children with a Navajo sample. *Journal of School Psychology*, 22(4), 373-379.

Naglieri, J. A., & Haddad, F. A. (1984). Learning disabled children's performance on the Kaufman Assessment Battery for Children: A concurrent validity study. *Journal of Psychoeducational Assessment*, 2(1), 49-56

Nzimande, B. (1995). To test or not to test. In Congress of psychometrics for Psychologists and Personnel Practitioners.

O'Malley, P. (2016). The Reconstruction and Development Plan (RDP). Retrieved from https://www.nelsonmandela.org/omalley/index.php/site/q/03lv02039/04lv02103/05lv02120/06lv02126.htm

Oakland, T., Douglas, S., & Kane, H. (2016). Top Ten Standardized Tests Used Internationally with Children and Youth by School Psychologists in 64 Countries: A 24-Year Follow-Up Study. J*ournal of Psychoeducational Assessment*, 34(2), 166-176.

Oliver, N. R. (2010). The Relationship between the WISC-IV GAI and the KABC-II. (*Master's Theses*), Retrieved from Marshall University Electronic Thesis and Dissertations.

Ortiz, S. O. (2015). CHC theory of intelligence. *In Handbook of intelligence* (pp. 209-227). Springer, New York, NY.

Ostrosky-Solís, F., & Lozano, A. (2006). Digit span: Effect of education and culture. *International Journal of Psychology*, 41(5), 333-341.

Poletti, M. (2014). WISC-IV Intellectual profiles in Italian children with Specific Learning Disorder and related impairments in reading, written expression, and mathematics. *Journal of Learning Disabilities,* 1-16. doi: 10.1177/0022219414555416

Princiotta, D., & Goldstein, S. (2015). AR Luria and intelligence defined as a neuropsychological construct. In Goldstein, S., Princiotta, D., & Naglieri, J. A. (Eds.), *Handbook of Intelligence: Evolutionary Theory, Historical Perspective, and Current Concept* (pp. 181-192). Springer, New York, NY.

Ramsay, M. C., & Reynolds, C. R. (1995). Separate digits tests: A brief history, a literature review, and a re-examination of the factor structure of the Test of Memory and Learning (TOMAL). *Neuropsychology review*, 5(3), 151-171.

Reynolds, C. R. (1997). Forward and backward memory span should not be combined for clinical analysis. *Archives of Clinical Neuropsychology*, 12(1), 29-40.

Schneider, J., & McGrew, K. (2012). The Cattell-Horn-Carroll (CHC) model of intelligence v2. 2: a visual tour and summary. *Institute for Applied Psychometrics* (IAP), 1, 03-13.

Seedat, Z. (2019). Comparing the performance of English First Language and English Additional Language Children on the Kaufman Assessment Battery for Children (2nd Edition) Knowledge Scale, *(Unpublished dissertation).*

Shuttleworth-Edwards, A. B. (2016). Generally representative is representative of none: commentary on the pitfalls of IQ test standardization in multicultural settings. *The Clinical Neuropsychologist*, 30(7), 975-998.

Shuttleworth-Edwards, A.B., Van der Merwe, A.S., Van Tonder, P., &Radloff, S.E. (2013). WISC-IV test performance in the South African context: A collation of cross-cultural norms. In S. Laher & K. Cockcroft (Eds.), *Psychological assessment in South Africa: Research and applications* (pp. 33-47). Johannesburg, South Africa: WITS University Press

Simon, M. K., & Goes, J. (2011). Correlational research. Includes excerpts from Simon. Available in: http://dissertationrecipes. com/wp-content/uploads/2011/04/Correlational-ResearchX. Pd

Skuy, M., Taylor, M., O'Carroll, S., Fridjhon, P., & Rosenthal, L. (2000). Performance of black and white South African children on the Wechsler Intelligence Scale for Children—revised and the Kaufman Assessment Battery. *Psychological Reports*, 86(3), 727-737.

Smith, D. K., Lyon, M. A., Hunter, E., & Boyd, R. (1988). Relationship between the K-ABC and WISC-R for students referred for severe learning disabilities. Journal of learning disabilities, 21(8), 509-513..

Sotelo-Dynega, M., & Dixon, S. G. (2014). Cognitive assessment practices: A survey of school psychologists. *Psychology in the Schools*, 51(10), 1031-1045.

Sternberg, R. J. (2003). *Wisdom, intelligence, and creativity synthesized*. Cambridge University Press

Sternberg, R. J. (2004). Culture and intelligence. *American psychologist*, 59(5), 325.

Taylor, M. (1998). Comparison of the Kaufman Assessment Battery and the Wechsler Intelligence Scales for learning-disabled black and white children (*Unpublished dissertation*).

Taylor, N. (2016). Generally representative is generally representative: Comment on Shuttleworth-Edwards. *The Clinical Neuropsychologist,* 30(7), 1017-1022.

Theron, L. C. (2013). Assessing school readiness using the Junior South African Individual Scales: a pathway to resilience. In S. Laher& K. Cockcroft (Eds.), *Psychological assessment in South Africa: Research and applications* (pp. 60-72). Johannesburg, South Africa: WITS University Press

Van de Vijver, F. J. R., & Tanzer, N. K. (1997). Bias and equivalence in cross-cultural assessment: An overview. *European Review of Applied Psychology*, 47, 263-279.

Van Voorhis, Wilson, C.R, & Morgan, B. L. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in quantitative methods for psychology*, 3(2), 43-50.

Wechsler, D. (2003). *WISC-IV: Wechsler Intelligence Scale for Children – Fourth Edition*. San Antonio, TX: Psychological Corporation.

Wechsler, D. (2014). *WISC-V: Wechsler Intelligence Scale for Children – Fifth Edition, Technical and Interpretive Manual.* Bloomington, MN: Pearson Clinical Assessment.

Wechsler, D. (2014). *WISC-V: Wechsler Intelligence Scale for Children – Fifth Edition, Administration and Scoring Manual.* Bloomington, MN: Pearson Clinical Assessment.

Westen, D., & Rosenthal, R. (2003). Quantifying construct validity: two simple measures. *Journal of personality and social psychology*, 84(3), 608.

WISC-V Efficacy Research Report, (2018). Retrieved from https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/efficacy-and-research/reports/efficacy-assessment-reports/WISC-V-research-report.pdf

Appendix A

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/48 Vorster

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H16/02/37**
PROJECT TITLE	The utility of the WISC-V and KABC-II in identifying South African children with specific learning difficulties realted to reading and written express
INVESTIGATOR(S)	Mrs A Vorster
SCHOOL/DEPARTMENT	Human and Community Development
DATE CONSIDERED	19 February 2016
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	17 November 2019

DATE 18 November 2016 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Dr Z Amod

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Figure A1. Ethical clearance certificate for the broader research project.

Appendix B

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Cassoojee

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H19/05/02**
PROJECT TITLE	A comparative analysis of test performance of South African learners on subtests of the Wechsler intelligence scale for children, fifth edition (WISC-V) and the Kaufman Assessment Battery for children, second edition (KABC-II)
INVESTIGATOR(S)	Miss Z Cassoojee
SCHOOL/DEPARTMENT	Human and Community Development/
DATE CONSIDERED	24 May 2019
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	06 October 2022

DATE 07 October 2019 **CHAIRPERSON** (Professor J Knight)

cc: Supervisor : Ms A Vorster

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Figure B1. Ethical Clearance Certificate for the Current Research Project.

Appendix C

Principal Information Letter (Broader Study)

Dear Sir/Madam

Good Day. My name is Adri Vorster and I am conducting research for the purpose of completing my PhD. The focus of my research study is on the usefulness of two cognitive assessment measures (intelligence tests) in the identification of South African children with specific learning difficulties. These include the Wechsler Intelligence Scale for Children – Fifth Edition (WISC-V) and the Kaufman Assessment Battery for Children – Second Edition (KABC-II).

In order to conduct my research I will need two groups of participants from various remedial and mainstream private schools in Johannesburg. Taking this into consideration, I would like to invite your school to partake in my research.

Participation in this research will require the administration of the above mentioned assessments with each of the participants. In addition, teachers will be asked to complete the Working Memory Rating Scale for each of the children who will be assessed. If any child has been assessed on the WISC-V and the KABC-II in the past 18 months, the specific assessment will not be repeated. In these instances, permission will be obtained from you, as well as the child's parents/legal guardians, to access these results for the purpose of the study. Each of the assessment measures takes between 35 – 100 minutes to administer and will thus be conducted with each of the participants on separate days. These assessments will be conducted at a time that will not negatively impact on the participants' or the schools' academic or related activities. The assessments will be administered by either registered educational psychologists, or registered educational intern psychologists who have been specifically trained in the administration of these measures and will work under the supervision of a registered psychologist. As far as the rating scale is concerned, teachers will be asked to complete this at a time convenient for them. It should take between 5-10 minutes to complete.

In addition to the administration of the intelligence tests and the teacher's rating scale, all parents/legal guardians will also be asked to complete a parent questionnaire, which includes questions that will assist me in appropriately describing the sample (group of participants). Further, consent will be obtained from you and the parents/legal guardians to access the participants' school records. However, it is important to note that all information of the participants and the school will be treated as confidential. Although anonymity cannot be ensured in the collection of data as the participants will be assessed individually, no particulars that can identify the school or any of the participants will be included in the final research thesis or any publications/presentations that might arise from it. Only my supervisor and I will have access to the raw data/assessment results and it will not be disclosed to anyone without the written and informed consent of the parents/legal guardians.

It should be noted that both of the intelligence tests have the potential to identify specific cognitive strengths and weaknesses in children, which can influence their scholastic progress

and point towards a potential learning difficulty. Parents/legal guardians will be advised of this and feedback will be offered to all parents/legal guardians at a time convenient for them. In addition, parents/legal guardians will be told that should any concerns regarding their children's cognitive functioning arise, they will be informed accordingly. Further, with the written consent of the parents/legal guardians, feedback will be provided in collaboration with the School Learner Support Specialist/s so that, where necessary, children can be supported academically within their educational environments.

Participation in this study is completely voluntary and there are no foreseeable risks or benefits for partaking in it; other than the parents/legal guardians having access to their children's assessment results for the purpose of supporting them academically. Also, the research does not expose any of the participants or schools to any harm. All participants and schools have the right to withdraw from the study at any time; without any consequence. Participants also do not have to answer any questions that they do not feel comfortable with.

Once data collection is completed, all raw data will be transformed into digital format with all identifying particulars removed. This digital data will be stored on a password protected file on a password protected computer. The raw data will be stored in a locked cupboard at the University of the Witwatersrand. In digital format, the participants' assessment results, personal and biographical information will be linked by means of codes. In this manner anonymity of the schools and the participants in the final thesis and other potential publications/presentations, can be ensured.

The results of the study will be compiled into a thesis, which will be stored in the University of the Witwatersrand main library, and made available online on the WITS Institutional Repository environment on WIReDSpace, where an electronic copy of all research reports, dissertations and theses are kept. Results of the study might also be published in the form of peer reviewed journal articles and/or book chapters. Likewise it might be presented at conferences. The school will also be provided with an executive summary of the research results.

Should you consent for your school to partake in this study, please indicate this in writing. Should you have any questions or concerns with regards to this research study, please contact me directly.

Thank you

Adri Vorster	Dr. Zaytoon Amod
Researcher: Educational Psychologist	Research Supervisor: Educational & Clinical Psychologist
011 717 4554	011 717 8326
adri.vorster@wits.ac.za	zaytoon.amod@wits.ac.za

Appendix D

Parent/ Legal Guardian Information Letter (Broader Study)

Dear Sir/Madam

My name is Adri Vorster and I am conducting research for the purpose of completing my PhD. The focus of my research study is on the usefulness of two cognitive assessment measures (intelligence tests) in the identification of South African children with specific learning difficulties. The two assessment measures include the Wechsler Intelligence Scale for Children – Fifth Edition (WISC-V) and the Kaufman Assessment Battery for Children – Second Edition (KABC-II). In order to conduct my research I will need two groups of participants from various remedial and mainstream schools in Johannesburg. Taking this into consideration, I would like to invite your child/ward to partake in my research.

Should you give consent for your child/ward to participate in this study, he/she will be assessed on both these tests. However, if your child/ward has been assessed on either of these assessments in the past 18 months, the specific assessment will not be repeated. In these instances, permission will be obtained from you, as well as the school, to access these results for the purpose of the study. Each of the assessment measures takes between 35 – 100 minutes to administer and will thus be conducted with each of the children on separate days. These assessments will be done at a time that will not negatively impact on the children's or the schools' academic or related activities. The assessments will be administered by a registered educational psychologist or alternatively a registered educational intern/student psychologist who have been specifically trained in the administration of these measures and will work under the supervision of a registered psychologist.

In addition to the administration of the intelligence tests, you will also be asked to complete a parent questionnaire, which includes questions that will assist me in appropriately describing the group of children who participate in the study. This questionnaire includes a variety of questions related to the children. It also probes whether your child/ward has ever been diagnosed with any difficulties that can impact his/her performance on these assessment measures.

Further, with your consent, I will access your child's school records, report cards and previous assessment results. However, it is important to note that all information of the children and the school will be treated as confidential. Although I cannot keep your child's/ward's information anonymous in the collection of the data as the assessments will be done individually with each child/ward, no information that can identify your child/ward or the school will be included in the final research thesis or any publications/presentations that might arise from it. Only my supervisor and I will have access to the raw data/assessment results and it will not be disclosed to anyone without your written and informed consent as the parent/legal guardian. This also means that an individual child's results will not be disclosed to the school without the written concerns of the parent/legal guardian.

Both intelligence tests have the potential to identify your child's/ward's cognitive strengths and weaknesses, which can influence his/her progress at school and point towards a potential learning difficulty. Taking this into consideration, feedback will be offered on your child's results. This can be done in two ways; you can either contact me directly to obtain feedback on your child's/ward's results. Alternatively, should I be concerned about your child's/ward's functioning at the end of the assessment and feel that difficulties were noted which can potentially impact his/her academic functioning, I will contact you to discuss these in more detail. Participation in this study is completely voluntary and it is your choice whether your child/ward will participate or not. I do not foresee that you, your child/ward or the school will be subjected to any risks whilst involved in this study. The only benefit is the fact that you will have access to your child's/ward's assessment results and that he/she can be supported scholastically were needed based on these results. All parents, children and schools have the right to withdraw from the study at any time; without any consequence. Children/wards and parents/legal guardians also do not have to answer any questions that they do not feel comfortable with.

Once data collection is completed, I will transfer all raw data into digital format to be stored on a password protected computer. In this format, any information that can identify you, your child/ward or the school will be removed. The raw assessment results in paper format will be stored in a locked cupboard at the University of the Witwatersrand. In digital format, the children's assessment results, personal and biographical information will be linked by means of codes. In this manner anonymity of the schools and the children in the final thesis and other potential publications/presentations, can be ensured. The results of the study will be compiled into a thesis, which will be stored in the University of the Witwatersrand main library, and made available online on the WITS Institutional Repository environment on WIReDSpace, where an electronic copy of all research reports, dissertations and theses are kept. Results of the study might also be published in the form of peer reviewed journal articles and/or book chapters. Likewise it might be presented at conferences. The school will also be provided with an executive summary of the research results. However, no individual children will be identified in this summary.Should you consent for your child/ward to be approached to partake in this research, please read and sign the attached consent form. Also, please complete the attached parent questionnaire as honestly and comprehensively as possible. Should you have any questions or concerns with regards to this research study, please contact me directly.

Please detach and keep these sheets

Thank you

Adri Vorster	Dr. Zaytoon Amod
Researcher: Educational Psychologist	Research Supervisor: Educational & Clinical Psychologist
011 717 4554	011 717 8326
adri.vorster@wits.ac.za	zaytoon.amod@wits.ac.za

Appendix E

Principal Consent Form (Broader Study)

I, _____, hereby give consent for Adri Vorster to conduct her research on the usefulness of specific cognitive assessment measures in the identification of children with specific learning difficulties in the South African context, at _____ (name of school).

I understand that:

- Participation in this study is completely voluntary and there are no foreseeable risks or benefits for partaking in it; other than the parents/legal guardians having access to their children's assessment results for the purpose of supporting them academically.
- The research does not expose any of the participants or schools to any harm.
- All participants and schools have the right to withdraw from the study at any time; without any consequence.
- Participants do not have to answer any questions that they do not feel comfortable with.
- The school's and participants' information will be treated as confidential.
- Anonymity and confidentiality will be ensured in the final research thesis or any publications/presentations that might arise from this research.
- The results of the study will be compiled into a thesis, which will be stored in the University of the Witwatersrand main library, and made available online on the WITS Institutional Repository environment on WIReDSpace, where an electronic copy of all research reports, dissertations and theses are kept.
- Results of the study might also be published in the form of peer reviewed journal articles and/or book chapters. Likewise it might be presented at conferences.
- The school will be provided with an executive summary of the research results.
- Feedback will be offered to all parents/legal guardians at a time that is convenient for them and they will be informed if any concerns regarding their children's cognitive functioning arise. With the written consent of the parents, this will be done in collaboration with the school's learner support specialist/s so that specific children can be supported within their educational environments.

_____ _____

School Principal's Signature Researcher's Signature

Date

Appendix F

Parent/Legal Guardian Consent Form (Broader Study)

I, _____, parent/legal guardian of _____, currently in Grade ____, hereby give consent for Adri Vorster to include my child/ward in her research on the usefulness of specific cognitive assessment measures in the identification of children with specific learning difficulties in the South African context.

I understand that:

- My child/ward will be assessed on all or some of the following assessment measures; Wechsler Intelligence Scale for Children – Fifth Edition (WISC-V) and the Kaufman Assessment Battery for Children – Second Edition (KABC-II).
- The researcher will access my child's/ward's school records, report cards and previous assessment results.
- I will be asked to complete a parent questionnaire.
- Participation in this study is completely voluntary and there are no foreseeable risks or benefits for partaking in it; other than me having access to my child's/ward's assessment results for the purpose of supporting him/her academically.
- The research does not expose my child/ward or his/her school to any harm.
- My child/ward and his/her school have the right to withdraw from the study at any time; without any consequence. Also, my child/ward does not have to answer any questions that he/she does not feel comfortable with.
- The school's and my child's/ward's information will be treated as confidential. Anonymity and confidentiality will be ensured in the final research thesis or any publications/presentations that might arise from this research.
- The results of the study will be compiled into a thesis, which will be stored in the University of the Witwatersrand main library, and made available online on the WITS Institutional Repository environment on WIReDSpace, where an electronic copy of all research reports, dissertations and theses are kept.
- Results of the study might also be published in the form of peer reviewed journal articles and/or book chapters. Likewise, it might be presented at conferences.
- The school will be provided with an executive summary of the research results.

_____ _____

Parent/Legal Guardian's Signature Researcher's Signature

Date

Appendix G

Participant Assent Form (Broader Study)

Dear Learner

Hello. My name is Adri Vorster and I am a student just like you. As part of my studies, I have to conduct some research, just like you have to do some projects. I would like to ask if you would be willing to help me with my project. If you are willing, one of my helpers or I will do some tasks with you. During our time together, we will do different tasks with you. Sometimes we will ask you to answer questions and sometimes we will ask you to build things or to look at pictures and answer questions about them. We might ask you to remember things for a bit and then to tell us what you remember. Some of the tasks might be easy and some might be more difficult. We only ask that you do your best and answer as many questions as you can. If you really don't want to do anything, you can tell us.

These tasks will be done with you alone and we will probably need at least two days on which to meet with you. On each of these days, you will be busy for about an hour and a half. We will meet you at a time that is convenient for you, your school and your parents. This means that my helpers and I will not ask you to do anything at a time that interferes with your school work or other activities that you might be busy with. You can decide whether you want to be a part of my project or not. Also, if you no longer want to be part of the project, you can also tell us.

Remember that my project is not part of your school work and your teachers, or anyone else in the school, will not see any of your answers. Your parents might ask me to tell them how you did with the different tasks and then I will tell them so that they and your teachers can help you with any of your school work that is a bit difficult. Other than that, no-one but my supervisor, who is my teacher, and I will know how you did with the different tasks.

If you are willing to help my with my project, please fill in your name and sign this letter and one my helpers or myself will contact you soon to do the tasks. These might take more than one day and if you are tired, you can tell us and we will take a break.

Thank you very much

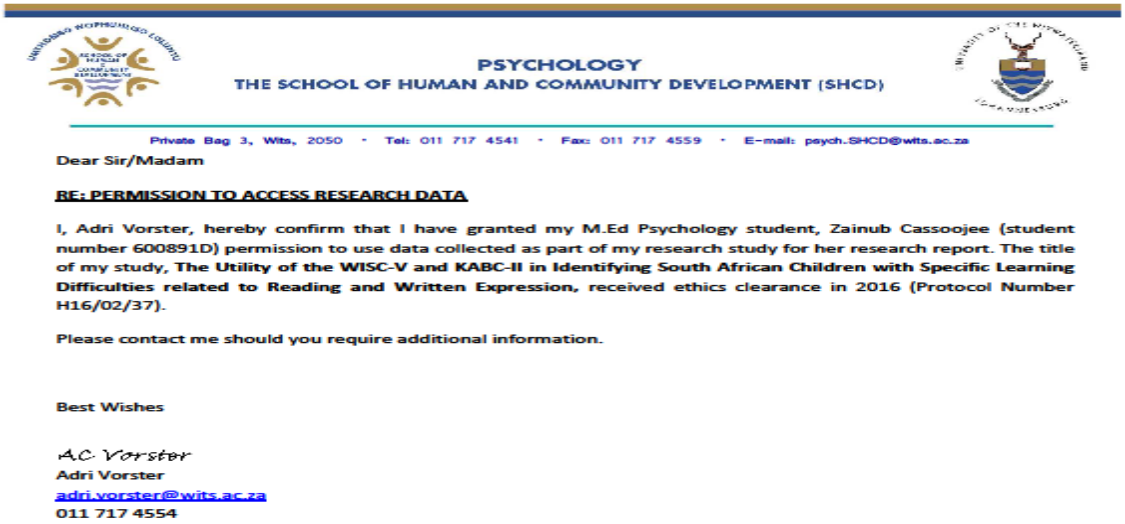
_____ _____

Learner's Name Learner's Signature

_____

Date

Appendix H



PSYCHOLOGY
THE SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT (SHCD)

Private Bag 3, Wits, 2050 · Tel: 011 717 4541 · Fax: 011 717 4559 · E-mail: psych.SHCD@wits.ac.za

Dear Sir/Madam

RE: PERMISSION TO ACCESS RESEARCH DATA

I, Adri Vorster, hereby confirm that I have granted my M.Ed Psychology student, Zainub Cassoojee (student number 600891D) permission to use data collected as part of my research study for her research report. The title of my study, **The Utility of the WISC-V and KABC-II in Identifying South African Children with Specific Learning Difficulties related to Reading and Written Expression**, received ethics clearance in 2016 (Protocol Number H16/02/37).

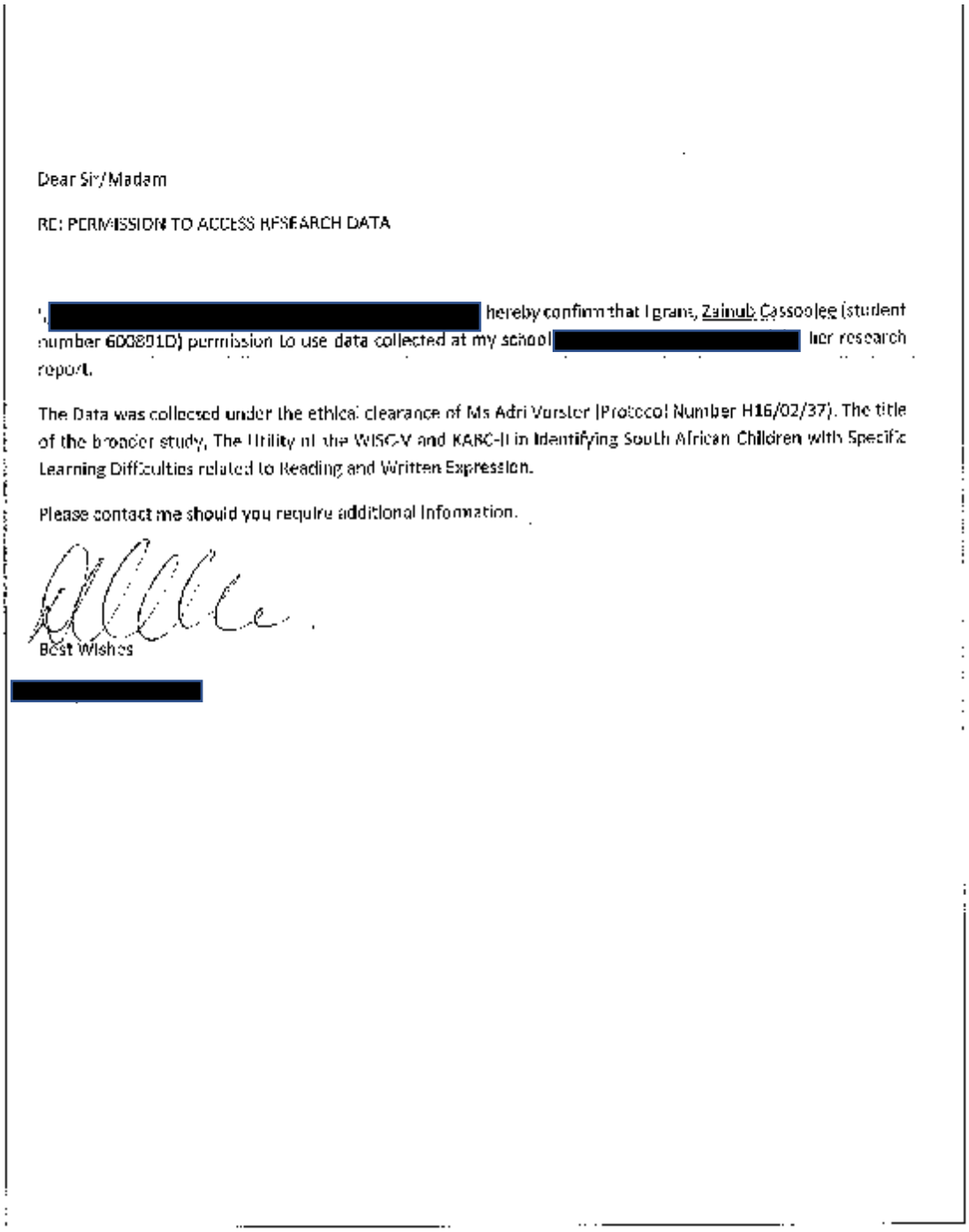
Please contact me should you require additional information.

Best Wishes

A.C. Vorster
Adri Vorster
adri.vorster@wits.ac.za
011 717 4554

Figure H1. Permission to use collected data from the researcher on the broader project.

Appendix I



Dear Sir/Madam

RE: PERMISSION TO ACCESS RESEARCH DATA

I, [redacted] hereby confirm that I grant, Zainub Cassoolee (student number 600801D) permission to use data collected at my school [redacted] for research report.

The Data was collected under the ethical clearance of Ms Adri Vorster (Protocol Number H16/02/37). The title of the broader study, The Utility of the WISC-V and KABC-II in Identifying South African Children with Specific Learning Difficulties related to Reading and Written Expression.

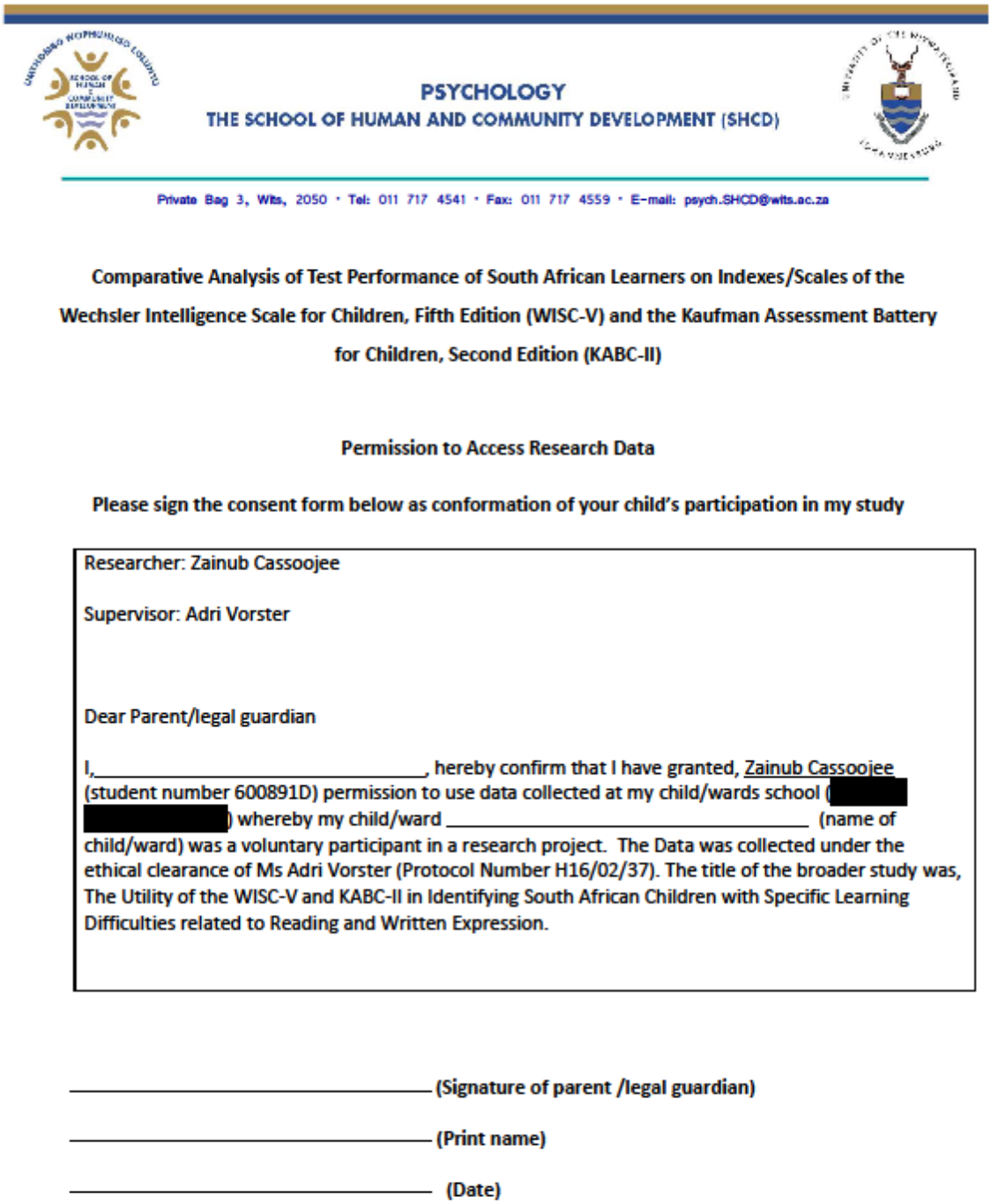
Please contact me should you require additional information.

Best Wishes

[redacted]

Figure I1. Permission to use collected data from the school principal.

Appendix J



PSYCHOLOGY
THE SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT (SHCD)

Private Bag 3, Wits, 2050 • Tel: 011 717 4541 • Fax: 011 717 4559 • E-mail: psych.SHCD@wits.ac.za

Comparative Analysis of Test Performance of South African Learners on Indexes/Scales of the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V) and the Kaufman Assessment Battery for Children, Second Edition (KABC-II)

Permission to Access Research Data

Please sign the consent form below as conformation of your child's participation in my study

Researcher: Zainub Cassoojee

Supervisor: Adri Vorster

Dear Parent/legal guardian

I,_____, hereby confirm that I have granted, Zainub Cassoojee (student number 600891D) permission to use data collected at my child/wards school ([redacted]) whereby my child/ward _____ (name of child/ward) was a voluntary participant in a research project. The Data was collected under the ethical clearance of Ms Adri Vorster (Protocol Number H16/02/37). The title of the broader study was, The Utility of the WISC-V and KABC-II in Identifying South African Children with Specific Learning Difficulties related to Reading and Written Expression.

_____ (Signature of parent /legal guardian)

_____ (Print name)

_____ (Date)

Figure J1. Permission to use collected data from the parents/legal guardians.

Appendix K

The histograms depict the performance of the children on the WISC-V VCI, VSI, FRI, and WMI and the KABC-II Gc, Gv, Gf, and Gsm.

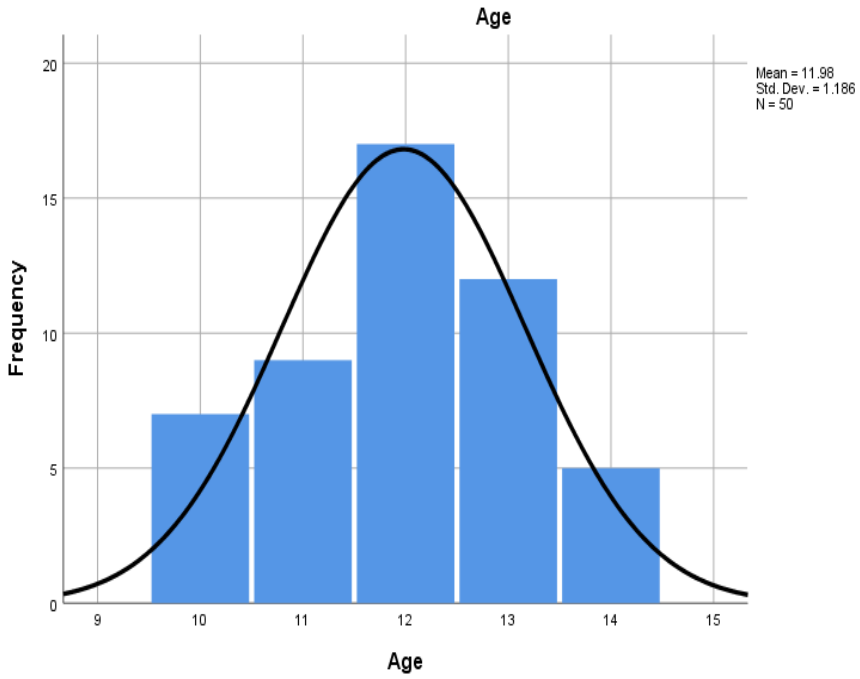


Figure K1. Age distribution of the sample population.

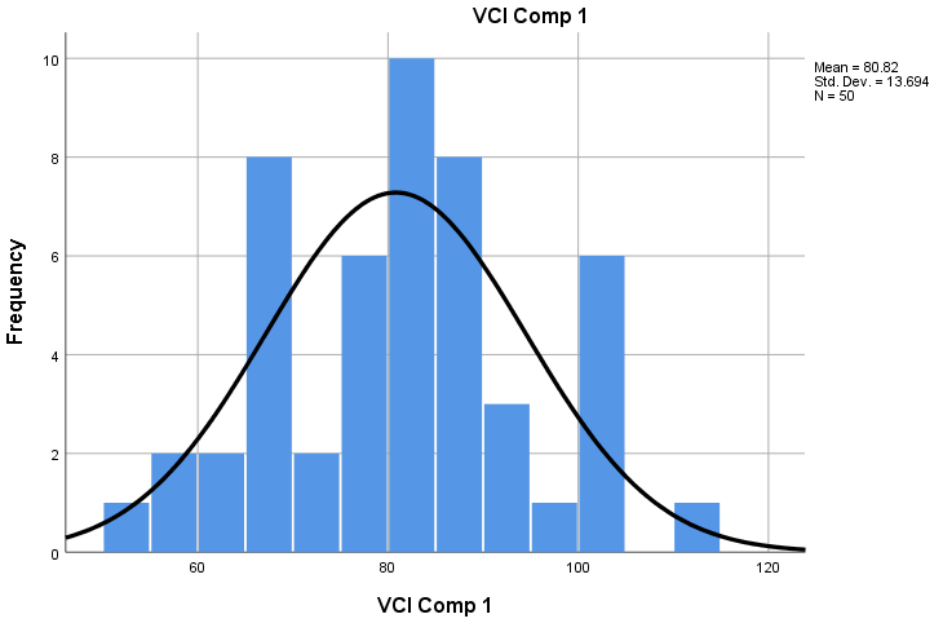


Figure K2. WISC-V Verbal Comprehension Index (VCI).

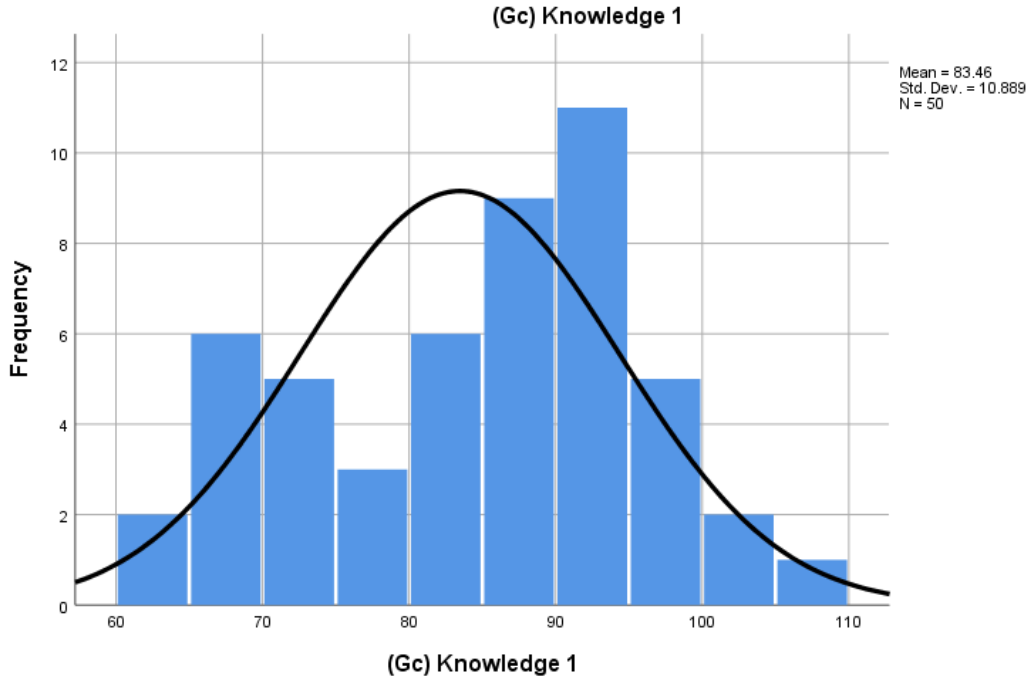


Figure K3. KABC-II Knowledge Scale (Gv).

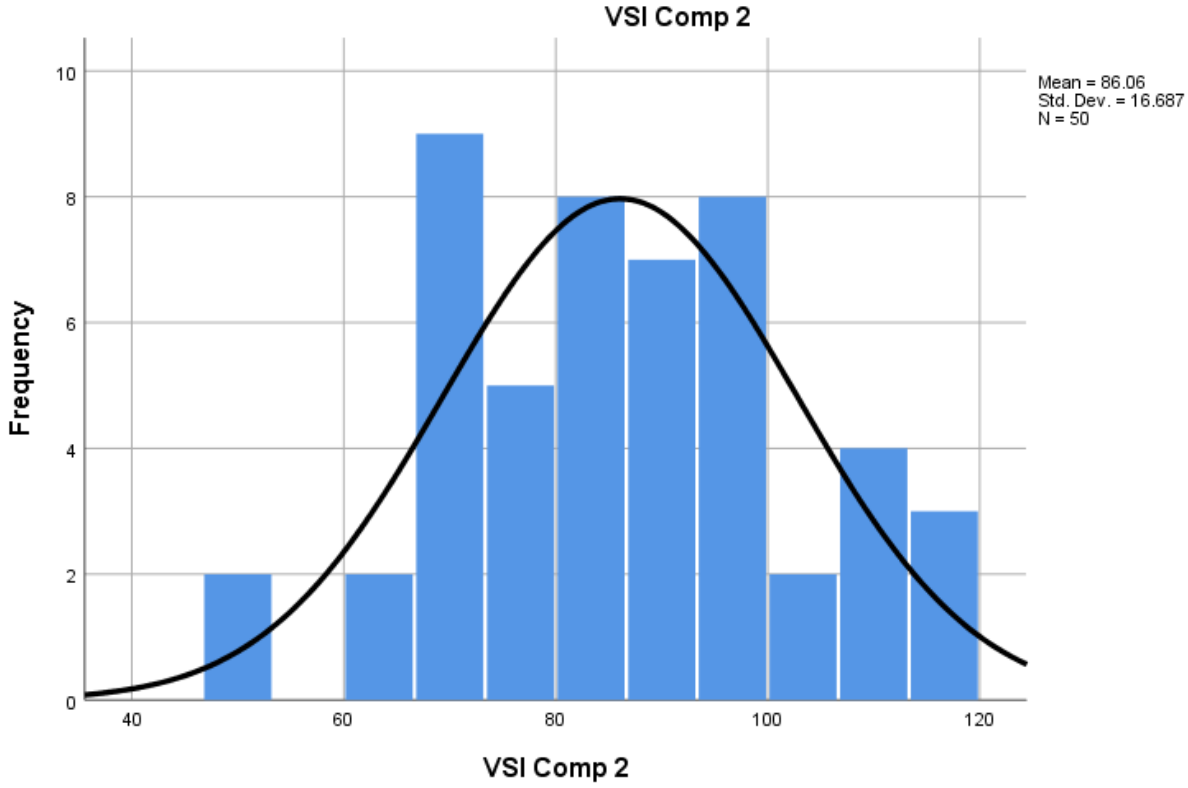


Figure K4. WISC-V Visual Spatial Index (VSI).

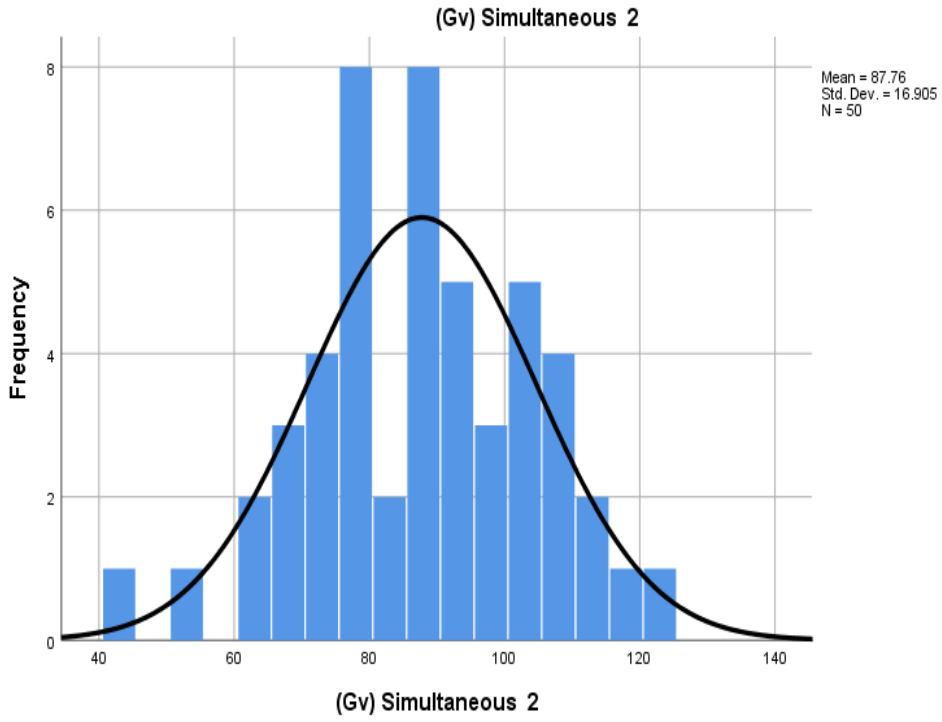


Figure K5. KABC-II Simultaneous Processing Scale (Gv).

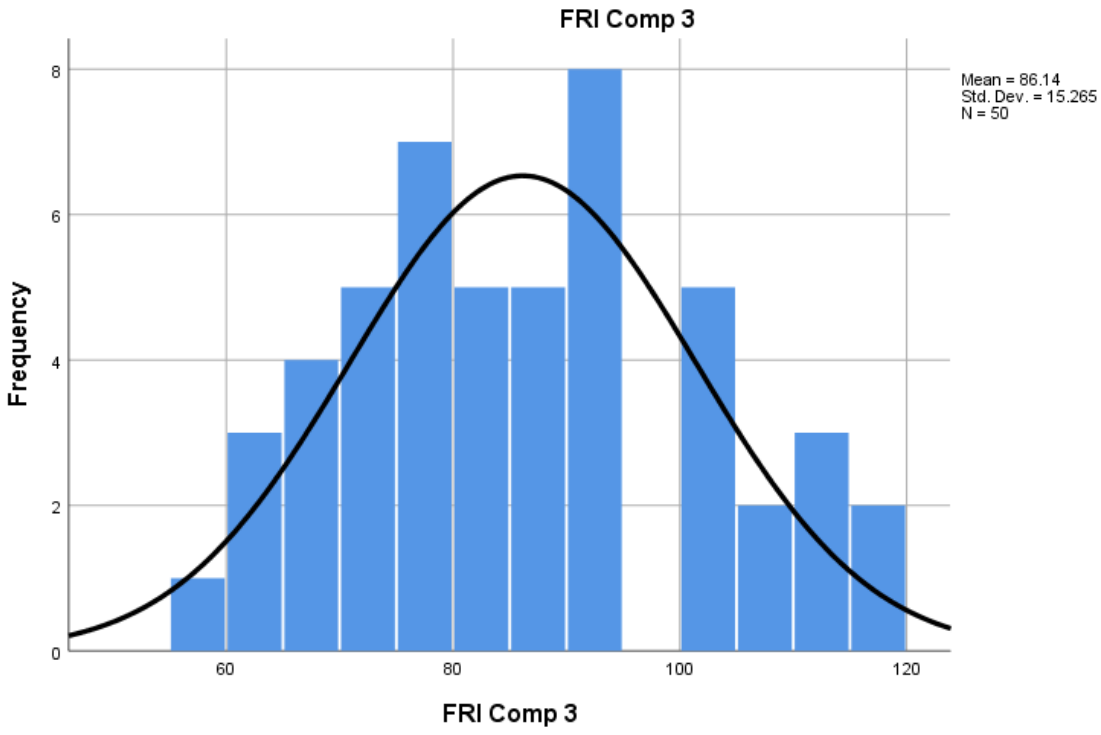


Figure K6. WISC-V Fluid Reasoning Index (FRI).

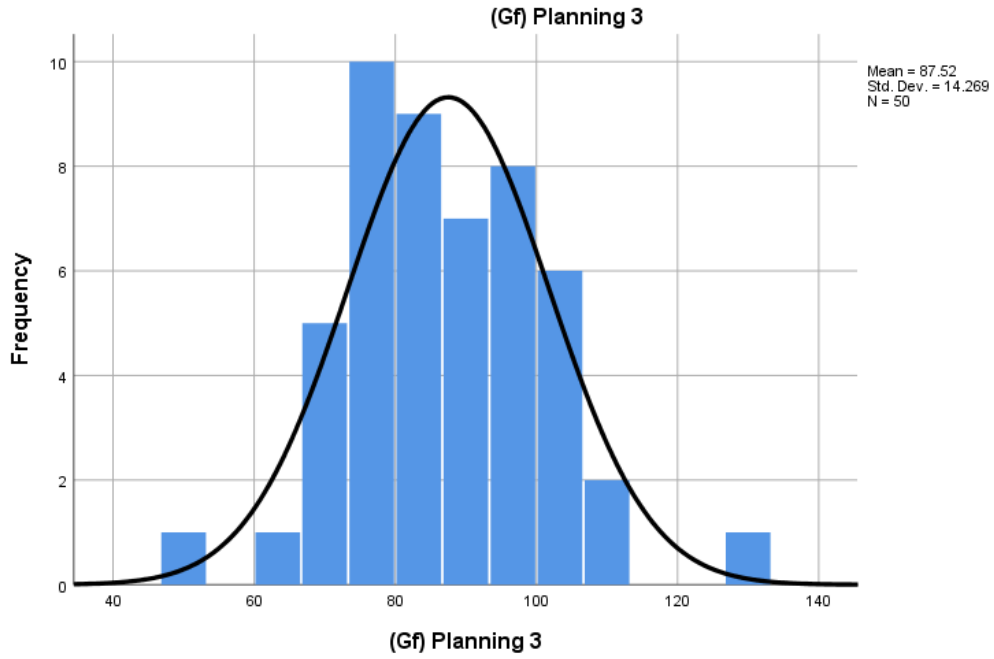


Figure K7. KABC-II Planning Scale (Gf).

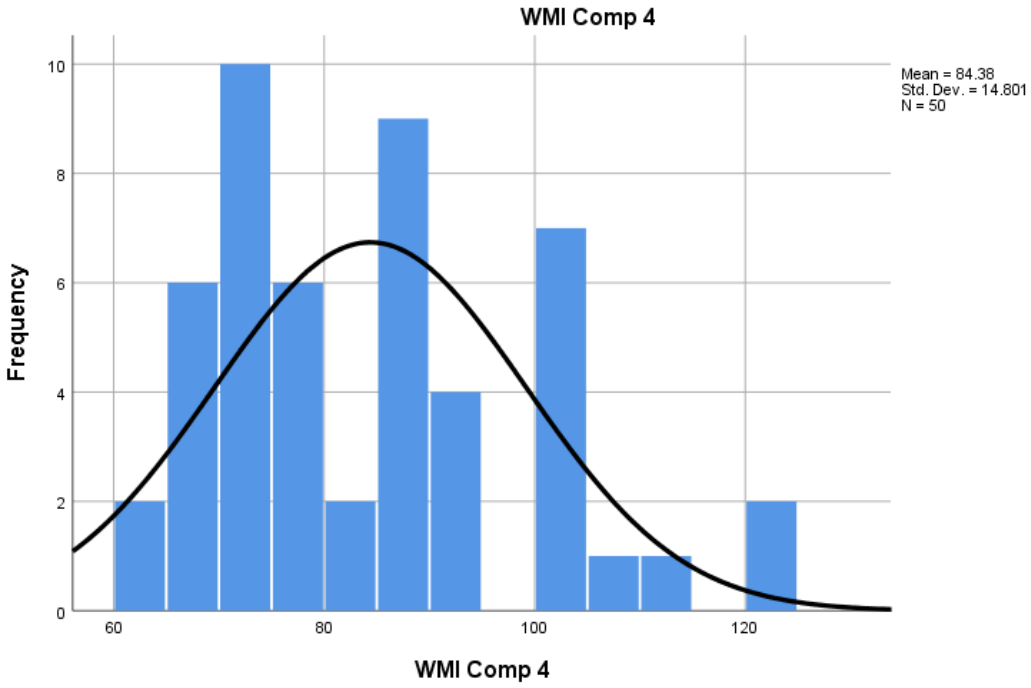


Figure K8. WISC-V Working Memory Index (WMI).

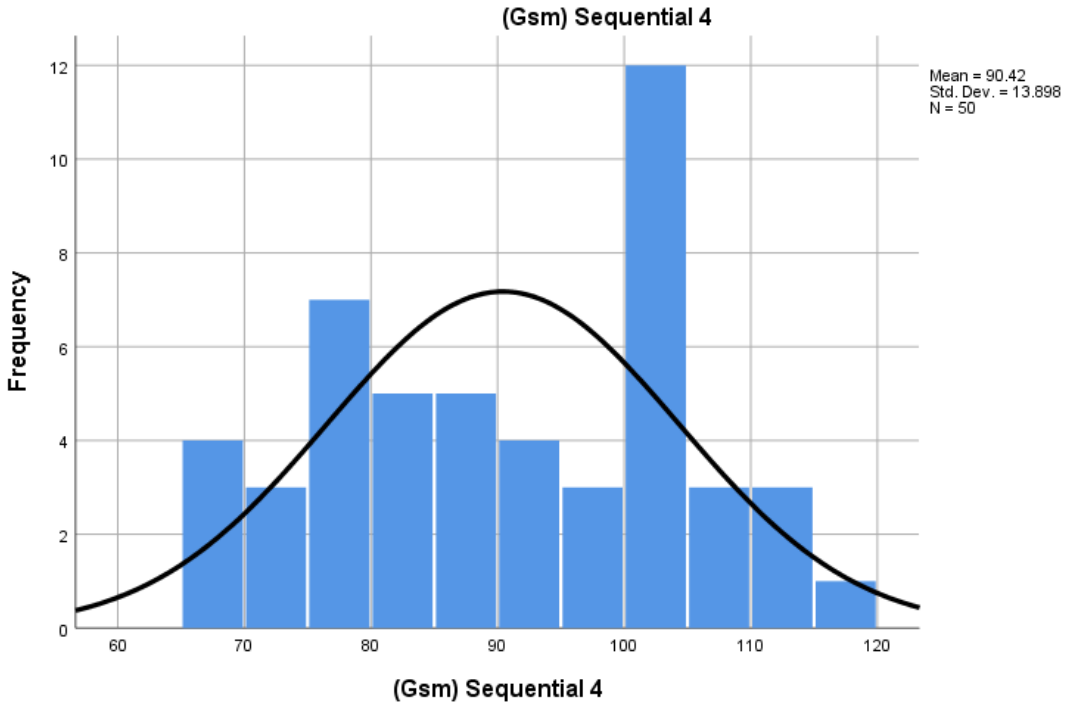


Figure K9. KABC-II Sequential Processing Scale (Gsm).

Appendix L

University of the Witwatersrand, Johannesburg
Faculty of Humanities – Postgraduate Office
Private Bag 3, Wits 2050, South Africa • **Tel:** +27 11 717 4007• **Fax:** +27 11 717 4037• **Email:** madile.moeketsi@wits.ac.za

Student Number: 0600891D

Miss Zainub Cassoojee
13 Acorn Ave Extension 6
Lenasia
Johannesburg 1827
Gauteng South Africa

18 May 2017

Dear Miss Cassoojee

APPROVAL OF PROPOSAL FOR THE DEGREE OF MASTER OF EDUCATION IN EDUCATIONAL PSYCHOLOGY

I am pleased to be able to advise you that the readers of the Graduate Studies Committee have approved your proposal entitled "***Comparative analysis of rest performance of South African children on the Wechsler intelligence scale for children, fifth edition (WISC-V) and the Kaufman assessment battery for children, second edition (KABC-II)***. I confirm that Ms Adri Vorster has been appointed as your supervisor in the School of SHCD.

The research report is normally submitted to the Faculty Office by 15 February, if you have started the beginning of the year, and for mid-year the deadline is 31 July. All students are required to RE-REGISTER at the beginning of each year.

You are required to submit 2 bound copies and one unbound copy plus 1 CD in pdf (Adobe) format of your research report to the Faculty Office. The 2 bound copies go to the examiners and are retained by them and the unbound copy is retained by the Faculty Office as back up.

Please note that should you miss the deadline of 15 February or 31 July you will be required to submit an application for extension of time and register for the research report extension. Any candidate who misses the deadline of 15 February will be charged fees for the research report extension.

Kindly keep us informed of any changes of address during the year.

Note: All MA and PhD candidates who intend graduating shortly must meet your ETD requirements at least **6 weeks** after your supervisor has received the examiners reports. **A student must remain registered at the Faculty Office until graduation.**

Yours Sincerely

MM Moeketsi

Madile Moeketsi (Ms)
Postgraduate Division
Faculty of Humanities
Private Bag X 3
Wits, 2050

Figure L1. Approval of proposal for this master's degree.

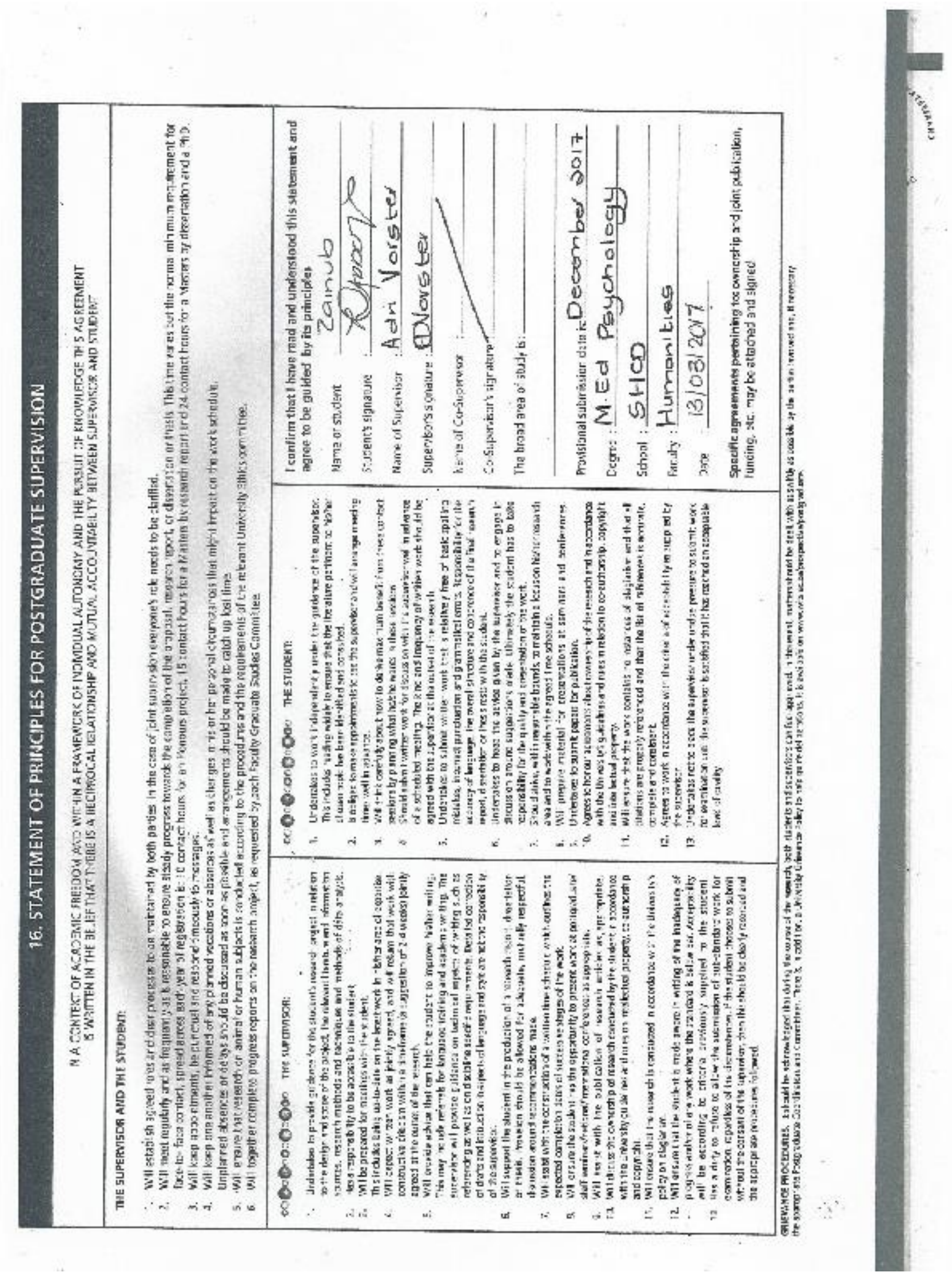
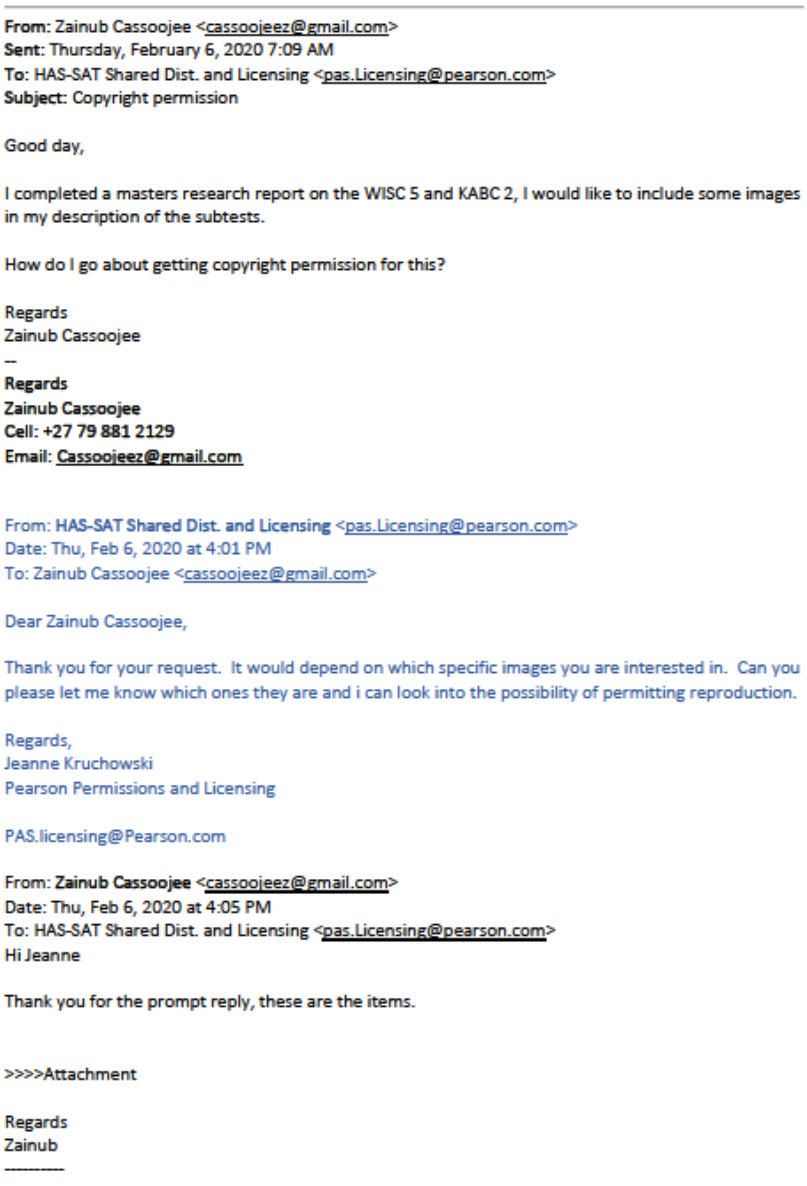


Figure L2. Statement of principles for postgraduate supervision.



From: Zainub Cassoojee <cassoojeez@gmail.com>
Sent: Thursday, February 6, 2020 7:09 AM
To: HAS-SAT Shared Dist. and Licensing <pas.Licensing@pearson.com>
Subject: Copyright permission

Good day,

I completed a masters research report on the WISC 5 and KABC 2, I would like to include some images in my description of the subtests.

How do I go about getting copyright permission for this?

Regards
Zainub Cassoojee
--
Regards
Zainub Cassoojee
Cell: +27 79 881 2129
Email: Cassoojeez@gmail.com

From: **HAS-SAT Shared Dist. and Licensing** <pas.Licensing@pearson.com>
Date: Thu, Feb 6, 2020 at 4:01 PM
To: Zainub Cassoojee <cassoojeez@gmail.com>

Dear Zainub Cassoojee,

Thank you for your request. It would depend on which specific images you are interested in. Can you please let me know which ones they are and i can look into the possibility of permitting reproduction.

Regards,
Jeanne Kruchowski
Pearson Permissions and Licensing

PAS.licensing@Pearson.com

From: **Zainub Cassoojee** <cassoojeez@gmail.com>
Date: Thu, Feb 6, 2020 at 4:05 PM
To: HAS-SAT Shared Dist. and Licensing <pas.Licensing@pearson.com>
Hi Jeanne

Thank you for the prompt reply, these are the items.

>>>>Attachment

Regards
Zainub

Figure L3. Pending permission for copyright of Figures 2, 3, 5, 6, 7, 8.

From: **HAS-SAT Shared Dist. and Licensing** <pas.Licensing@pearson.com>
Date: Thu, Feb 6, 2020 at 4:07 PM
To: Zainub Cassoojee <cassoojeez@gmail.com>
Thank you,
I will forward these images to the respective product managers and let you know as soon as I have their replies.

Regards,
Jeanne Kruchowski
Pearson Permissions and Licensing

PAS.licensing@Pearson.com

From: Zainub Cassoojee <cassoojeez@gmail.com>
Sent: Thursday, February 6, 2020 8:05 AM
To: HAS-SAT Shared Dist. and Licensing <pas.Licensing@pearson.com>
Subject: Re: Copyright permission / WISC 5 and KABC 2

Thank you very much.

From: **Zainub Cassoojee** <cassoojeez@gmail.com>
Date: Mon, Feb 10, 2020 at 5:08 AM
To: HAS-SAT Shared Dist. and Licensing <pas.Licensing@pearson.com>
Hi Jeanne,

Do you perhaps know how long this process takes?

Regards
Zainub

From: **HAS-SAT Shared Dist. and Licensing** <pas.Licensing@pearson.com>
Date: Mon, Feb 10, 2020 at 3:53 PM
Subject: Re: Copyright permission / WISC 5 and KABC 2
To: Zainub Cassoojee <cassoojeez@gmail.com>

Dear Zainub,
I'm afraid I don't know. I just need to wait until the product managers have reviewed the request and have let me know their decisions. How long that takes will depend on what other issues they are currently dealing with.

Regards,
Jeanne Kruchowski
Pearson Permissions and Licensing

PAS.licensing@Pearson.com

Figure L4. Pending permission for copyright of Figures 2, 3, 5, 6, 7, 8.

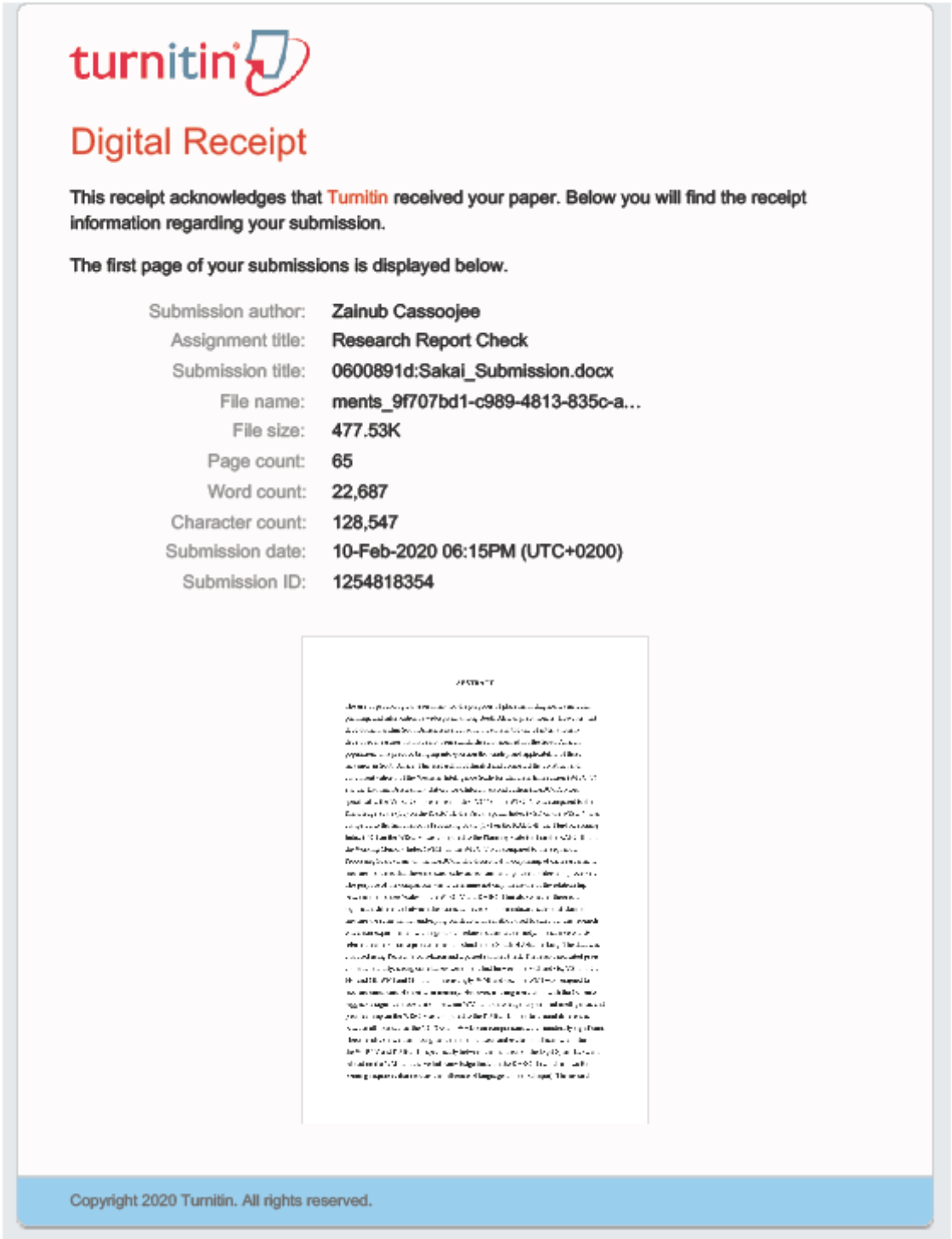


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Figure L5. Turnitin digital receipt.