A Normative Study of the Raven's Coloured Progressive Matrices for South African Children with Cognitive Barriers to Learning

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Declaration

I, *Justin Oswin August (199215421)*, hereby declare that the *dissertation* for *Masters of Arts in Psychology (Research) to be awarded* is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification.

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Abstract

With the changing landscape in South Africa to a full democracy, increased research has been undertaken in the psychometric field on local and national normative studies regarding various assessment measures. The Raven's Coloured Progressive Matrices (CPM) is one of the measures that have already been extensively normed throughout the world for various population groups. In South Africa, local norms for normal populations of children have been developed by groups of researchers in the Grahamstown (Eastern Cape) as well as the Bloemfontein (Free State) areas. With a South African school educational system that focuses on Inclusive Education, there is a growing need for mainstream schools to identify learners who are at risk for learning disabilities in order to develop appropriate supportive intervention plans. The research aimed to establish psychometric normative screening data based on the Raven's CPM, and to compare these with the established and published international and local Raven's CPM norms. In addition, the researcher developed pilot classification scores for the early screening and detection of at risk learners in order to encourage the potential role and use of the Raven's CPM in the identification of cognitive learning barriers. The sample consisted of 388 primary school learners identified as having cognitive barriers to learning. Archival data was used that was gathered from a Psychological clinic that provided screening services to schools in the Nelson Mandela Metropolitan area. The results of the study indicated that there was a proportional relationship between age and test performance. Gender differences were found where the males in this study outperformed the females. There was a significant difference in the Raven's CPM test performance with respect to the grade levels of the learners. The study developed a special set of norms with cognitive classification scores that will aid in the early identification of learning disabilities.

Key words: learning barriers; Ravens Progressive Matrices; psychometrics; South African Norms.

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Chapter 1

Introduction

This chapter introduces the relevance of Ravens Progressive Matrices as a cognitive screening measure for identifying 'at-risk' learners. This is an essential question in the South African context, especially when seen in light of previous segregation policies, which resulted in educational disparities across racial groups. The impact that these disparities had on the applicability of psychometric tools within the school context is that historically local test norms were reflective of minority population groups. Consequential to these early psychometric practices in South Africa, many learners have been disadvantaged when faced with psychometric testing. The norms developed for these tests were not inclusive of the diversity reflected across the South African educational landscape. It follows that there is a need for ongoing norm development based on inclusive psychometric tools.

It is in this scenario, that the usefulness of the Raven's Coloured Progressive Matrices (CPM) as a possible cognitive screening measure needs to be considered especially as the matrices comprise a non-verbal psychometric measure that largely eliminates the potential bias which occurs with verbal testing.

This study extends previous research on establishing local South African norms for Raven's Coloured Progressive Matrices (CPM). Furthermore, the use and appropriateness of culture-reduced, non-verbal psychometric screening tests of cognitive ability in South African education with a view to identifying learners with barriers to learning, is required (Knoetze, Bass, & Steele, 2005; Linstrom, Raven, Raven, & Jopie van Rooyen and Partners, 2008; Pretorius, 2015). A recent study conducted by Pretorius (2015), found that participants with barriers to learning obtained Raven's CPM scores that are minimally affected or biased by socio-demographic factors. This significant finding by Pretorius (2015) was the motivation for the current study. A decision was made to establish norms for Raven's CPM for leaners identified as having cognitive barriers to learning, using the same data set.

According to the 2014 education statistics South Africa had an estimated 13 068 855 learners and students in the basic education system; they attended 30 500 education institutions and were served by 448 105 educators (Department of Basic Education, 2016). This population consists of learners and students in nine provinces, across eleven official language groups, different cultures, and different socio-economic categories. If one considers the number of educators to the number of students, the burden faced by the education system is clear. Recent media reports highlight the fact that 60% of South African learners in Grade 4 cannot read at the end of the grade. Specific to the Eastern Cape, 73% do not complete the minimum schoolwork required of the prescribed curricula (Butler, 2016). In the Eastern Cape 1 946 885 learners across school grades were enrolled in 2014 of which 162 077 were Grade 4 learners. These worrying statistics are underpinned by many factors.

South Africa's apartheid history is one of the main contributors to the education crisis in the country. Historical laws segregated white schools from black schools and the quality of education at these schools differed (Shuttleworth-Jordan, 1996). Different Acts governed schooling at the time and the regulations were contained in the Bantu Education Act of 1953, the Christian National Education Act of 1962 for "white" South Africans, the Education for Coloured People's Act of 1965, and the Education for Indians Act of 1969. Schooling was segregated across racial lines, with Indian teachers teaching Indian learners in an Indian community. The same happened with the Coloured and Black populations. Teacher qualifications in these schools differed to the qualifications in white schools. Resource allocations between the White schools and Black, Coloured, and Indian schools was unequally distributed favouring the White schools (Carrim, 2006).

Despite the new political dispensation in the country little has changed and the effects of the past is evident in the ongoing poor performance of learners today. The Eastern Cape has been classified as the poorest performing province in terms of its matric results for several consecutive years (Eastern Cape Socio Economic Consultative Council, 2015). Overcrowded classes as well as lack of resources are still the order of the day. In reaction to this, parents and teachers in the Nelson Mandela Metropole's northern areas recently closed schools and took to the streets in a bid to address teacher shortages and lack of resources (Gillham, 2016).

In the same manner that mainstream education was segregated by race, separate special education existed for learners with disabilities or impairments. Engelbrecht (2006) states that there was a need to address the segregation of these two entities and bring South African education in line with international standards. In a shift towards inclusive education in South Africa, the Department of Education embarked on policy reforms that would ensure equal, nondiscriminatory access for all. The South African Schools Act of 1996 came into play as a result of these changes in education (National Department of Education, 1996a). The Education White Paper 6 was then developed by the Department of Education to guide the implementation of inclusive education. The policy aims at moving away from categorising learners according to disabilities and separating them from mainstream education but rather strives towards an inclusive educational environment (Department Of Education, 2005). Despite this policy, the reality is somewhat different. Teachers are not implementing the policy guidelines as they have not been trained to action what is required in an inclusive educational environment (Geldenhuys & Wevers, 2013).

According to Magare, Kitching, and Roos, (2010, p. 53), "prior to 1994, educators in South Africa were trained only for either mainstream education or specialised in a field". The current education system is therefore still aligned with previous practices despite the paper

EWP6, which was implemented to change the status quo (DOE, 2001). The goal of implementing screening and identification assessments and support to leaners with learning difficulties in schools in South Africa is therefore still far from being achieved. Instead, we find that in the absence of support learners are either simply retained in a grade or promoted to the next grade. This invariably leads to the high drop-out rate evident in South African schools. Rossi and Stuart (2007) argue that learners with barriers to learning are retained, placed in special education, drop out of high school, and inevitably lose confidence. Landbrook (2009) suggests that these outcomes could be the result of learners not receiving attention in mainstream classrooms and that it could be avoided if the teachers are equipped to implement existing policies.

The policy of inclusive education, however, does not advocate the psychometric testing of learners. This can be linked to the questionable history of psychological testing in South Africa. Nevertheless, the benefits of such testing cannot be underestimated and further research with respect to feasibility and applicability needs to be undertaken. For example, the Senior South African Individual Scale-Revised (SSAIS-R), is a South African test developed in the 1970’s to determine a learner’s intelligence level. The potential benefit of being able to use this test in the current schooling system is undermined by a lack of research that aims to develop norms which reflect the diversity of the South African learner population. The problem with the SSAIS-R test is that it comprises both verbal and non-verbal sub-tests. This means that a language bias is likely to be a factor that renders the test inappropriate for diverse learners who speak a variety of indigenous languages. This does not, however, take the emphasis away from the need for current and subgroup norms to be developed, and for tests that can be used to benefit learner progression in the schooling system.

Non-verbal tests can be administered to a variety of populations with more ease than verbal tests. The Raven’s CPM is a culturally fair non-verbal test which can be administered to a multilingual/multicultural population. Its figural stimuli make it an ideal cognitive measure to be used with people who do not speak or understand English (Brouwers, Van de Vijver, & Van Hemert, 2009). This makes the Raven's CPM a test that should receive immediate attention in re-norming for specific groups or subgroups as it has the potential to be integrated into the educational system to assist with the identification of learners who have learning barriers. Teachers will be able to use the findings to align their teaching strategies to be more inclusive of the needs of their students. In doing so, the aim of White Paper 6 (2005), namely inclusive education for all, will become more realistic. Identified learners with learning barriers could be given access to early interventions which address cognitive barriers that may hinder their performance, and teachers and educators would be better equipped to understand their educational needs.

This study endeavours to develop a set of Raven's CPM normative data for South African children with learning barriers and to compare and contrast these norms with selected existing local and international norms. The research will be extended to develop pilot cognitive classification categories for the early screening and detection of at risk learners to encourage implementation of Raven's CPM in the identification of barriers to learning.

Problem Statement

Norm development, reflective of the current South African learner, is under-researched. This study aims to provide normative data for a special population group, namely South African children with identified cognitive barriers to learning. In so doing this study will contribute to a growing body of literature that is focused on exploring the applicability of fair and unbiased psychometric tests in the education system.

Research Aims

The aims of this study are:

1. To establish Raven's Coloured Progressive Matrices age norms for children identified as having cognitive learning barriers.
2. To establish Raven's Coloured Progressive Matrices grade norms for children identified as having cognitive learning barriers.
3. To compare these norms against published local and international norms.
4. To establish pilot Raven's Coloured Progressive Matrices cognitive classification categories for the purpose of the psychometric screening of children with probable learning disabilities.

Outline of the Study

Chapter 1 provides an overview of the focus of the study. In this chapter, the research objective and research aims are highlighted.

Chapter 2 is the first of two literature review chapters. It focuses on the historical underpinnings of intelligence followed by a background to the development of intelligence testing and its implication on current norm development studies.

Chapter 3 outlines the history of psychometric intellectual functioning assessments in South Africa. Specific focus is given to the policies implemented by the South African government to guide assessment practices in education and industry.

Chapter 4 outlines the methodology adopted in this study, namely the sampling procedures, the measure used, and the statistical procedures applied in the analysis of the data.

Chapter 5 presents the findings of the study. Relevant tables and figures are included to aid the discussion related to normative data development. The findings are interpreted in relation to the reviewed literature and aligned to the research objective and aims.

Chapter 6 gives the conclusions of the study. The main findings are highlighted and limitations and strengths are discussed. Recommendations for future research are made.

Chapter 2

The Development of Intelligence Tests

Introduction

This chapter provides a review of human intelligence and a background to the development and theory of intelligence testing. Intelligence as a construct, posited by Spearman (1927) and Cattell (1937), provides a theoretical framework for the study on the Raven's CPM (Raven, Court, & Raven, 1995). The review explains the concept of norms in the field of psychological testing and highlights South African normative studies conducted on Raven's CPM. The Flynn effect and the need for updated norms is discussed as this provides insight into normative challenges (Flynn, 1985).

Intelligence

Intelligence is a culturally relative concept according to Shuttleworth-Jordan (1996) since it is the degree to which a person successfully adapts to cognitive tasks valued by members of a particular culture. This statement is supported by the views of Helfrich (1999) and was upheld by Hunt and Sternberg (2006).

The word 'intelligence' according to Vernon (1979) goes back to Aristotle who distinguished *orexis*, the emotional and moral functions, from *dianio*, the cognitive and intellectual functions.

Intelligence at a general level seems easy to define as it is a popularly recognised word used on a regular basis. By universal acknowledgement among psychologists, it is also one of the most elusive and slippery ideas (Richardson, 1991). Psychologists do not agree on an exact definition, how to precisely explain the way in which it functions, or how it should be measured. Intelligence is a flexible concept with many meanings. For example, Foxcroft and Roodt (2009) distinguish different types of intelligence, namely biological, psychometric and social (emotional) intelligences.

De Beer (2000) states that intelligence is a construct, which is measured by, standardised psychological instruments that provide numerical values to represent present performance and can be used to predict academic success. However, according to Murphy (2011) the definition is controversial as there are numerous manifestations of what intelligence is and how it can be methodologically represented. Pal, Pal and Tourani (2004), explain that different theories of intelligence exist, with none truly agreeing with each other. Various approaches to cognition and thinking come with their own perspectives and assumptions which often contradicts at least one of the earlier theories .

According to the psychometric stance, intelligence is defined as that which an intelligence test measures (Mazabow, 2010), while biological intelligence focuses on the physical structure and functioning of the brain waves that can be objectively measured (Foxcroft & Roodt, 2009). Another form of intelligence as cited by Mazabow (2010) is contextual, also known as social intelligence which is defined in terms of adaptive behaviour specific to the context in which it is used.

Intelligence testing.

Since time immemorial humankind has been fascinated by its own existence and has searched to understand its structure and functioning. This has been fuelled by the development of formal academic institutions. It was an invariable consequence of this search for knowledge that humankind would ultimately turn attention towards the nature and function of the very faculties that began our search for knowledge, namely intelligence. In its more scientific and objective form, intelligence testing originated more than a hundred years ago when Sir Francis Galton (1869) developed the first test battery to assess intelligence (Gregory, 2004).

Using a variety of sensory and motor measures, Galton is considered the father of the type of mental testing which would later become known as psychometrics. According to Gregory (2004), Galton was the first person to suggest the importance of individual differences and to create questionnaires and tests to understand and measure the association between ideas in a subject's mind. Wilhelm Wundt (1893) was a major proponent of psychophysical measures, specifically those measuring simple sensory processes. He created the first laboratory dedicated to psychological research in Leipzig, Germany in 1879. This, according to many, was considered the beginning of psychology as a separate formal discipline (Urbina, 2004). McLeod (2008), states that Wundt is regarded as the father of experimental psychology, using introspection to study conscious mental states and reductionism to frame his conclusions. His work roused interest in cognitive psychology and he trained many psychologists from the United States and elsewhere. This led to the establishment of similar research laboratories in other countries, dedicated to the field of psychological testing (Urbina, 2004). Wundt (1893) clearly set in motion a series of events that resulted in research laboratories paving the way in psychological testing.

It was Alfred Binet (1905), who designed the first intelligence quotient (IQ) test for the identification of students for special education (Foxcroft & Roodt, 2009; Rust & Golombok, 1989). This introduced the concept of establishing a mental level of functioning, namely a statistically derived intelligence quotient (IQ) which forms the basis of many intelligence tests developed and used today. Binet attempted to measure intelligence in order to distinguish between individuals who seemed more likely to benefit from further instructions or training and individuals who would not (De Beer, 2000). According to Binet (1905), the level of intelligence an individual display can be ascribed to nurture (the way we are raised) and is therefore modifiable. Thus, an individual's intelligence could be increased with appropriate training or intervention (De Beer, 2000). Binet's (1905) theoretical approach states that complex mental functions such as comprehension, memory and imagination provide an accurate indication of intellectual ability (Brody, 1992).

Binet (1905) stressed the shortcomings of his test stating that it could not be used to measure a single, permanent or inborn level of intelligence. He believed that intelligence was influenced by a number of factors which can only be compared amongst children of similar backgrounds, and that it changed over time (Cherry, n.d.). Despite this early contribution from Binet (1905) and his construction of the Binet-Simon Scale for the measurement of intelligence, his stance was somehow overshadowed as interest in and further development of intelligence testing took place.

The Binet-Simon Scale was translated for use in the USA by Henry Goddard (1910) who was impressed with the measure and its methods of classification for mental retardation. Lewis Terman (1916) went a step further and developed the first Stanford-Binet scale which was an enlarged version of the Simon-Binet test (White, 2000). These developments happened despite Binet's concerns as he was still in the process of refining and adapting the original measure. Additionally, the amended measures were used to remove 'defective' individuals from society, to place children in special schools, and to help with the identification of vocational fitness (White, 2000). It is sufficient to then state that despite the importance of intelligence testing, traditions of misuse developed in measuring the very complex construct of intelligence. With this in mind, the following section focuses on and describes intelligence as a construct.

Theoretical Approaches to Intelligence

Spearman's two-factor model of intelligence.

The two-factor theory was developed in 1904 by an English psychologist, Charles Spearman, who developed his theories after spending 15 years as an officer in the British Army. His work was greatly influenced by Francis Galton (Williams, Zimmerman, Zumbo & Ross, 2003). He proposed that intellectual abilities comprised two factors namely general or common ability known as the '*g*' factor, and another group of specific abilities which refer to that which is unique in a test, known as the '*s*' factors (Pal et al., 2004). According to Spearman (1927), *g* is a function of heredity, while *s* represents specific learnings and experiences (Raven, 2000; Spearman, 1927). He believed that *s* could be increased as a result of environment or education whereas *g* could not.

Raven's Progressive Matrices (RPM) were developed as a measure based on Spearman's (1927) investigation and theory of general intelligence (g-factor) (Mackintosh & Bennet, 2005). This 'two-factor' theory of intelligence assumed that all measures of intelligence could be divided into two separate components and it laid the foundation for applying statistical methods to the study of intelligence (Brody, 1992). The general (g) factor was defined by Spearman as a component of any cognitive test, whereas *s* factors are test unique or specific (Foxcroft & Roodt, 2009). Spearman discovered that an individual's performance on a specific intellectual domain predicted increased performance on other domains. He subsequently recognised that *g* is a good predictor of academic success (Buschkuehl & Jaeggi, 2010).

Spearman (1927) further argued that the 'g' factor comprises two components namely, educative ability and reproductive ability. Educative ability assesses an individual's ability to cognitively construct meaning out of confusion and an ability to generate sophisticated, non-verbal schemata. Reproductive ability on the other hand, refers to the ability "to absorb, recall, and reproduce information that has been made explicit and communicated from one person to another" (Raven, 2000, p.2).

Raven worked closely with Spearman and used his theory to underpin the development of the Progressive Matrices test which was specifically designed to assess the 'g' factor in individuals (Raven, Raven, & Court, 1998). It can thus be inferred that Raven's Progressive Matrices provide the necessary means to measure a person's ability to reason, and to assess levels and use of the visual modality. The scales are therefore tests of observation and clear, conceptual thinking ability which is specifically rooted in an individual's fluid intelligence (Raven, 2000).

Cattell's two types of intelligence.

Raymond Cattell (1937) was born in England in 1905 and studied under Charles Spearman. He developed a similar interest to that of his mentor and proposed a culture-free intelligence test before moving on to develop his factor analysis of personality (Tucker, 2009).

Cattel was of the belief that intelligence is genetically inherited. He wrote an article in 1936 for the Eugenics Review where he answered "yes" to the question whether England's national intelligence was declining. He argued that the higher the social class of individuals, the higher the level of intelligence will be. This conclusion aroused the interest of Edward. L. Thorndike to the extent that Cattel was subsequently offered a faculty position at Columbia University Teacher's College (Allan, 2016)

Cattell proposed that intelligence is divided into two separate but complementary components, namely crystalised intelligence and fluid intelligence (Cattell, 1937; Cohen & Swerdlik, 2010; Kane & Brand, 2003). Crystalised intelligence refers to knowledge acquired by past experiences and is dependent on exposure to a specific culture as well as formal and informal education which includes vocabulary or specific skills. Crystalised intelligence can be measured via vocabulary tests or tasks requiring general knowledge (Buschkuehl & Jaeggi, 2010). Fluid intelligence on the other hand, refers to the ability to manage new situations for which previously learned knowledge is of minimal importance. Fluid intelligence can be regarded as the most reliable and predictive measure of successful performance in both educational and professional settings. According to Buschuehle and Jaeggi (2010) fluid intelligence is theoretically close to or similar to *g*.

The relevance of Cattell's theory with respect to Raven's Progressive Matrices is that the matrices developed as part of a series of nonverbal tests for measuring fluid intelligence. Raven's SPM was developed in 1938 and Raven's Coloured Progressive Matrices (CPM) in 1949 (Raven et al., 1995). Cattell's theory on fluid intelligence can thus be located in the design and use of Raven's Progressive Matrices.

The preceding sections outline initial thoughts and conceptualisations about intelligence and alluded to emerging theories on intelligence. An important phenomenon, as already mentioned, was the development of the first intelligence quotient (IQ) measure by Binet (1905) which took a different turn to what Binet had anticipated. The IQ measures which were developed after the Stanford-Binet scale, followed the same tradition of excluding and unfairly discriminating against certain population groups. It was and is still characterised as discriminatory because it is not fairly applied across diverse groupings. It is with this in mind that the following section highlights the importance of norms and norm development especially for IQ measures. According to Shuttleworth-Edwards, Donnelly, Reid, & Radloff (2004), the creation of appropriate norms or comparative reference groups helps with the minimisation of misclassifications.

Norms within Psychological Testing

The basic concept of norms in the field of psychological testing is neither unique nor unusual. Norms are frequently used to make comparisons as well as interpretations of specific human attributes (Angoff, 1984). A raw obtained score on a psychological test remains meaningless unless it can be compared to specific comparative data that will place the score in an applicable explanatory context (Angoff, 1984; Kaplan & Saccuzzo, 2013; Smit, 1996). Cohen, Swerdlik and Stuurman (2013, p. 128) describe norms as “…test performance data of a particular group of test takers that are designed for use as a reference when evaluating or interpreting individual test scores”. Norms are established by administering psychological tests to a group of individuals who represent the population as a whole. The distribution of scores obtained by the group of test takers is then used as a normative standard to which others can be compared (McIntire & Miller, 2000).

A norm provides a context or framework which allows the researcher to interpret results in a meaningful way. According to Kaplan and Saccuzzo (2013), norms are used as a reference against which an individual’s psychological test results can be interpreted relative to the distribution of a larger population. Norming is used in most, if not all, psychological tests. All psychological tests require a benchmark, and thus norming is a form of benchmarking where the performance of the individual is compared to a relevant reference group. The process of norming psychological tests is, however, a controversial issue which requires careful consideration of related factors such as age and education. Norming is regarded as a parallel process to the standardisation of measures (Kaplan & Saccuzzo, 2013).

Norms, as explained above, serve as an external reference with three main benefits. The first is that norms act as a ‘yardstick’ in relation to the average score of a particular group of people. The second is that norms indicate the variability of scores around average. The third is that norms are based on real-life data rather than laboratory samples thus allowing them to account for administration effects such as test-taker anxiety and time demands (Kaplan & Sacuzzo, 2013).

The development of norms forms an integral part in the construction of psychological tests. Without norms, test results are meaningless; it is only when raw scores are interpreted in relation to the norms that have been developed that any measurement conclusions can be justifiable in terms of, among other things, objectivity and reliability.

Normative studies therefor are a common phenomenon in the field of psychological assessment research both internationally and in South Africa. When norm groups are established, it is imperative to ensure that the norm group is a true representation of the population for whom it is developed (Gregory, 2004; McIntire & Miller, 2000). A range of normative studies were conducted after constitutional changes were propagated to reduce unfair and biased testing in South Africa. Most of the test batteries included an intelligence quotient (IQ) component, such as one of the various Wechsler intelligence scales or Raven's Progressive Matrices (Ferrett, 2011). Besides the local Raven's CPM normative studies under consideration in this study, further afield Kazem et al. (2009), conducted a normative study for Raven's CPM on Omani learners in the Sultanate of Oman, and Al-Qurashi, (1987) conducted a study of Raven's CPM in Dar es Salaam.

Since 2000, several normative studies have been undertaken in South Africa on various cognitive assessment measures which include the following:

- Grieve and Viljoen (2000): Individual administration of a computerised version of the Austin Maze; Halstead-Reitan Category Test; Raven's Standard Progressive Matrices (RSPM).
- Claassen, Krynauw, Holtzhausen, and Mathe (2001): Individual administration of the Wechsler Adult Intelligence Scale, 3rd edition (WAIS-III).

- Skuy, Schutte, Fridjhon, and O'Carroll (2001): Individual administration of the Wechsler Intelligence Scale for Children, Revised edition (WISC-R); Individual scales for African Language Speaking children ; Rey's Auditory Verbal Learning Test (RAVLT); Rey-Osterrieth Complex Figure Test (ROCFT); Stroop Color-Word Test (SCWT); Wisconsin Card Sorting Test (WCST); Trail Making Test (TMT); Spatial Memory Test; Draw-a-Person Test; Phonemic Fluency
- Jinabhai, Taylor, Rangongo, Mkhize, Anderson, and Pillay (2004): Group administration of the Raven's Coloured Progressive Matrices (RCPM); Rey's Auditory Verbal Learning Test (RAVLT); Symbol Digit Modalities Test; Young's Group Mathematics Test
- Shuttleworth-Edwards, Kemp, Rust, Muirhead, Hartman, and Radloff (2004): Individual administration of the Wechsler Adult Intelligence Scale, 3rd edition (WAIS-III)
- Boon and Steel (2005): Group administration of the Paper and Pencil Games, Human Sciences Research Council test (HSRC test).
- Jansen and Greenop (2008): Individual administration of the K-ABC excerpts

Of central importance to this research are two previous studies which provided local South African norms for the Raven's CPM. Firstly, Knoetze et al. (2005) undertook a study in the Grahamstown area of the Eastern Cape province sampling Black-Xhosa disadvantaged learners between the ages of 6 to 11 years. Secondly, Linstrom et al. (2008) subsequently conducted a similar study in the Free State province on learners between the ages of 6 to 12 years and 8 months.

The focus of the current normative study is on a different and selected population which extends the findings of these studies by using Raven's CPM to establish normative data for Eastern Cape children drawn from the Nelson Mandela Bay Metropole, and who were identified by teachers as having learning barriers.

The Flynn effect and the importance of current norms.

The Flynn effect refers to the tendency for cognitive scores to improve over time (Flynn, 1985). Psychologists have deduced a variety of causative variables for this time-based improvement phenomenon in intelligence or cognitive scores and ascribe it to the "multiplicity hypothesis" which states that the Flynn effect can be explained by a host of external factors, such as "improvements in early education, increased sophistication of tests, better test taking attitudes and adequate nutrition" as well as "causative variables such as genetics, environmental factors (e.g., nutrition, education, improved public health, increased use of computer games) ethnicity and different societal risks and benefits associated with different generations" (Kaufman & Weiss, 2010, p. 379).

While Flynn worked in New Zealand, he analysed IQ tests taken by Dutch children. One group took the tests in the 1950s and the second group in the 1980s. This brought about the discovery of large increases in the IQ scores from one generation to the next as the scores from the 1980s sample depicted significantly higher scores than the samples from the1950s; thus research began on the Flynn effect (1985). Flynn found that this phenomenon had been occurring globally and similar gains in IQ scores had been found during the mid-twentieth centuries (Flynn, 2015). However, It has been observed that in developed countries such as Denmark and Norway, the Flynn effect has gradually diminished (Teasdale & Owen, 2008), compared to developing countries such as Kenya, Brazil and even South Africa where it has been found that lack of nutrition and environmental factors played a huge role in performance and intelligence (Bakhiet, Barakat, & Lynne, 2014). The level of exposure to opportunities that help build cognitive abilities is crucial in this regard and appears to not have been optimal in developing countries. Consequently, one cannot underestimate the role of environmental and social factors as key drivers in cognitive development. Outdated and unrepresentative norms, especially those constructed for cognitive measures, carry a high risk of being misleading, and need to be continuously updated and kept relevant (Foxcroft, 2004, Nell, 1999).

The implication of this, specifically in South Africa, is that inflated estimates of abilities are likely to be obtained with participants who are tested long after norms had been collected and constructed (Nell, 1994).

Conclusion

The above discussion highlighted the construct of human intelligence with a focus of some of its varied interpretations and definitions. It reviewed the history of intelligence testing with pioneers such as Galton, Wundt, and Binet. The work of Binet provided the background for how intelligence testing started, and how misinterpretations of test scores or results can generate potential misuse of intelligence measures. This is still evident today. The ongoing need for researching and developing updated norms as well as the standardisation of intelligence measures is a process that must be vigorously pursued.

Spearman's two factor theory of intelligence and Cattell's two type intelligence frameworks provided the theoretical foundations for the measures under investigation. Despite continued debate and controversy around '*g*', Horn and McArdle (2006), point out that the possibility of factor overlap has never been entirely ruled out. Despite this, both Spearman's (1927) and Cattell's (1963) theories speak to the development and appropriate use of Ravens CPM.

The next chapter focuses on psychometric assessment in South Africa and on contrasting the assessment of intelligence and abilities during the pre and post-apartheid eras.

Chapter 3

Psychometric Assessment of Intellectual Functioning in South Africa

Introduction

South Africa has a complex and controversial political history and the trends in psychometric testing cannot be separated from this past. During the pre-apartheid and apartheid eras intelligence testing was undertaken on a range of individuals despite the fact that existing measures were mostly developed and normed for the South African white English and Afrikaans speaking population only (Laher & Cockcroft, 2014). As mentioned in the previous chapter, intelligence (IQ) measures were initially developed in Europe, with the most popular being the Stanford-Binet test. All IQ test development was subsequently benchmarked against this test even though its misuse in categorising the intellectual levels of people for whom it was not standardised, dates back to 1910s in America (White, 2000). Unfortunately, continued misuse of psychometric measures and in particular IQ tests resulted in marked differences in IQ scores between whites and indigenous populations in South Africa, and these results used to legitimise racial segregation before apartheid policies were formalised and written into law (Foster, 1993; Laher & Cockroft, 2014; Painter & Terre Blanche, 2004).

The 1950s was a time fuelled with intense class separation, and characterised by crime and racial oppression. Psychological services at the time were largely only available to a privileged minority and psychology as a profession was characterised by discrimination and inequality since it excluded the majority of black people (Ahmed & Pillay, 2004; de la Rey & Ipser, 2004; Pretorius, 2012). Furthermore, access to psychological services was mostly restricted to urban areas, from which people of colour were historically isolated (Mayekiso, Strydom, Jithoo, & Katz, 2004). It is evident that in the pre-democratic era psychology played a role in supporting racial oppression and contributed to racial divisions in South African society (Pretorius, 2012).

This chapter outlines the history of psychological and cognitive testing in South Africa. The education system, inclusive education policies and the role of psychometric assessment with respect to these policies, are also discussed.

South African History of Psychological and Intelligence Testing

Claasen (1997) confirms that psychological testing migrated to South Africa via Britain and its development followed a similar pattern to that of the USA. Test development in the USA, according to critics, was heavily dependent on language and verbal skills and marginalised illiterate individuals (Foxcroft & Roodt, 2013). This process was mirrored in South Africa; early tests were developed in a context of an unequal distribution of resources and under existing apartheid policies.

According to Nzimande (1995), psychological assessment practices were used to justify the exploitation of black labour and to deny black people access to education and economic resources since the tests were specifically used to determine who would be given access to economic and educational opportunities. During the apartheid era employment preferences were given to whites under an employment reservation policy. Psychometric testing and psychological assessments were therefore misused to support policy.

Tests were developed and standardised on educated white individuals and then administered to illiterate, uneducated or poorly educated black South Africans; the results were used to depict the superiority of white people's intellectual capacity over their black counterparts to justify the "logic" of employment reservation and the apartheid system. As a result, a general mistrust of psychological assessment, and more specifically psychometric testing, exists amongst the black population in South Africa (Foxcroft & Roodt, 2009; Laher

& Cockroft, 2014). *This was redressed in law in terms of Section 8 of the* Employment Equity Act no 55 of 1998 which stipulates that "psychological testing and similar assessments are prohibited, unless the test is scientifically valid and reliable, can be applied fairly to all employees, and is not biased against any employee or group"(Nzimande, 1995).

In the early development phase of cognitive testing, controversy about the use of cognitive assessments originated in 1923 when the American psychologist Carl Brigham used the Army Alpha and Beta Test to investigate differences in intelligence between racial groups in the United States. He published *A Study of American Intelligence* which outlined that African-Americans, on average, seemed to score lower on intelligence assessments than other racial groups (Brigham, 1923). He concluded that the primary reason for these findings was the inherent differences of intelligence between races. Following on this research in the US, Fick (1929), commissioned a similar study in South Africa. He used the Army Alpha and Beta Test and his Fick Scale to measure differences of intelligence between Black and White students.

In 1929, Fick published the results of his ethnic study of intelligence which determined that there was a significant discrepancy between the intelligence test scores of Black and White students. The scores of Black students were lower than those of White students. He, however, proposed that there were environmental, cultural, educational, and social reasons for this discrepancy, unlike Brigham (1923) who attributed it to inherent racial differences. Later Fick changed this initial view; in his book *Educability of the South African Native* (1939) he argued that the differences between racial groups were due to race, and not external factors. This conclusion would have far-reaching implications for the legitimacy of psychological testing in South Africa in later years (Jopie van Rooyen and Partners, 2015).

Biesheuvel (1949) points out that local black individuals were not familiar with the content of the test items, nor were they familiar with the type of test material that was used.

This brought about the questionable introduction of the concept of "adaptability testing", and a general adaptability battery (GAB) was subsequently developed in 1949.

During the 1960s to late 1990s two bodies dominated the field of psychological assessment, namely The National Institute for Personnel Research (NIPR), who focused on tests which could identify the occupational suitability of black individuals who had very little or no formal education, and the Institute for Psychological and Edumetric Research (IPER) who developed educational and clinical tests. The two bodies where then incorporated into one organisation, namely the Human Science Research Council (HSRC) which was established for the development of specialised local measures (Laher & Cockcroft, 2014). The HSRC was one of the most productive agencies for psychological assessment in South Africa and created the foundation on which the field stands today (Abrahams, 2001; Foxcroft & Davies, 2008). The following tests were adapted during this period: the South African Wechsler Adult Intelligence Scale (SAWAIS), the General Scholastic Aptitude Test (GSAT), the Ability, Processing of Information, and Learning Battery (APIL-B), and the Senior South African Individual Scale-Revised (SSAIS-R). The SAWAIS was released in 1969, and the GSAT developed in 1980. The development of this measure was intended for a multicultural group and was standardised as such (Jopie van Rooyen and Partners, 2015).

South African psychologists subsequently became increasingly aware that there was a need to create psychometric instruments, or to use existing instruments in a fair and unbiased manner. The Health Professions Act was promulgated in 1974. This led to the establishment of the Professional Board of Psychology which was mandated to govern the profession and in particular psychological testing (Seedat & Mackenzie, 2008). Unfortunately, there was a lack of relevant and appropriate local measures. This resulted in the use of psychological tools developed for a westernised population on other cultural groups in the country, and a custom of applying the norms "with caution" (Setshedi, 2008). Foxcroft (1997) states that this left the psychological assessment practitioners with little certainty about the validity, biases and cultural appropriateness of the measures they used. The use of potentially biased measures to make important decisions regarding intervention and educational placements led to incorrect decisions being made.

Engelbrecht, Green, Naicker, and Engelbrecht, (1999) point out that criticisms levelled at the type of intelligence testing that was performed focused on the inappropriateness of the test instruments used for the majority of learners. Bulhan (1985) describes how inappropriate use of IQ tests led to historically advantaged students being elevated to academic heights and promising careers while the rest of the marginalised majority were (because of low and inappropriately assessed IQ scores), relegated to inferior education, and doomed to menial jobs. According to Setshedi (2008), the bad practice of psychological assessment made it seem as if the education system was intentionally designed to promote failure for the majority of disadvantaged South Africans, and success for a small number of advantaged people.

The historical pattern of psychological testing and intelligence testing in South Africa is one that cannot be repeated. For years the Senior South African Intelligence Scale-Revised (SSAIS-R) was the most popular measure used for Intelligence Quotient (IQ) predictions even though the measure was never standardised on a representative South African sample (Laher & Cockcroft, 2014). The norms of this measure are now older than 15 years which makes it highly vulnerable to the Flynn effect. As mentioned previously, the basic premise of the historical development of intelligence measures was predicated on verbal and language skills. This in itself was as limiting in the South African context as it was in the United States because of our multilingual society.

There was a need to identify and develop non-verbal IQ measures that could be applied fairly to all. Raven’s CPM is such an existing measure; it has been reported as culture free and not heavily dependent on verbal and language skills. Updated and relevant norms are essential for this measure to make its use relevant and applicable to the South African context. Should this be achieved it will be a measure that can be applied freely to all groupings and can aid in the screening and early identification of learners with barriers to learning in South Africa.

Assessment and Education

Before the establishment of democracy, the South African education system had segregated children with learning disabilities from those without learning disabilities into different schools known as mainstream and special schools (Legotlo, 2014). The identification of learners with barriers to learning was based primarily on psychometric assessments which classified learners into particular categories. The standardisation of the psychometric measures used at the time was questionable as it was seen to disadvantage the black population (Foxcroft & Roodt, 2009). Kriegler and Skuy (1996), argued that this assessment approach identified learning problems primarily within the child, and labelled the learner by using a medical model which was not necessarily accurate.

Specialised education in South Africa was originally developed along the same lines as those of other countries. However, due to inequalities in South African society, implementation differed vastly under local prevailing political and philosophical ideologies. Because of this, learners were classified in terms of race, language and disability (Landsberg, Kruger, & Swart, 2016; Lomofsky & Lazarus, 2001; Naicker, 2005). The provision of specialised education benefitted white learners more since their educational support services were well developed compared to those that existed for black learners (Landsberg et.al., 2016).

These factors left the post-apartheid government with a heavy backlog in terms of addressing special needs education in the new dispensation. Policy reform was required to address the inequalities of the past; the legacy of formalised racial segregation in the country resulted historically deprived and under-resourced mainstream schools for a number of years. The schools in the townships and the broader Eastern Cape province are characterised by a lack of teachers, overcrowded classrooms, and a lack of resources and infrastructure to provide quality education (ACPF, 2011). These conditions affect learning and need to be considered when assessing learners as it may affect their cognitive test performances (Foxcroft, 2004; Foxcroft & Roodt, 2009; Shuttelworth-Jordan, 1996;).

The importance of assessment in education can, however, not be downplayed or discarded since it assists with the identification of learners with learning barriers and helps with the development of appropriate interventions. South Africa as a nation has been experiencing serious ongoing challenges in its education system and the same can be said for the provision of special needs schools. There are insufficient resources to cater for the needs of learners with learning disabilities and a lack of educator training to teach and provide quality educational services (Wright, 2012). It is recorded that there are learners with learning disabilities in South Africa who do not attend schools because of the following reasons: (1) distance from schools, (2) schools lack infrastructures to accommodate learners with disabilities, (3) unavailability of educators, and (4) financial costs of sending a learner to a specialised school (DSD, DWCPD & UNICEF, 2012).

While the challenges faced by children who do not have learning disabilities are of course often similar to those faced by children with learning disabilities, the former at least have access to an educational environment and curriculum which caters for them. It is imperative to identify children with learning disabilities or barriers to learning as early as possible to enable correct educational placements or the provision of supportive educational measures.

Transformation in the South African Education System for Learning Disabilities

The role of psychologists and psychometric assessment in the South African education system changed drastically with the adoption of the White Paper 6 on special needs education which aimed at moving education away from psychometric testing and stopping the segregation of learners with special educational needs from mainstream schools (DOE, 2001; Foxcroft & Roodt, 2013). Furthermore, the country has adopted an inclusive education policy to address barriers to learning which incorporates individuals with learning disabilities into mainstream education (Dalton, Mckenzie, Kahonde, 2012). This policy is described in the Department of Education and Training System Framework: Education White Paper 6: Special Needs Education (DOE, 2001).

The National Education White Paper

The main purpose of this policy is to address the various needs of learners who experience learning barriers. The policy is based on the following premises: (1) All children, youth and adults have the potential to learn, given the necessary support, and (2) The system's inability to recognise and accommodate a diverse range of learning needs, results in a breakdown of learning (DOE, 2001; Dalton et al., 2012). The inclusive South African education policy stresses the recognition of individual learning needs and differences as well as the practice of non-discrimination in all contexts (DOE, 2001, Catto, 2008).

Education White Paper 6 distinguishes between two types of barriers namely, systemic barriers such as poverty, and barriers that exist within the child. The paper specifies that these barriers to learning must be properly identified by means of appropriate intervention strategies. The policy further details the move away from segregation to inclusion of learners with learning barriers into mainstream schools. Inclusive schools should be able to host a small number of learners with special education needs while special schools serve as resource centres for the inclusive schools. The policy guide highlights that special schools would host students who require high level support only (DOE, 2001).

Since admissions to special schools are problematic due to high application volumes, learners with severe learning difficulties should be identified timeously in order to secure placement. Assessment practices which identify learners must be in line with the policy which embraces diversity as stated in the EWP6 (DOE, 2001).

The national strategy on screening, identification, assessment and support (SIAS).

This strategy was implemented to guide the inclusive education policy. It defines the process of identification, assessment, and enrolment of learners in special schools. The importance of parental as well as educator involvement is highlighted, and it further provides a guide on how learners should be assessed to determine the most suitable means of assisting them in the learning process (DOE, 2008). The National Strategy on Screening, Identification, Assessment and Support (SIAS), reiterates a shift away from psychometric assessment as it was done in the previous system, since it did not provide appropriate strategies to address the learning needs of individuals (DOE, 2001). The strategy does however recognise the importance of psychometric assessment if the purpose is to inform teaching and learning processes (DOE, 2008).

The SIAS outlines several processes. It describes the process of identification of learner needs in relation to both the home and school context in order to establish the level and extent of additional support required. It also describes the process of enabling access and providing additional support at various levels. The demand for special schools has increased over time and the SIAS documents describe the problems which need to be addressed:

1. The number of learners being referred to special schools from their local mainstream schools is on the increase. In the period 2004 to 2007, the number increased by more than 15 000 learners from 77 752 to 93 000.
2. Access to special services or facilities is limited. This leads to the marginalisation and exclusion of children with additional support needs, including a large number with disabilities. Some are being admitted into mainstream schools, with varying levels of success.
3. There is no system of rigorous assessment and identification to ensure a consistent process of screening, identification, and referral of learners into special schools.
4. A lack of involvement of teachers, parents and learners in the assessment process has been observed.
5. Current assessment practices fail to outline the nature and level of support needed, so it is difficult to fund support appropriately (DOE, 2008).

The aim of the SIAS is to prevent the marginalisation of certain learners and to maximise the participation of learners in the education system. The old system of identifying children with special needs lacked strategies to address the learning needs of the learners. Psychometric assessments as used previously have been done away with but it is acknowledged that they can still add value if they inform teaching and learning processes (DOE, 2008).

The National Strategy on Screening, Identification, Assessment and Support (SIAS), describes a four stage assessment process to identify and assist with barriers to learning. The stages are:

Stage one: Gain background information on the learner.

Stage two: Identify barriers to learning and development.

Stage three: Establish levels of support and an action plan with a ‘support package’.

Stage four: Action planning for the provision and monitoring of additional support.

During stage one, learner profiles are drawn up. This applies to all learners upon entry to schools, particularly those in Grade R and Grade 1. The learner profile is passed on as the learner progresses in school. The school and the teacher takes responsibility for its compilation during this stage. Once the learner profile has been completed, the parent or caregiver might be called in especially if developmental areas or giftedness have been identified.

The parent or caregiver of the learner provides basic information at this stage which will inform an overall picture of who the child is, and what their experiences have been before arriving at the school. Information on the family, family relations and home circumstances are gathered, as well as what strengths, weaknesses and interests there are. This information serves to supplement information already gathered in the learner profile.. This information is important as it may shed light on the level of support available to the learner. Stage one also provides an opportunity to gather information on what the parent/caregiver understands to be the strengths and weaknesses, goals and aspirations, interests, and personality of the child. This gives a better understanding of behaviour displayed other than at school level.

Once all the information has been gathered and the learner has been identified as being at risk, a diagnostic profile is completed. The format of the profile is based on the International Classification of Functioning developed by the World Health Organisation, and it is the responsibility of the health professional to complete. This provides a clearer picture of the functional limitations experienced by children. It does however not indicate what support the learner needs, nor can it be used for educational placement.

Stage two is compiled by the Institutional Level Support team (ILST) in consultation with the teacher and the parent. This section only applies to learners that have been identified as experiencing barriers to learning. The is to accurately assess the factors that may influence the learner’s performance at school, and takes into account curriculum challenges that the learner might experience as well as contextual factors such as parental support or poor teaching which may influence the potential for learning and development.

Stage three is a District-Based Support Team (DBST) function, where an assessment of the level of support required is determined based on the information provided in stages one and two.

Stage four deals with access to the support required, plans around implementation, and the roles and responsibilities of each partner. The partners are educators, parents/caregivers, the Department of Social Development, healthcare providers, and NGOs. This stage is managed by the DBST in consultation with the school. The psychologist is a pertinent role player in this stage and forms part of the DBST.

Even though the process to achieve inclusive education is specified , a number of issues still hamper the functioning of the process. Several studies highlight the fact that educators are neither well prepared nor trained to effectively roll out inclusive education. Furthermore, district support teams are under-capacitated to provide the relevant support and to drive implementation (Dalton et al., 2012; Geldenhuys & Wevers, 2013; Landbrook, 2009). In spite of all the challenges and inefficiencies, it is the researcher’s view that effective implementation of psychometric screening is a viable and meaningful tool for accurate identification of leaners with cognitive barriers to learning, and for the planning of appropriate intervention.

The Relevance of Raven's as a Screening Measure in South Africa

The Education White Paper 6 (EWP 6) prioritises the transformation of practises relating to the identification and psychological assessment of learners who experience barriers to learning (DOE, 2001). This stems from the realisation that there are other factors that contribute to these barriers such as language, poverty, social class, health, and race. Pretorius (2015), in her study on the relationship between socio-demographic factors and psychometric screening performances of primary school children with barriers to learning, found that language, parental education level and the employment status of parents and caregivers, had no effect on the test performance of her sample on the Raven's Coloured Progressive Matrices (CPM). As mentioned in Chapter 1, the sample used by Pretorius (2015), is exactly the same sample as used for this research study.

One of the arguments levelled against the usage of psychometric assessments in school as mentioned by Setshedi (2008), is that it labels and marginalises certain children because the content is culturally irrelevant to them and the norms are therefore inappropriate. The language is often problematic both in terms of administration of the tests and language usage in the test items (Nell, 1994). The language used in a test is an important variable that impacts on test performance, especially in the South African context which has eleven official languages (Setshedi, 2008).

With the arguments levelled against the uses of psychometric assessment (Nell, 1994; Setshedi, 2008), and the need for a different and appropriate approach to identify and assess learners (EWP 6, 2001), the Raven's CPM stands out as an appropriate psychometric tool that can aid in the identification and psychological assessment of learners who experience cognitive barriers to learning in South Africa. The measure has been cited as the most culturally reduced measure (Raven, Court, & Raven, 1990), and a later study by Pretorius

(2015) supports these earlier findings. Knoetze et al. (2005), consider Raven's CPM an effective screening measure that can be administered to either groups or individuals.

Conclusion

In South Africa there remains a serious need for updated and relevant psychometric norms that will cut across ethnic groupings and various disabilities to ensure that the process of screening forms an important valid and reliable part in the early detection of children with learning barriers. Finding suitable measures that guide professionals in this regard is challenging. This study endeavours to develop a set of Raven's CPM normative data for South African children with learning barriers or problems for the purpose of assisting in the detection of at risk learners..

In South Africa we have a host of articles and books by local researchers which focus on multicultural psychometric testing, specifically with white and black racial groups (Knoetze, Bass & Steele, 2005; Linstrom et al., 2008; Vass, 1992), but they are prone to giving less attention to individuals with disabilities and learning disabilities. This study seeks to address the field of culture fair cognitive psychometric screening in South Africa by means of extending the use of Raven's CPM as a screening measure for learning disorders or barriers to learning.

Chapter 4

Methodology

Introduction

This chapter describes and explores the aims and objectives of the research and methodological design that was used in this study. The research design, which drew on the use of archival data, is discussed. The selection of the participants in the study and the sampling procedure are described together with the data analysis techniques. A further review of the psychological measure, the Raven’s CPM which was used in this study, is also provided. Finally, ethical considerations pertaining to the study are addressed in this chapter.

Research Aims and Objectives

The aim of this study was to create normative data for a special population group, namely South African children with identified cognitive barriers to learning.

The objectives were as follows:

1. To establish Raven’s Coloured Progressive Matrices age norms for children identified as having cognitive learning barriers.
2. To establish Raven’s Coloured Progressive Matrices grade norms for children identified as having cognitive learning barriers.
3. To compare these norms against published local and international norms.
4. To establish pilot Raven’s Coloured Progressive Matrices cognitive classification categories for the purpose of psychometric screening of children with probable learning disabilities.

Research Design

This study used a quantitative exploratory- descriptive research design with the aim of developing normative psychometric data based on an analysis of archival participant biographical and psychological test data. Exploratory-descriptive research according to Cozby and Bates (2011), involves providing accurate and detailed descriptions of observed information about a specific phenomenon or construct.

The data was drawn from the files of a university psychological clinic based in the Eastern Cape of South Africa. Both descriptive and inferential statistics were used. Descriptive research attempts to describe variables and provides a description of a situation while inferential statistics allow the researcher to look for trends and relationships (Struwig & Stead, 2001). In light of the aims of study, the research design allows for the development of local norms for Raven's CPM for the target population under study.

Archival data implies using information collected by someone else, for other research projects or for some purpose other than the one currently considered (Cnossen, 1997). Due to tradition in research methodology, the establishment of research norms has usually focused on the collection and analysis of new data. This trend resulted in the development of skepticism over the use of archival data. However, this position now seems to be shifting. In 1991 for example, the *Developmental Psychology Journal* published a special issue on secondary data analysis. This followed despite the fact that developmental psychologists' interests rest primarily with developmental changes over time. The required longitudinal data for such an analysis and understanding posited a shift from the tradition of collecting new data for every research project (Brooks-Gunn, Phelps, & Elder, 1991; McCall & Appelbaum, 1991).

This research project which focused on providing normative data for a specific population group, used data collected from 2002 until 2009. This seven-year collection of data was part of a project conducted by the Community Psychology Clinic at the former Vista University Missionvale campus. The clinic, at the time, was approached by several primary schools in the Nelson Mandela Metropolitan area to conduct psychometric screening assessments on learners identified as having learning barriers. All the assessment results were recorded and stored in a centralised database. The use of the archived data from this project consequently allowed the researcher to gather appropriate information regarding the development of the Raven's CPM norms for this population, namely children with learning difficulties. The data collected comprised of 394 participants. The researcher found value in using the archived data base as it spoke directly to the aims of the current project, and the collection of new data would in all probability not have yielded any different results from that which had already been collected. A decision was therefore made to use the available data set and to extract relevant information from it.

Sampling and Participants

A sample selection was made by means of non-probability sampling. In this type of sampling the odds of knowing the population size and its members is unknown to the researcher (De Vos, Strydom, Fouché, & Delport, 2005).

The Community Psychology Clinic situated on the former Vista Missionvale campus was approached by several primary schools in the Nelson Mandela Metropolitan area to conduct psychometric screening assessments on learners who had already been identified by the respective Institutional Level Support Teams (ILST) as having learning barriers. The sample that subsequently became available consisted of Afrikaans, English and Xhosa speaking learners from schools that were geographically located around the Missionvale campus. The age of the participants ranged from 6 years to 15 years, and educationally they were spread from Grade 1 to Grade 7. The learners had been identified by their respective class teachers on the basis of their consistently poor scholastic performance and progress.

Personal details of each of the learners was obtained by means of a biographical questionnaire which was completed by their parents or caregivers with assistance from the teachers, if required. All the personal participant information and psychological test assessments were recorded and stored in a centralised database.

Inclusion criteria. The participants attended mainstream schools at the time of the assessment and were included in the study if they had been identified by their teachers as having barriers to learning at school level. The ages of the participants who were assessed ranged from 6 years 1 month to 15 years 4 months.

One of the research objectives was to compare the norms obtained from this study's population sample to selected relevant published norms. The same age range was used as those published in the Raven's CPM manual for the purpose of statistical comparison with international published norms. Technically, the Raven's CPM is designed to assess non-verbal reasoning from the age of 5 years 0 months to 11 years 6 months (Raven, 2000).

Exclusion criteria. Participants were excluded if informed consent and biographical information documentation was incomplete. Incomplete protocols or spoilt non-scorable test answer sheets were also excluded from the data analysis.

Procedure

The study used archival data collected from a university clinic in the Nelson Mandela Metropolitan area. The data sets consisted of completed consent forms, biographical questionnaires and the completed and scored Raven's CPM protocols. The final sample after applying the inclusion and exclusion criteria consisted of 388 primary school children. According to the European Federation of Psychologists Association (EFPA, 2013), a sample of 300 is considered a large sample. These EFPA (2013) guidelines have been adopted by the

Health Professions Council of South Africa's Professional Board for Psychology to aid the review and classification of psychometric measures (HPCSA, 2015).

As mentioned above the children in the sample were identified by Institutional Level Support Teams (ILST) at the various schools primarily on the basis of their consistently poor scholastic performance and progress. The broader battery of administered psychometric assessments or tests included the Bender Gestalt, the Rey-Osterrieth Complex Figure Test, and the Raven's CPM that was used for this study. This test battery provided information to guide further intervention in the schools or by the Department of Education. The parents and caregivers of the children were required to complete consent forms, giving permission for the assessment and consenting that the data may be used for research purposes. Biographical questionnaires also had to be completed by the respective parents/caregivers. Permission was also obtained that feedback could be given to the schools. The consent forms and the biographical questionnaires were made available in both English and Afrikaans. (See Appendix A)

Administration Procedure

Group administrations of the psychological tests were conducted with the children who were grouped according to age and language medium. The assessment groups consisted of no more than 25 learners per session with three test administrators allocated to each venue. The venues were either at the relevant schools or at the university clinic with a teacher who was familiar to the children present during the assessment. (See Appendix B)

Great care was taken to ensure that the testing environment was conducive for testing. Each learner was seated at a separate desk in the venue which was equipped with an overhead projector since the Raven's CPM was adapted to be administered by means of overhead transparencies projected onto a large screen. The Raven's CPM was administered at each session and the participants were provided with a pencil, eraser and the Raven's CPM answer sheet. The main administrator provided instructions on how to answer the items while two co-administrators walked around the room making sure that each of the learners followed the instructions and rendering assistance where necessary. The Raven's CPM items were presented individually in the standardised sequence by means of the overhead projector. (See Appendix C)

The assessment and test instructions were conducted in the participant's language of instruction which was either in English or Afrikaans. All the test administrators were trained and familiar with the administration and scoring procedures. Subsequent to the testing sessions, the administrators scored the test protocols and captured the results on a standardised summary school feedback report.

From the process notes written at each test session, no personal or psychological problems manifested or were noted during the administration of the Raven's CPM or any of the other measures that formed the total administered battery.

Research Measure

The Raven's Coloured Progressive Matrices (CPM) was selected as a screening measure. The test is considered to be one of the best displays of a culture free intelligence test (Hogan, 2003). According to Gregory (2004), the Raven's Progressive Matrices are culturally reduced because the test itself does not contain a single word in any language. The intention of a culture fair test is to reduce cultural bias, which comprises to a large degree of language (Foxcroft & Roodt, 2009).

The Raven's Progressive Matrices (RPM) was initially designed as a measure based on the fundamentals of Spearman's 'g' factor. It was first introduced in 1938 as a non-verbal test of individual logical thought process based on figural stimuli (Gregory, 2004). The RPM can be administered in a group or individually as a measure of non-verbal general intelligence in children and adults. According to Raven and Court (1998), RPM is used as a tool of assessment to quantify and evaluate an individual’s observation and rational thinking abilities, regardless of their own past encounters and existing verbal abilities. They further state that it assesses an individual’s capacity to cope with significant symbols, ability to understand the correlation between symbols, and one’s aptitude for logical thinking.

The Raven’s Progressive Matrices consist of three published versions namely the Standard, Coloured, and Advanced Progressive Matrices. The Coloured Progressive Matrices were used as the research measure in this study.

The Coloured Progressive Matrices (CPM) are based on the same principle as the Raven’s SPM, but it is firstly in colour in order to be visually stimulating to children and to help sustain their motivation and attention. Secondly, it is intended to assess, as accurately as possible, testees present clarity of observation and their level of non-verbal intellectual development (Martin & Wiechers, 1954; Raven, 2000; Raven et al.,1995).

The Raven’s CPM was initially standardised in the United Kingdom in 1949 on 627 Scottish school children (Raven et al., 1995). At the time the target population under investigation differed from the Raven’s SPM and the Raven’s APM, as it was specifically developed for children aged five to eleven years and individuals who are senile, mentally handicapped, had physical disabilities (e.g. aphasia, cerebral palsy or hearing impairments), had no common language, or were deteriorated or impaired (for example elderly clients) (Raven et al., 1995). Raven (2000) indicates that prior to a person’s *mature* capacity to form comparisons and reason by analogy (as is the case of children or mentally impaired people) or in instances where that capacity has become impaired due to neurological damage at a later stage in life, the Raven’s CPM will depict the degree to which the individual’s ability to observe or think logically has developed, or the degree to which it has deteriorated.

The Raven's CPM comprises 36 problems divided into three Sets (Set A, Ab and B), each containing twelve problems (Cotton, Kiely, Crewther, Thomson, Laycock, & Crewther, 2005; Tzuriel, 2001). Each item in the Sets consists of a single drawing or *matrix* of a pattern from which a specific piece is missing. Below the matrix, six patterns are printed which have a probability of fitting into the gap left open in the top drawing. From this, the respondent has to choose which of the six alternatives will form the best match (Cotton et al., 2005). Thus, "the respondent has to deduce a relationship on the completed part of the matrix, and then apply the relationship to the incomplete part" (Tzuriel, 2001, p. 33) since the test requires the testee to make comparisons, to perceive and organise space, to analyse visual stimuli and to think analogically (Tzuriel, 2001).

It is important to note that the items in each Set increase progressively in difficulty, and so do the Sets themselves, as knowledge acquired through answering previous items serves as fundamental building blocks to answer subsequent, more 'advanced' items. In other words the person is expected to learn from earlier items (Van den Heuvel & Smits, 1992). Cotton et al. (2005) add that the Sets in the Raven's CPM have been particularly designed to "distinguish between the degrees of intellectual maturity by quantifying a child's (or handicapped adult's) ability to form comparisons and to reason by analogy" (p. 648). To further clarify matters, Set A is recognised for changing the optional or alternative patterns first in one direction and upon increasing difficulty into two opposite directions, whereas Set Ab measures the testee's ability to identify discrete figures as spatially related wholes. Set B, on the other hand is the most 'difficult' set in Raven's CPM and involves analogies to evaluate whether or not the testee is capable of abstract thinking and processing (Raven, 2000).

The overall goal of the Raven's CPM is thus to measure a testee's capacity to grasp the principle underlying a problem and to apply the newly acquired principle to novel problems that need solutions (Tzuriel, 2001).

It is of high importance for the professional or tester to present the test Sets in order, since they follow a set sequence (Tzuriel, 2001). The testee should be allowed to proceed from Set A through to Set B without interruptions or being bound by time limitations because no additional assistance is allowed. All testees regardless of age are given the same Sets of problems and the Raven's CPM can be used for either individual or group assessments (Raven, 2000).

Reliability and validity studies have demonstrated that the Raven's CPM is both reliable and valid. The reliability coefficient has been found to range between 0.8 and 0.90, which is considered high and acceptable (Raven, 1995). Similarly, the validity coefficient ranges from 0.4 to 0.6, which is also considered high (Raven, 1995).

In South Africa there are two published studies on establishing local norms for the Raven's CPM on a normal population. Knoetze, Bass and Steele (2005), conducted a study in the Grahamstown area on black-Xhosa speaking disadvantaged learners between the ages of 7years to 16 years 5 months, and Linstrom, Raven, van Rooyen and Partners, (2008) conducted a study in the Free State province on learners between the ages of 6 years to 12 years 8 months. To expand our knowledge of normative data with respect to Raven's CPM this study focuses on establishing norms for children with learning barriers and comparing these norms with the manualised 1979 British norms and recent local South African published norms. A set of cognitive classification scores is also developed to aid in the screening process of at risk learners.

Scoring Procedures

The test protocols of the Raven's CPM were scored by trained test administrators and scorers who were either psychologists or psychometrists-in-training. The measure was scored using the published criteria contained in the test manual (Raven et al., 1998).

The total number of correct responses for each participant was recorded and the total raw scores that were calculated were used for data analysis.

Data Analysis

The data was analysed using a variety of analyses including descriptive and inferential statistics. Descriptive statistics such as the mean, standard deviation, range and frequency distribution were calculated for each age group at half yearly intervals (Babbie & Mouton, 2004; Wilson & Maclean, 2011).

Inferential statistics were calculated in order to draw comparisons between the variables. This method allows one to query or interrogate a sample from the population and then to make inferences about the characteristics of the population at large (Struwig & Stead, 2001).

For the purposes of this study the researcher performed a series of analyses of variance (ANOVAs) to determine if there is equivalent performance or significant differences in performance within and between various groups such as gender and age of participants in the study. A Bartlett test was used to verify the assumption that variances are equal across groups or samples. The Bartlett test is used to test if k samples are from populations with equal variances. Equal variances across samples is called the homogeneity of variances (Snedecor and Cochran, 1989).

To compare the new and specifically created norms to the published norms, the researcher ran a robust t test using MM estimation and then corrected for a Type 1 error by using Bonferroni corrections.MM-estimation is a commonly used robust regression technique; it is a combination of high breakdown value estimation and efficient estimation, which was introduced by Yohai (1987). The Bonferroni method or correction is used to counteract the problem of multiple comparisons (Abdi, 2007; Multiple Comparisons, 2015). The same correction was also used in this research for the school grade comparisons. The premise of this correction is based on the idea that if an experimenter is testing a dependent or independent hypotheses on a set of data, one way of maintaining the familywise error rate is to test each individual hypothesis at a statistical significance level of 1/n times what it would be if only one hypothesis were tested (Abdi, 2007).

A set of pilot cognitive classification categories for identifying children with probable learning disabilities was developed which would aid in early intervention of at risk learners. Five grades of classification categories were used based on the raw scores of each age group.

Ethical considerations

The following ethical considerations were taken into account in the research design and procedures to protect the rights and well-being of the research participants.

In conducting research, one must behave in an ethical manner by always upholding the philosophy of beneficence and justice (Ethics in Health Research in South Africa, 2000; Health Professions Council of South Africa, 2005). It is the responsibility of the researcher not to cause any harm to the research participants. No untoward reactions or experiences were noted with any of the participants during the data gathering or testing phase, and to date there have been no reported adverse manifestations or outcomes due to being included in this cognitive screening and research project which took place several years ago.

South African researchers have an ethical and moral responsibility to ensure that their research is relevant to both the country's health and development needs (Ethics in Health

Research in South Africa, 2000). As mentioned by Knoetze et al. (2005), and Linstrom et al. (2008), South Africa is in need of assessment measures which are normed for the local population. This study will contribute to the generation of these much needed norms.

The researcher has to possess a level of competence to be able to carry out a research study. Being technically sound in psychometrics as well as adopting a humanistic approach is vital (Health Professions Council of South Africa, 2005). In the current study the research assistants were all postgraduate psychometry students who were trained in the administration and scoring of Raven's CPM, and they worked under the supervision of a qualified and registered psychologist who was a university lecturer.

The current study used data collected at the Missionvale Campus Psychology Clinic of the Nelson Mandela Metropolitan University. The project was a clinical/psychometric screening intervention initiated by primary school principals in the area as the referring sources. The learner's parents or caregivers together with the principals consented to the group intervention strategy. Informed consent was given by the parents and caregivers at the time of the project. The consent form states that the results may be used for research purposes.

The participants, headmaster, and schools received confidential feedback in the form of a summary report after administration of the screening measure. The recommendations made after the screening assessment indicated whether each individual participant either needed or did not need to be referred for further comprehensive psychological assessment. Both confidentiality and anonymity is further maintained because the data or results are presented as grouped data in the form of set norms for this particular population.

The actual primary and secondary data continues to be stored at UCLIN as per professional guidelines and ethics.

Conclusion

The research methodology of the present study was discussed in this chapter. The study used a quantitative design with the aim of developing a new set of local normative data for the Raven's CPM based on the use of archival data accessed from a psychological screening project conducted under the auspices of a university psychology clinic. Information regarding the method, the sampling, the participants, the research measure, and the data analysis was reviewed. The chapter also offered a discussion of the ethical considerations pertaining to the current study.

The following chapter presents the results of the research.

Chapter 5

Results

Introduction

This chapter presents the results obtained from the research study. The study focused on the development of normative data for learners identified as having cognitive barriers to learning, using the Raven’s CPM. The study essentially aimed at developing norms for age, and school grade. Furthermore, a comparison was made between the existing British and South African Raven’s CPM norms and the findings of the current study. The study also aimed to develop cognitive classification categories for the early identification of learners who may be at-risk to experiencing cognitive barriers. In doing so, this study will contribute to a much needed area of research that focuses on relevant normative studies.

The chapter is divided into two sections. First, descriptive statistics are presented in the form of graphs and tables, providing the reader with the characteristics of the sample, specifically in terms of age, gender and grade. However, other descriptive variables are presented as well. Second, the inferential statistics presented focus on the obtained norms and cut-scores. Tables generated by the statistical analysis provide summarised descriptions of the findings. The existing published norms, both British and South African – are then compared with the norms established by the current study. The aims of the study are also being highlighted in relation to the results and the pertinent literature. This allows for elaboration regarding the significance of the current findings when compared with those findings that are already published.

Descriptive Analysis

This section presents the participant learners' demographics as well as their socio-economic characteristics.

Gender

The final data set comprised of 388 participants. Not all the learners reported their gender and were excluded from the data analysis. The obtained sample comprised more boys than girls. Of the 388 learners who reported their gender, there were 233 (60%) males and 155 (40%) female, as shown in Fig 1.1.

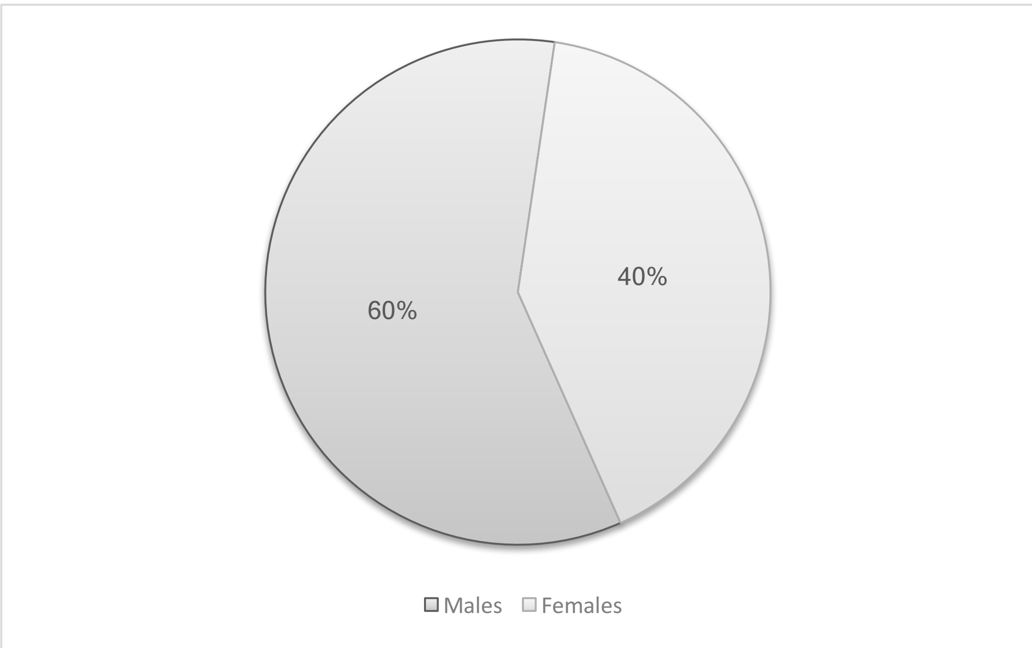

Figure 1.1. Gender distribution chart.

Age

Age was almost normally distributed with the majority of the learners being aged between 8 years to 12 years old. The majority of the learners were aged 9.5 years with a frequency of 60 learners. The mean age of the participants was 9.9 years (Mean=9.95; Standard Deviation=1.8). The age distribution of the sample highlights that some schools in the Nelson Mandela Metropolitan area have learners over the age of 13 years who are still in primary school while the number of leaners aged 13 and upwards is relatively small when compared to the other age groups. Twelve learners nevertheless were found to be in the 14 to 15 year age category.

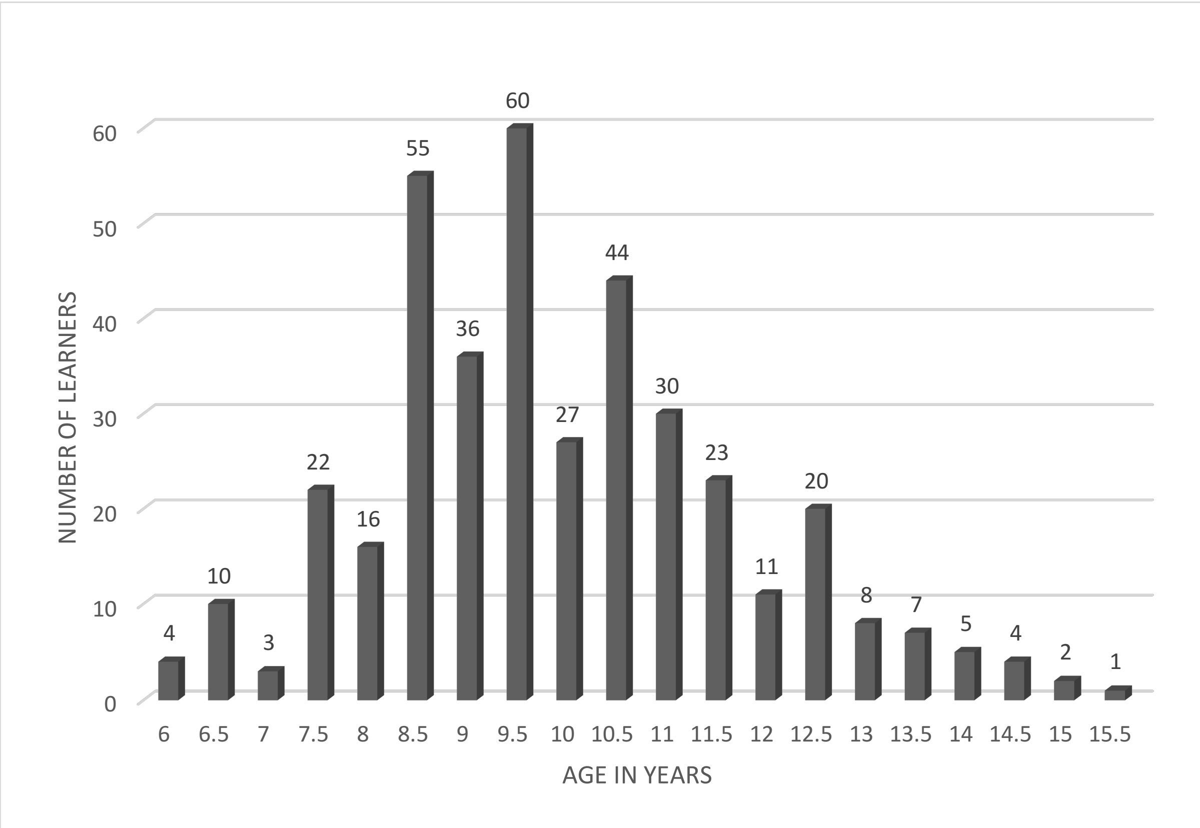

Figure 1.2. Age distribution.

There was a statistically significant difference between the mean age for boys (Mean 10.12; Standard Deviation=1.84) and girls (Mean=9.65; Standard Deviation=1.70) with a p-value <0.05 (P-value=0.01). The finding indicates that the progression of boys at Primary School is slower than the girls.

Grade

The majority of the learners: 26% (104 learners) and 25% (99 learners) in this study were in Grade 3 and Grade 4 respectively. The grade with the lowest proportion, namely 4%, of learners who took the tests, was Grade 7 (15 learners). The rest of the distribution is shown in Fig 1.3.

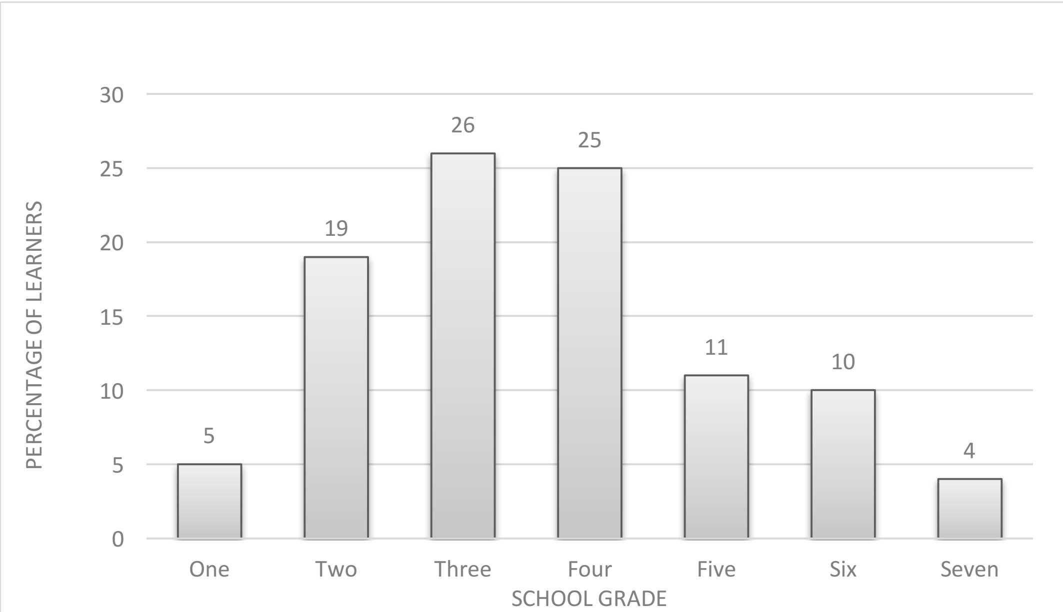

Figure 1.3. School-Grade distribution.

Distribution of other variables stratified by gender

To determine if there were any significant differences between males and females for each variable, a series of Chi-square tests were done with cross tabulations between each variable and gender. The variables that were described and assessed for differences by gender were: grade, home language, mother’s education, father’s education, primary caregiver, and caregiver’s employment status. Two variables, namely mother’s and father’s education were categorised into 4 levels of education; (i) no or low primary education (Grade 0-4), (ii) some primary or secondary education (Grade 5-8), (iii) secondary education (Grade 9-12), and (iv) post-matric. In the case where some of the group categories had less than 5 observations, the exact test was used instead of a chi-square test. There was no relationship found between any of these major variables and gender. All the p-values of association were greater than 0.05 ($p>0.05$), showing that there was no difference between males and the females on these variables.

Tables 1.1 to 1.6 provide additional descriptive information about the sample obtained for this study. The home language distribution of the test takers was 79% Afrikaans speaking, 10% Xhosa, and 9% English. Slightly more than half of the participants in the sample came from households where the caregiver was unemployed. A total of 53% of the caregivers in this sample was unemployed compared to 47% that was employed. Pretorius (2015), who utilized the same data set, found that the caregiver's employment status as displayed in Table 1.6 had no significant bearing on the test performance of the sample under investigation. She further found that neither the language of the participants nor the education of the caregivers had a significant impact on the test performance of this sample. Similar findings are replicated in this study in that these socio-demographic factors or variances were statistically equivalent for boys and girls. Both genders originated from similar backgrounds with respect to having predominantly Afrikaans speaking homes with high rates of Caregiver/Parent unemployment and relatively low levels (sub-matric) of parent education.

The results for all the comparisons in each variable against gender are shown in Table 1.1 to 1.6. Not all the caregivers and parents reported on some of the information and was thus excluded from the analyses below.

Table 1.1

Grade distribution by gender

Variable	**Gender**			
Grade	Male n (%)	Female n (%)	Total n (%)	p-value
1	10(4)	9(6)	19(5)	0.25
2	46(20)	28(18)	78(19)	
3	55(24)	49(32)	104(27)	
4	62(27)	36(23)	99(25)	
5	25(11)	18(12)	43(11)	
6	27(12)	8(5)	35(9)	
7	8(3)	7(5)	15(4)	
Total	233	155	388	

p-value>0.05

Table 1.2

Language Distribution by Gender

Variable	**Gender**			
Language	Male n (%)	Female n (%)	Total	p-value
English	17(7)	17(11)	34(9)	0.103
Xhosa	20(9)	18(12)	39(10)	
Afrikaans	192(82)	115(74)	307(79)	
English and Afrikaans	4(2)	2(1)	6(2)	
English and Xhosa	0(0)	3(2)	3(1)	
Total	233	155	388	

p-value>0.05

Table 1.3

Type of Caregiver Distribution by Gender

Variable	**Gender**			
Caregiver	Male n(%)	Female n(%)	Total	p-value
Mother and Father	112(50)	68(45)	180(48)	0.86
Grandmother and/or Grandfather	23(10)	18(12)	41(11)	
Mother only	74(33)	52(35)	126(34)	
Father only	2(1)	2(1)	4(1)	
Other	12(5)	10(7)	22(6)	
Total	223	150	373	

p-value>0.05

Table 1.4

Mother's Education Distribution by Gender

Variable	**Gender**			
Mother's education	Male n (%)	Female n (%)	Total	p-value
Grade 0-4	4(2)	4(3)	8(2)	0.87
Grade 5-8	65(33)	40(30)	105(32)	
Grade 9-12	123(62)	84(64)	207(62)	
Above Matric	8(4)	4(3)	12(4)	
Total	200	132	332	

p-value>0.05

Table 1.5

Father's Education Distribution by Gender

Variable	**Gender**			
Father's education	Male n (%)	Female n (%)	Total	p-value
Grade 0-4	2(1)	0(0)	2(1)	0.74
Grade 5-8	43(29)	30(33)	73(30)	
Grade 9-12	100(67)	58(64)	158(66)	
Above Matric	4(3)	3(3)	7(3)	
Total	149	91	240	

p-value>0.05

Table 1.6

Caregiver's Employment Status Distribution by Gender of Learners

Variable	**Gender**			
Caregiver's employment status	Male n (%)	Female n (%)	Total	p-value
Employed	108(49)	66(45)	174(47)	0.46
Unemployed	113(51)	81(55)	194(53)	
Total	221	147	368	

p-value>0.05

Inferential Statistics

Analysis of differences in Raven's CPM scores by Age, gender and Grade

Age Differentiation: To investigate whether, as in the case with a normal population, individuals with Barriers to Learning also show systematic progress in their Raven's Matrices raw scores with increasing age, a one-way ANOVA was used. As shown in Table 2 the calculated 'F' value was found to be statistically significant at $p < 0.05$ (p-value=0.000 F value=3.06). As age increases, Raven's CPM Score also increases. A Bonferroni test for multiple comparisons revealed statistically significant differences between age group 6.5 with age groups 10, 10.5, 11, 11.5, 12, 12.5, 13 and 13.5 years. Table 2 summarises the ANOVA results. To test for the assumption of equality of variance for an ANOVA test, a Bartlett's test was performed. Below the table are the results of the Bartlett's test of equality of variance with a $p>0.05$ (p-value=0.151) which shows that there is equality of variance hence the one-way ANOVA is a valid test for this analysis.

Table 2

One-way ANOVA Results for the Differences between Age Groups in Raven's CPM

Source	Sum of squares	Degrees of freedom	Mean of Squares	F-value	Prob>F
Between groups	2653.84913	19	139.67627	3.06	0.0000
Within groups	17073.3419	374	45.6506467		
Total	19727.191	393	50.1964147		

*Bartlett's test for equal variances: chi2 (18) = 24.1182 Prob>chi2 = 0.151

In Table 3, a summary of the mean Raven's CPM scores by age categories is provided. The table also shows the standard deviation, the range (minimum and maximum score), and the number of learners in each age group.

Table 3

Mean Raven's CPM scores by Age Category

Age	**Mean CPM Score**	**Standard deviation**	**Range (Min- Max)**	**Number of learners**
6	20	9.3	15-34	4
6.5	11.2	3.5	5-17	10
7	16.3	0.6	16-17	3
7.5	17.3	6.4	1.5-27	22
8	16.7	6.5	8-30	16
8.5	17.4	6.3	3-31	55
9	18.8	7.4	6-33	36
9.5	18.8	6.8	5-33	60
10	20.6	6.3	7-31	27
10.5	21.2	6.8	6-33	44
11	22	6.7	6-33	30
11.5	21.4	5.7	9-32	23
12	21.9	8.5	9-31	11
12.5	22.9	6.5	12-34	20
13	24.1	9.9	8-34	8
13.5	23.5	4.81	17-32	7
14	23.8	7.7	12-33	5
14.5	23	10.1	11-35	4
15	14.5	14.8	4-25	2
15.5	31	-	31-31	1

Fig 1.4 shows that there is a directly proportional relationship between age and the mean Raven’s CPM scores. As age increases, despite small anomalies, mean Raven’s CPM scores also increase. As observed, the mean Raven’s CPM score for the 15.5 year olds is the highest. However, it is important to note that there was only one participant in this age category.

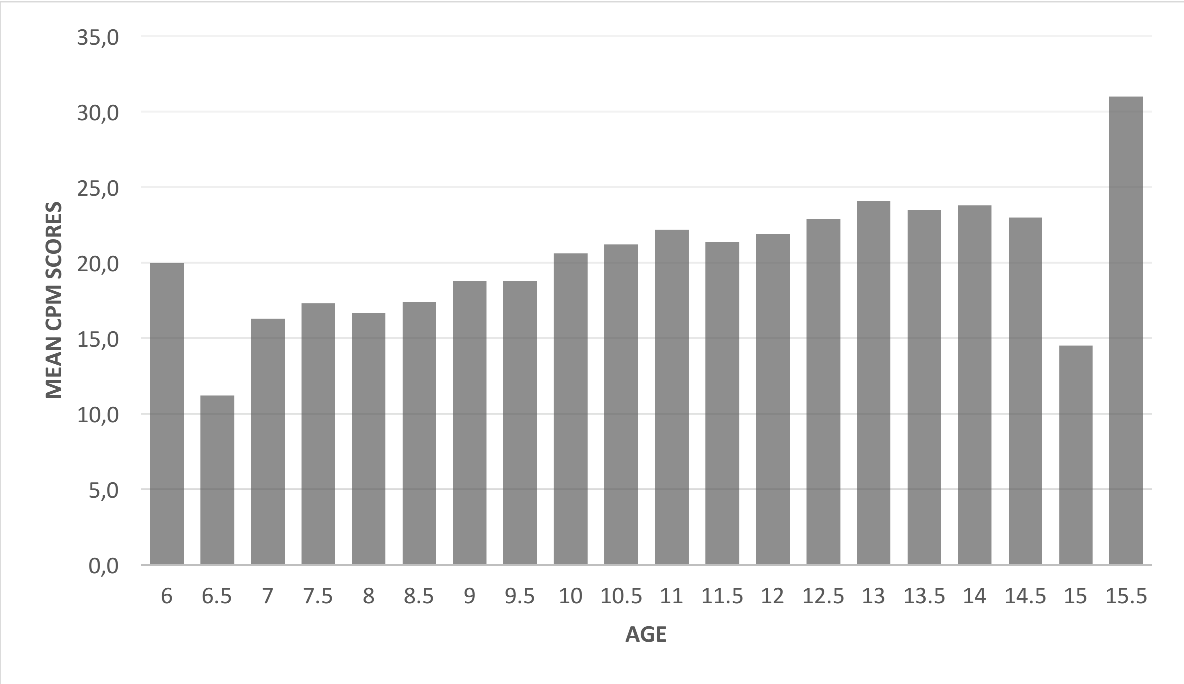

Figure 1.4. Distribution of mean CPM scores by age

Gender differences: To test the hypothesis on invariance of Raven’s CPM test scores across gender, a t-test for two independent samples was performed on the CPM scores of males and females in each age category. The calculated t-scores showed that for many of the groups there is no significant difference ($p>0.05$), however the males seem to have a trend to outperform the females. Table 4 shows the t-test results for the comparison of Raven CPM test scores between the males and females according to each age category from the ages of 6 through to 15.5 years.

Table 4:

Gender Differences on Raven's CPM test Performance for Children Aged 6-15 years

Age group	Males		Females		t-score	df	P-value
	n	mean	n	mean			
6	2	24.5	2	15.5	0.95	2	0.44
6.5	5	11.8	5	10.6	0.52	8	0.62
7	2	16.5	1	16	-	1	-
7.5	10	17.9	12	16.7	0.675	20	0.42
8	8	15.5	8	17.86	-0.723	14	0.48
8.5	32	19	23	15.4	2.16	53	0.04*
9	29	19.8	7	14.4	-1.01	34	0.08
9.5	29	19.4	31	18.2	0.719	58	0.47
10	11	24.9	16	17.4	3.577	25	0.002*
10.5	23	21.9	21	20.5	0.695	42	0.49
11	21	22.67	9	21.22	0.5345	28	0.60
11.5	18	19.11	5	19.3	0.772	21	0.45
12	7	27.6	4	14.3	3.97	9	0.003*
12.5	18	23.2	2	23.5	-0.0563	18	0.96
13	7	23.4	1	29	-	6	-
13.5	2	26.5	5	23.6	0.769	5	0.48
14	3	28.3	2	17	2.37	3	0.098
14.5	4	23	-	-	-	-	-
15	1	25	1	4	-	0	-
15.5	1	31	-	-	-	-	-

***p-value<0.05**

Grade differences: To test the hypothesis which states that individuals show systematic progress in their scores in Raven's Matrices tests with increasing grade, a one-way ANOVA test was used. The calculated F-value was found to be statistically significant at $p < 0.05$ (p-value<0.001 F value=11.9). The finding here is that there is an association between grade and the Raven's CPM scores; as the grade increases, so does the CPM score. A Bonferroni test for multiple comparisons revealed statistically significant differences between Grade 1 and all the subsequent grades from Grade 4 to Grade 7. However, there were significant differences between Grade 2 and Grades 4, 5, 6 and 7, as well as between Grade 3 and Grades 4, 5, 6 and 7. There were no significant differences between Grades 4, 5, 6 and 7 when compared to each other. Table 5 summarises the ANOVA results. Below the table are the results of the Bartlett's test of equality of variance with a $p>0.05$ (p-value=0.54) which shows that there is equality of variance between grades; hence the one-way ANOVA is a valid test for this analysis.

Table 5

One-way ANOVA Results for the Differences between Grades in Raven's CPM

Source	Sum of squares	Degrees of freedom	Mean of Squares	F-value	Prob>F
Between groups	3073.7393	6	512.2898	11.9	0.0000
Within groups	16653.4517	387	43.0321749		
Total	19727.191	393	50.1964147		

*Bartlett's test for equal variances: chi2 (6) = 4.9975 Prob >chi2 = 0.54

Establishment of Raven's CPM Score Norms for Age, Grade and Gender

Age Specific Norms: To establish Raven's Coloured Progressive Matrices age norms for children identified as having cognitive learning barriers, a detailed summation of the Raven's CPM scores was done with the data sorted by age group. Percentile scores were recorded from the 5th to the 95th percentile for each age category. Age categories were calculated as a range and a uniform difference of 0.5 years was used to separate each age group. The norms for each age category are presented in Table 6 and 7. For convenience purposes the sample was split into two age range tables (i.e. lower age range, 6 to 10.5 years and upper age ranges 11 to 15.5 years).

Table 6

Smoothed Raven's CPM Percentile Norms for the Lower Age range

PERCENTILE	**CHRONOLOGICAL AGE IN YEARS**									
	6 *(n 4)*	**6.5** *(n10)*	**7** *(n 2)*	**7.5** *(n22)*	**8** *(n16)*	**8.5** *(n55)*	**9** *(n36)*	**9.5** *(n60)*	**10** *(n27)*	**10.5** *(n44)*
95	34	17	17	26	30	27	33	32	28	31
90	34	16	17	24	28	26	30	27	27	31
75	25	13	17	22	20	22	24	23	25	26
50	16	12	16	18	16	18	18	19	22	22
25	15	9	16	15	12	13	12	13	18	16
10	15	5	16	12	9	10	11	11	10	12
5	15	5	16	2	8	8	7	8	9	11

Table 7

Smoothed Raven's CPM Percentile Norms for the Upper Age range

PERCENTILE	**CHRONOLOGICAL AGE IN YEARS**									
	11 *(n30)*	**11.5** *(n23)*	**12** *(n11)*	**12.5** *(n20)*	**13** *(n8)*	**13.5** *(n7)*	**14** *(n5)*	**14.5** *(n4)*	**15** *(n2)*	**15.5** *(n1)*
95	31	31	31	33	34	32	33	35	25	31
90	30	29	30	30	34	32	33	35	25	31
75	28	25	29	29	32	27	26	31	25	31
50	24	22	26	21	28	22	26	23	15	31
25	17	18	13	19	16	21	22	16	4	31
10	13	13	11	15	8	17	12	11	4	31
5	12	13	9	14	8	17	12	11	4	31

Grade specific norms: To establish Raven's Coloured Progressive Matrices grade norms for children identified as having cognitive learning barriers, a detailed summation of the Raven's CPM scores was done with the data sorted by grade. Percentile scores were recorded from the 5th to the 95th percentile for each age grade. The norms for each age category are presented in Table 8.

Table 8

Raven's CPM Percentile Norm Ranks by Grade

Percentile	**Learner Grade**						
	One	Two	Three	Four	Five	Six	Seven
95	34	26	30	33	31	33	35
90	28	24	27	31	30	31	34
75	17	21	23	26	29	29	31
50	15	16	18	22	23	22	26
25	11	11	13	18	19	17	22
10	7	9	10	12	13	12	11
5	5	5	7	12	11	9	4
n	19	74	103	99	43	35	15

Comparison of the local mean CPM scores for Grahamstown and the current study

A series of t-tests for two independent samples were performed for the mean Raven's CPM scores of the Grahamstown study (Mean 2 in Table 9) and the current study (Mean 1 in Table 9). There were no significant differences between the mean age related Raven's CPM scores of the current study results and the Grahamstown study (t-test=-1.50; p-value=0.29). This highlights that although the Raven's CPM test is often criticised for not being tailored to meet local language needs, it is still a valid test for assessing learning disabilities in other settings.

Table 9

T- test Comparing the Mean Raven's CPM Scores of the Current Study and the Grahamstown Study

Variable	Observations	Mean	Std. Err.	Std. Dev.	[95% Conf Interval]	p-Value
Mean 1	20	15.56	0.96	4.28	13.56 - 17.56	0.29*
Mean 2	20	17.52	1.59	7.10	14.19 - 20.84	
Combined	40	16.54	0.93	5.87	14.66- 18.42	
diff	-1.95	1.854	-5.70	1.79		

Pr (T < t) = 0.14 Pr(T > t) = 0.29* Pr(T > t) = 0.85

Comparison of international and local norms from previous results

Table 10 below shows a summary of the t-test results for the comparison of local and international norms with the current study. As can be seen, there are some statistically significant differences between some of the local and international norms and the current study's norms.

British Norms

There were statistically significant differences between the current study norms and the British norms. Apart from the 25th and 5th percentiles (p-value=0.068; p-value =0.18

respectively), there were significant differences between all the other percentile norms. All the upper percentile norms for the British norms were significantly different from the norms in the current study. For the lower percentile norms, the 10th percentile was the only one that was significantly different. In general the British normative scores were higher when compared to the norms in this study. This is similar to what has been found previously.

Grahamstown Norms

There was no significant difference in the upper percentile normative scores between the Grahamstown findings and the norms of the current study, but there were significant differences in the lower norms at the 50th percentile and less. Apart from the 95th, 90th and 75th percentiles (p-value=0.52; p-value =0.76; 0.21 respectively), there were significant differences in all the other percentile norms. However, a t- test comparison of the total mean CPM scores of the two samples found that there were no significant differences between the overall scores of the children in this study and the scores of children in the Grahamstown study. Despite the language differences, the results of the current study and those from the Grahamstown study (both based on samples drawn from the Eastern Cape) demonstrated a greater equivalence than those comparisons made with the international British and local Free State and studies.

Free State Norms

All the normative scores for the Free State study were significantly different from those of the current study except for the 90th percentile (p-value=0.41). The differences in the co-efficient values showed that the obtained Free State normative scores, drawn from a randomised sample of a normal population of learners, were higher than those determined in the current study. The Free State study also had a much larger representative sample size when compared to this study.

Table 10

T-Tests with MM Estimation Results Comparing Local and International Norms

Norms	Co-efficient	T score	p-value	95% Confidence Interval
British Norms				
95	1.48	3.31	0.008*	0.48 – 2.49
90	1.41	4.75	0.001*	0.75 – 2.07
75	0.81	6.44	0.001*	0.53 – 1.09
50	0.55	7.49	0.001*	0.38 – 0.71
25	0.38	2.05	0.068	-0.034 – 0.80
10	0.16	2.77	0.02*	0.03 – 0.29
5	0.27	1.43	0.18	-0.13 – 0.58
Grahamstown Norms				
95	-0.17	-0.67	0.52	-0.74 – 0.41
90	0.13	0.32	0.76	-0.79 – 1.05
75	0.35	1.37	0.21	-0.24 – 0.94
50	0.55	5.01	0.001*	0.29 – 0.79
25	-2.21	-3.42	0.009*	-3.71 – -0.72
10	0.48	2.36	0.046*	0.01 – 0.96
5	0.69	5.29	0.001*	0.39 – 0.99
Free State Norms	**Co-efficient**	**T score**	**p-value**	**95% Confidence Interval**
95	0.87	1.99	0.07*	-0.08 – 1.83
90	-0.42	-0.85	0.41	-1.48 – 0.65
75	0.87	14.49	0.001*	0.74 – 1.00
50	0.64	9.97	0.001*	0.49 – 0.77
25	0.39	3.34	0.006*	0.13 – 0.66
10	0.45	2.81	0.016*	0.10 – 0.80
5	0.33	3.23	0.007*	0.12 – 0.55

***p-value <0.05**

Pilot Cognitive Classification Categories for the determination of learning disabilities

To determine the pilot intellectual or cognitive performance classification categories needed for the psychometric screening of children with probable learning disabilities, five categories were created based on the raw scores of each age group. These categories of the cognitive performance of children with identified barriers to learning were based on those used in international studies as defined below by Raven, Court, and Raven (2002):

- Grade I: intellectually superior –scored at or above the 95th percentile.
- Grade II: above average –if score lies at the 75th percentile or above. (If at between the 90th & 94th percentile then it can be designated II+).
- Grade III: intellectually average–if scored is between the 25th and 75th percentile. (It may be designated III+ if above the 50th percentile and III- if it is below).
- Grade IV: below average: if score lies at or below the 25th percentile. It may be designated IV-if it lies at or below the 10th percentile.
- Grade V: intellectually impaired. If a score lies at or below the 5th percentile for that age group.

As shown in Table 11, the classification categories for each age group were computed using the abovementioned grade criteria. Each category places the learners in this sample into a particular cognitive learning ability grade. However, due to the very small number of learners in some of the age cohorts, the number of the obtained Raven's CPM raw scores here limit the ability to generalise these categories to the identified population at large. This is most evident with the youngest and oldest age levels.

Table 11

Pilot Cognitive Classification Categories according to Raw Scores

Age	**Intellectually Superior**	**Above Average**	**Intellectually Average**	**Below Average**	**Intellectually Impaired**
6	31	21	10	9	9
6.5	34	8	5	2	1
7	12	12	11	11	11
7.5	22	11	11	5	2
8	34	22	13	5	4
8.5	32	20	14	4	4
9	35	21	17	5	5
9.5	35	23	16	5	5
10	34	22	19	4	4
10.5	30	23	18	6	5
11	30	24	20	7	7
11.5	29	23	18	10	7
12	29	26	24	6	5
12.5	30	25	17	9	8
13	35	31	26	7	7
13.5	29	23	17	12	12
14	30	22	22	6	6
14.5	32	27	19	5	5
15	33	33	27	21	21
15.5	28	-	-	-	-

Chapter 6

Discussion and Conclusion

Introduction

The primary aim of this study was to establish Raven's CPM normative data for learners identified as having cognitive barriers to learning. This was done by using archival data gathered from a Psychological Clinic that rendered psychometric screening services to schools in the Nelson Mandela Metropolitan area. The study further aimed at developing cognitive classification scores which would further aid in the identification of learners with cognitive barriers to learning.

The development of these norms could then be used for the rapid non-verbal psychometric screening and early identification and classification of learners with otherwise observed cognitive barriers to learning. This would assist both teachers and learners as firstly, it would allow the teacher to quantify and grade the learner's level of cognitive functioning in order to identify an appropriate teaching strategy to be used, or to refer the learner for further assessment. Secondly, the learner would have the advantage of a confirmed early objective identification of cognitive difficulties which could assist the learner to then develop his or her skills by means of access to remediation in the mainstream school system, or otherwise.
The chapter discusses the main findings of the study in relation to the research aims and objectives that were set.

The value and limitations of the study are also discussed. Finally, recommendations for future research are provided.

Discussion of Results

As discussed in Chapters 4 and 5, the sample consisted of 388 male and female learners aged between 6 years to 15.5 years from predominantly Afrikaans speaking homes where there are high rates of caregiver/parent unemployment and relatively low levels of parent education. What further distinguishes this sample from the general population of learners is that the learners in the research sample had been identified by educators as having cognitive barriers to learning.

In the present study, the statistical indices of the Raven's CPM test conformed to a normal distribution and they confirmed that with an increase in age and grade there is an associated increase in measured intellectual performance. This would allow psychological test administrators to consider using these sub-population norms, for South African learners with cognitive barriers, as an alternative to those established for representative "normal" South African population groups.

The Effects of Age on Test scores

The mean scores for the Raven's CPM for learners who were identified as having cognitive barriers to learning increased as age increased. While this is in alignment with both local and international norms based on normal populations, there were minor anomalies in the 6 years age group which had a mean score of 20 that was higher than the 6.5, 7, 7.5, 8, 8.5, 9, and 9.5 age groups. The age group with the highest mean score was the 15 years 5 months group but this group only had one respondent.

The sample sizes for the upper and lower age categories were unfortunately small. This was due to missing information that excluded some participants from the data analysis. Furthermore, the small sample of participants in the 13.5 years and higher age categories was due to the learner identification selection and referral at school level that impacted on the convenient sample. A common phenomenon at schools in the Nelson Mandela Metropolitan is the long waiting lists for special school placements. A two-year waiting period is typical which means that schools attempt to identify learners for screening at a young age even in the absence of clear evidence of learning problems. In fact, if not identified these learners could be retained for long periods in the mainstream schools while awaiting appropriate screening and placement. A lack of special education facilities also makes the placement of learners over 14 years of age problematic. Data confirming this is presented in Chapter 5, Table 3.

The results of the study indicate that there is a proportional relationship between age and test performance on the Raven's CPM. Despite the present study's focus on a special population, namely, learners identified as having cognitive barriers to learning, it found that the Raven's CPM scores were significantly associated with age as was also determined in other international and South African studies (Al-Qurashi, 1987; Raven, et al., 1990; Eid, 1999; Linstrom, 2002; Knoetze et al., 2005; Kazem et al., 2009). It can therefore be argued that in this regard children with cognitive barriers to learning perform along similar lines as the 'normal' population on the Raven's CPM, with the exception that their scores are generally lower.

The Effects of Gender on Test Scores

There was no significant difference on the Raven's CPM test performance with respect to gender for most of the age categories. However, significant differences were found with the 8.5, 10, and 12 years age categories. These findings contradict Raven et al. (1990) who found no significant differences at all between gender and the Raven's CPM scores. The Grahamstown study, however, had previously also found that there were differences in some age groups between males and females, particularly in the age groups 7.5, 10.5 and 16 years (Knoetze et al., 2005). This gender difference was also noted in other previous studies (Vass, 1992). The current finding which showed a difference in performance between the gender groups is fairly similar to some existing research.

It would appear that the gender differences of males who tend to score higher than females in the South African population on the Raven's Progressive Matrices is common. Vass (1992) also reports this finding in his research on the Raven's SPM. The characteristics of the Vass (1992) and Knoetze et al. (2005) samples were fairly similar except that the Vass's study had an older population. About 50% of the current study's population shares the same characteristics as the Vass and Knoetze studies.

An anomaly in the findings of this study with respect to gender is that while males in general were found to have a statistically better performance than females on the Raven's CPM the trend was that they progressed slower at a scholastic level. It appears that their relatively slow scholastic advancement, when compared to females, is not due to greater cognitive limitations but rather that other factors contribute to this. It is speculated that the higher prevalence of lack of diligence, Conduct Disorder and Attention Deficit Hyperactivity Disorder among male learners could account for this phenomenon. Further research into these findings of gender based differences is strongly indicated.

The Effects of Grade on Test scores

There was a significant difference in Raven's CPM test performance with respect to the grade levels of the learners. There is an association between school grade and the Raven's CPM scores; as the grade increases the CPM scores increase. A Bonferroni test for multiple comparisons revealed statistically significant differences between Grade 1 and all the subsequent grades from Grade 4 to 7. There were also significant differences between Grade 2 and Grades 4, 5, 6 and 7, as well as between Grade 3 and Grades 4, 5, 6 and 7. There were no significant differences between Grades 4, 5, 6 and 7 compared to each other. The differences in the Raven's CPM scores, especially when you compare the 95th percentile of grade 1 to that of grade 7, in which grade 1 learners outperform grade 7 learners, could be due to the learner identification process that was employed at school level. Educators might have erroneously identified these Foundation Phase children, who they do not yet know well, as having cognitive barriers to learning and thereby they became included in the sample. The sample was drawn from schools where overcrowded classrooms are a common phenomenon and didactic expertise is lacking in certain areas. Oosthuizen and Van Staden (2007) classify these as school related factors that contribute to disruptive behaviour. Marais and Meier (2010) highlighted the general causes of disruptive behaviour and speak of the developmental stage of the Foundation Phase learner as a factor. The Foundation Phase learner is in a stage where they are learning about their world, and this might explain why they cannot sit still and this is regarded as misbehaving by the teacher.

It is found, especially in these school environments, that learners who appear to be disruptive in the classroom are normally referred for testing as the teacher finds it difficult to control suchlike individuals in these school conditions.

Norms

The focus of this normative study extends the findings of previous research by using the Raven's CPM to establish normative data for Eastern Cape children identified as having cognitive learning barriers. The study provides normative data regarding the performance of children aged 6-15 years on the Raven's CPM. The norms are presented in half year intervals as is the case with both the local and international published norms. Although the study has a somewhat smaller sample size when compared to the Linstrom et al., (2008), Raven et al., (1990), and Kazem et al., (2009) studies, this study nevertheless yielded meaningful data.

The development of a separate set of norms for this special population under investigation, adds to the body of knowledge on subgroup normative studies in the South African context. The implication of this contribution is that the norms derived from this study may be utilised when assessing learners who have already, by means of teacher evaluations, been identified as having cognitive barriers to learning in order to compare them to an equivalent reference group with similar attributes. This would allow for refined interpretation of the test scores in order to plan educational development interventions and/or placements.

Comparison of Norms with Raven et al. (1990), Knoetze et al. (2005), Linstrom et al. (2008)

The differences between the British norms (Raven et al., 1990) and those of the current study could be attributed to the variation in context and settings. As argued by some studies, the Raven's Progressive Matrices may be biased as they were developed based on Western learning and cultural contexts (Caffarra, Vezzadini, Zonato, Copelli, & Venneri, 2003). The use of norms from international studies to determine cognitive learning disabilities for learners in South Africa could therefore be misleading. Nevertheless, Linstrom et al. (2008) found that the test was working well for both local and international samples. However, the fact that the data set for this study was obtained from learners who had been purposefully selected as having probable cognitive or learning barriers as opposed to a randomly selected sample, like those of the British sample, could explain the determined normative differences between the current study and those of Raven et al. (1990). The tendency for this sample to perform lower than their Western counterparts, however, is a replication of Knoetze et al. (2005) finding for learners located in the Eastern Cape Province of South Africa. Despite the language differences of the two samples (predominantly Afrikaans verses isiXhosa), these joint findings of a depressed performance of South African learners on the Raven's CPM when compared to British norms, could be accounted for by the differences in the quality of education and probable local socio-economic deprivation, more than anything else.

Further comparison of the local norms contained in the Grahamstown study by Knoetze et al (2005), to those of the current study, provided evidence to show that the norms from this study largely mirror the former findings, although, there were some significant differences in the normative scores for the lower percentiles groups (50^{th} to 5^{th}).

On the other hand, the results from the Free State study (Linstrom et al., 2008), showed widespread significant differences when comparing their norms to those of the current study The exception here was at the 90^{th} percentile. This difference could be due to the combined differences in the contextual settings, language, and sample sizes.

What is clear, is that due to the likelihood of the presence of cognitive barriers with the participants of this study's sample, their norms were thus expected to be probably lower be than those of normal populations, as is represented in the British as well as the two local data sets. This accounts for many of the statistical differences that were found. Furthermore, the differences can also be attributed to variances in geographical location and the levels of opportunity that exist in these regions with respect to schooling and our historical context.

As discussed in previous chapters, the pre- and post-apartheid history of South Africa remains a major contributing factor for results like these. Unequal opportunities amongst racial groupings are present in certain contexts, especially education. For example, the Eastern Cape's low educational performance may be attributed to socioeconomic factors like poverty which affects the type of schooling and opportunities available to learners. This compared to the Free State, provides impetus to the argument that geographic locations require their own normative studies for the tests conducted in order for them to be appropriate and applicable. Currently, international norms are still applied to contexts where there are significant differences in intellectual performance. This invariably has an impact on learners whose potential is measured against standards that have not been developed locally.

Pilot Cognitive Classification Categories

One of the objectives of this study was to establish a set of classification categories that can be used locally to identify learners with learning disabilities.

The pilot classification categories identified in this study are envisaged to be of use in diagnosing and detecting children with learning difficulties. They could be extended and refined to further investigate the psychometric properties of the CPM for South African children with learning disability needs. There is, however, also a need for further studies to establish more robust scores from more representative samples. One of the limitations of the current study was the small sample size of some of the age cohorts that were not well represented. To establish nationally generalizable classification categories, it would be imperative for future research to consider the use of larger representative random samples.

Value of the study

1. This study developed recent local subgroup norms that can be applied in the current educational context more appropriately.
2. The establishment of the cognitive classification categories can contribute to the psychometric identification of learning disabilities and the study generates a platform for future research on cognitive barriers to learning.
3. The study identified significant geographic influences on the expression of intellectual performance which appears to be associated with the quality of schooling and socio-economic factors.
4. The study confirmed the value of using and applying a British measure to the South African context. In doing so it reinforces the position that, despite some existing

criticisms, the Ravens CPM norms are culturally fair and that they minimize the bias which is present in many other tests.

Limitations

1. While the study yielded a range of statistically significant results, due to the convenience sample of archival data which was used, small age and grade cell sizes resulted in limiting the generalizability of the research findings.
2. The establishment of the pilot classification categories was only partially successful due to the above.
3. The screening of learners in the current study did not control for the influence of language and developmental or medical problems.
4. Language and socio-economic differences in terms of test performance needs to be explored further. This was not one of the aims of the current study.

Conclusion and Recommendations for future research

The field of psychometrics in South Africa has recently experienced renewed interest. Ongoing normative studies within the South African context need to be undertaken, especially on tests used to measure intelligence and cognitive functioning. This study highlighted the need for the early identification of learners using the Raven’s CPM as a psychometric screening measure, which once again has been found to be capable of being applied fairly across disparate groups. It is hoped that the Raven’s CPM normative data that was developed in this study will assist with the psychometric identification of learners and in so doing it will help to address special needs education in South Africa.

For the further development, use and applicability of psychometric tools and assessments within South Africa, the following is recommended.

1. Continuous normative studies with larger well distributed and representative sample sizes using random sampling techniques should be conducted. This will keep the normative date used for the screening and identification of learners with cognitive barriers to learning relevant and updated.
2. Further research with respect to gender performance on non-verbal intelligence, as measured by the Raven’s CPM, is required
3. To enable the development of national South Africa norms, further localized studies on the use of the Raven’s CPM with learners who have cognitive barriers to learning are encouraged.
4. The findings of the current study suggest that research efforts should broaden to explore the applicability and cross validation of other norm-based cognitive measures for psychometric screening and the early identification of South African individuals with cognitive barriers to learning.

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Appendix A

BIOGRAPHICAL QUESTIONNAIRE AND CONSENT FORM

The Community Psychology Centre of Vista University will be conducting psychometric screening tests with learners at selected schools in order to evaluate the presences of any possible learning problems. The testing will be conducted by trainee psychologists under the supervision of registered psychologists. All information will remain confidential within the Vista Psychology Centre’s team and the child’s school who will be provided with the test results. Maintaining confidentiality, grouped data may be used for research purposes.

Should you agree to your child being included in the group testing then please complete the relevant information below and return it to the child’s class teacher as soon as possible.

1. **WITH WHOM DOES THE CHILD LIVE? (Please tick one)**

1.1	Mother and Father	
1.2	Grandfather and/or grandmother	
1.3	Mother only	
1.4	Father only	
1.5	Others	

2. **PARENTS EDUCATIONAL LEVEL**

2.1	Mothers highest educational level	
2.2	Fathers highest educational level	

3. **PARENT/CARETAKER EMPLOYMENT (Please tick one)**

3.1	Employed	
3.2	Unemployed	

SIGNATURE OF PARENT/GUARDIAN: ……………………………

DATE: ……………………………

TO BE COMPLETED BY SCHOOL

FIRST NAMES:	**SURNAME:**
DATE OF BIRTH:	**DATE OF TESTING:**
SCHOOL:	**GRADE:**
GENDER:	**HOME LANGUAGE:**

OFFICE USE ONLY

PARTICIPANT NUMBER:…………….. TEST AGE:………..yrs………….mths

RAW SCORE: Coloured Ravens : ……………….

Appendix B

PSYCHOMETRIC SCREENING PROJECT – SITUATIONAL REQUIREMENTS FOR TESTING

1. Consent and Biographical forms to be completed
2. Only children with consent and biographical forms completed to be tested.
3. Children to be grouped according to age for testing purposes.
4. No group to be larger than 25 learners.
5. Testing venue to provide a separate desk for each testee.
6. Each testing venue to have an effective overhead projector, which is the apparatus, required for the proposed measure.
7. At each testing session a teacher to be in attendance for the duration.

<u>TEST BATTERY</u>

(All to be modified and adapted for the overhead projector administration)

	ESTIMATED TEST TIME
1. Raven's Coloured Progressive Matrices Test (CPM)	30 Mins

Appendix C

INSTRUCTIONS FOR THE GROUP ADMINISTRATION OF PSYCHOMETRIC MEASURES

1. GENERAL INSTRUCTIONS

1.1 Group testing of learners, aged between 6 to 12 years at various schools or at the premises of Vista Psychology Centre in Missionvale. Transport to the testing venue is to be arranged by the school authorities in conjunction with the department of Psychology.

1.2 Testing of learners will be on site at each of the schools or the Vista Community Psychology Centre, in classroom venues provided with a desk for each testee and an overhead facility for the use of test stimuli, which will be presented on overhead transparencies.

1.3 No group of testees to be larger than 25.

1.4 Three testers are to be allocated to each testing venue with one being the principal tester and the others to be testing assistants.

1.5 The measure used:

Raven's Coloured Progressive Matrices Test (CPM)

1.6 Testers are to be highly familiar and competent with the test material, administration procedures and scoring criteria prior to the testing session.

1.7 All testees will have a completed biographical questionnaire available for collection on the day of testing which has to be attached to the test protocols.

1.8 Test administrators will be responsible for scoring those tests that they administered and for completing the subsequent standardized report. They are also responsible for the safekeeping of the test material obtained.

2. TEST ADMINISTRATION

2.1 Material

2.1.1 Each testee is to have a completed biographical questionnaire in their possession. Each testee is to be provided with:

A pencil

An eraser

A Ravens CPM answer sheet

2.1.2 Each group of test administrators is to be provided with:

A copy of the test administration procedures and instructions

A set of Ravens CPM transparencies

2.1.3 Each venue to be equipped with a desk and chair per testee and an overhead projector.

2.2 Establishing Rapport and Preamble

The testee are to be made to feel welcome and at ease in the testing situation. After testers have introduced themselves and established a conducive test atmosphere the following preamble is to be provided.

"Today you are going to have an opportunity to complete a puzzle."

"The puzzle will be shown to you on the overhead projector. You have all been given a pencil, an eraser and an answer sheet to use. We will collect them at the end of today's session. If you have any questions during the tasks please put up your hand and we will assist you.

Please do not concern yourself with what other children are doing!"

"Listen carefully to the instructions and try to do your best."

"Do you understand?"

"Do you have any questions?"

"Let's begin"

2.3 Test Instructions

Testees are to be provided with an answer sheet or record form. They are to be entrusted to enter their choices on their own record forms. Guidance is needed to ensure that a child has looked carefully at the pattern and is satisfied that the piece he chooses is the only one he thinks will complete the pattern. Care must be taken throughout the test to ensure that the method of completing the record form is properly understood and complied with.

The tester places the transparency (A1) on the overhead projector and says:

"Look at this" (Points to the upper figure) "you see, it is a pattern with a piece cut out of it. Each of these pieces (points to each in turn) is the right shape to fit into the space, but only one of them is the right pattern. Number 1 is the right shape, but it is not the right pattern. Number 2 is not a pattern at all. Number 3 is quite wrong. Number 6 is nearly right but is wrong here (points to the white piece). Only one is right"

Now say:

"On your answer sheet write the number of the piece which is quite right on your answer sheet next to number 1 under Set A"

The tester now presents the problem A2 transparency and says:

"Now write the number of the piece which came out of this pattern next to number 2 under Set A"

Present problem A3 transparency and proceed as before.

When presenting problem A4 the tester says:

"Look carefully at the patterns (moves fingers across patterns). Only one of these pieces is quite right. Be careful, look at each of them first (points to each of the six pieces). Now write down the answer of the correct piece in the space next to 4 under Set A."

Problem A5 is demonstrated the same as A4

The tester then says:

"From here on each time that I put a puzzle on the overhead, look carefully at the pattern and write down the correct answer on your answer sheet in the space provided. If you are not sure what to do, put up your hand and one of us will assist you."

Demonstrate the first 3 items of sets Ab and B in a similar fashion.

TIME LIMIT = 1 MINUTE PER ITEM

3. Collection of Material

3.1 Please check that all the answer sheets are completed and that each has the testee's name on it.

3.2 Staple the answer sheets to the biographical questionnaire.

3.3 Collect pencils and erasers from each child.