

Relationship between the Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV) subtests and Reading Ability

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Declaration

I hereby declare that this research report is my own, unaided work, and has not been presented for any other degree at any other academic institution or published in any form.

It is submitted in partial fulfilment of the requirement for the degree of Masters of Education in Education Psychology by Coursework and Research Report at the University of the Witwatersrand, Johannesburg.

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Abstract

This research report attempts to identify the relationship between subtests of the Wechsler Intelligence Scale for Children (WISC-IV) and reading, using the Neale Analysis of Reading – Revised (NEALE-R). The subtests of the WISC-IV used for this study are Vocabulary, Similarities, Comprehension, Word Reasoning and Digit Span. These subtests have similar properties to the skills needed for reading. The study included a sample of 33 Grade 2 boys and girls attending an English-medium, private school in Gauteng. Parametric and non parametric tests were run on the sample due to the small size of the sample. Results showed statistically significant relationships between variables like the Word Reasoning, subtest and the Similarities subtests. Analyses were also run separately on the gender groups to determine any correlations between specific gender and reading ability. Significant correlations were found between the Similarities subtest of the WISC-IV and the Accuracy subtest of the Neale-R; and Word Reasoning on the WISC-IV and Comprehension on the Neale-R. However overall on gender analysis showed a decrease in difference on performance levels between boys and girls.

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Chapter One

Introduction

Consider the following scenario involving a learner named Johnny, who lives with his maternal grandmother and younger sister in a shack in Soweto. Both Johnny's parents died from AIDS. Johnny's friend's mother helped his grandmother place Johnny in a rural school. Johnny is seven years old and has just started grade one. Due to his environment and his grandmother's financial position, they had no money to buy anything but the bare essentials; therefore Johnny has never seen a book up until his first day at school, and has not obtained the skills required for reading which are usually gained in the home environment. However, Johnny is a hard worker and tried his best to learn to read but no matter how much effort he put in he did not succeed. This is due to the fact that Johnny shares a classroom with 89 peers and one teacher. The lessons are also given in English which is not Johnny's mother tongue. Johnny's teacher eventually realized that Johnny is falling behind and called his grandmother in for a meeting. The teacher thought that Johnny was experiencing a developmental delay, however he showed no difficulties with activities involving oral input. The teacher recommended that Johnny be assessed to determine whether he has a learning disability. The assessment was however too expensive and therefore did not take place. Johnny continued to experience difficulties until grade four where he was assessed by a research student as part of a research project. The assessment results showed that Johnny met the criteria for a reading disorder. Johnny was then referred for the necessary help for his reading difficulty.

Although this scenario was an imaginary one, situations like these occur on a daily basis. Many children fail academically due to reading difficulties not being identified early

enough. In South Africa, however the situation becomes more complex considering the broader socio-cultural and economic context. As depicted in the imaginary scenario many factors influenced Johnny's difficulty in learning, unfortunately this is not a new phenomenon to South Africa. South Africa's education system has been in crisis since the 1980's (Hartshorne, 1992). In 1990, Macdonald reported the poor quality of reading skills in children attending township schools due to the past education policies of 'Bantu Education' and the lack of exposure to English in these areas. After 1994, 11 official languages were established to share the same status as English and Afrikaans, this was partly to address the problem of English not being a first language for many South African children. The Department of Education is considering the introduction of the indigenous languages as a medium of instruction in technikons and schools. However, for many South Africans today English is seen as the language of opportunity (Buthelezi, 2003).

Resources are also very scarce i.e. like books written in English: one book is allocated to five children at school (Buthelezi, 2003). At home children are once again disadvantaged due to the lack of resources like bedtime stories in English or parents might not be literate. There is a lack of qualified teachers, 'South Africa needs to train enough teachers - up to 20 000 a year - or face an education crisis' (Mtshali, 2005 p.1). The lack of teachers has built up from the apartheid era, when training institutions were racially segregated. Now however even with the transformation to democracy the situation still needs to improve. One hundred and two teacher training institutions were phased out limiting the number of trained teachers. Moreover, most of the teachers that are trained are considering moving overseas and 40 % of the end of year students seem to be following in their footsteps (Robinson, cited in Mtshali, 2005).

In an attempt to address these issues, a new educational policy, Curriculum 2005 was implemented. This curriculum is utilized in most mainstream schooling as well as adult

education programs. Although this move to quality education seems like something to be delighted about, this is not the case with many people (Buthelezi, 2003). The countless complaints and perplexity over the low matriculation results and pitiful pass rates of secondary education of pupils in South Africa, seems to stem from the difficulty in learning to read, as without being able to read a child cannot read to learn (Hough & Horn, 2001 cited in Pretorius, 2002). This was evident in a study done on grade 12 English second language students applying to Technikons in Gauteng, where a steady decline in literacy levels were evident (Hough & Horn, 2001 cited in Pretorius, 2002).

Furthermore in 2003, the deputy minister of education Mr. Masibudi Mangena stated that although an emphasis is being placed on education in South Africa, for example the Schools Act, the National Curriculum Statements, the language in Education Policy and ABET policy, a clear focus on reading is still lacking (Mangena, 2003).

Another major contribution to the frequency of the imaginary situation portrayed at the outset of this chapter is that many South African schools are not equipped with any formal assessment procedures for the purpose of reaching large numbers of pupils at a cost that is affordable. Most assessments are done individually and cost a lot of money. Another contributing factor is that many South African normed tests are outdated and hardly any new assessment tools are being developed to assist in minimizing the reading problem. Consequently, the current research focuses on comparing aspects of reading ability and intellectual functioning as a means of addressing this problem as early identification is considered imperative in grades one and two in order for interventions to be put into action. Since South Africa is said to be amidst an educational crises (Pretorius, 2002), research in this area will prove to be a valuable asset for teachers and educators.

Another aim of this research is to determine whether there are any gender differences in the cognitive processes involved in reading. Previous literature relating to gender differences in intellectual functioning indicate a definite gap between boys and girls, with girls performing better in verbal tasks and boys performing better in spatial and mathematical tasks (Joseph, 2000; Maccoby & Jacklin, 1974 cited in Lloyd, Walsh & Yailagh, 2005). Nevertheless recent research indicates that girls and boys are now exposed to similar environments and social situations which have reduced this gap (Feingold, 1988 & Flynn, 1998, cited in Cockcroft & Blackburn, 2008). However many factors are also contributing to maximizing this gap, especially in South Africa. One of these is the HIV/AIDS pandemic coupled with high levels of poverty. Many children are orphaned by parents who have died from HIV/AIDS, often leaving the burden of raising the family on the eldest daughter, who may sacrifice her schooling to care for her siblings, thus contributing to the statistics in increasing illiteracy in South Africa (Buthelezi, 2003).

Chapter Two

Literature Review

Literacy and its importance

Learning disabilities are defined as a severe discrepancy between achievement and intellectual ability in many different areas of literacy (reading, writing or mathematics) such as oral expression; listening comprehension; written expression; reading skills; basic mathematic computation or reasoning. These literacy skills play a vital role in the basic functioning of human life and therefore will have an influence on many different stages of a of a child's development. Learning disabilities not only affect a child's ability to progress within the school environment, but also influence a child's academic and future employment potential. This in turn will have an effect on their quality of living, satisfaction in their work and the resources (such as education) they can provide for their children (Jensen, 1996; Pretorius, 2002; Werner, 1996).

Research in this area over the last 30 years has evidenced that these disabilities do exist and are prevalent in 15 % of children in developed countries (Gaddes, 1976 cited in Springer, 2007; Harris, 1998 cited in Springer, 2007; Sadock & Sadock, 2003; Wrong Diagnosis, April, 2005). According to the Diagnostic and Statistical Manual – fourth edition (DSM-IV), three major clusters of learning difficulties are identified. These include difficulty in reading, difficulty in writing and difficulty with mathematics. The more formal names for these three clusters of learning disabilities are Dyslexia, Dysgraphia and Dyscalculia respectively (Sadock & Sadock, 2003). However in the ninth edition of the Synopsis of

Psychiatry, these difficulties are referred to as Reading Disorder, Disorder of Written Expression and Mathematics Disorder (Sadock & Sadock, 2003).

Among the three main clusters, Reading disorders are regarded as the most common and detrimental type of learning difficulty (Hyde & Cohen, 1983; Stanovich, 1986). Pretorius (2002) regards the reading situation in South Africa as a national educational crisis. She believes that the problems experienced by learners who have reading difficulty appear to widen as they progress along the academic ladder. Literacy and reading skills tend to become exceedingly more demanding and indispensable, not only in terms of the basic functioning of life but also to achieve academic success (Perie, Grigg & Donahue, 2005). Research shows that the ability to construct meaning during reading and to acquire, combine and make use of information that was read determines academic success (Pretorius, 2002). This is due to the fact that literacy has become a vital skill in our everyday lives. Read and McKay (1984, cited in Cretchley, 2000) propose that literacy exists on a continuum which ranges from initial literacy to technical literacy and is seen as a tool for survival in western based economies (Adams, 1996).

Initial Literacy is the most basic form of literacy and involves the ability to read and write one's name. The next level is **Basic Literacy** whereby one is able to read and write short, simple sentences based on everyday life. However in order to function in our everyday lives, one needs to be equipped with slightly more advanced skills such as being able to read, write and comprehend pieces of information on subjects that are well-known. The understanding of signs, labels, instructions and directions (such as using an ATM) are also very important to survive in one's environment. This level is termed **Survival Literacy**. The next two levels are slightly more advanced than the previous levels. The first of these two is known as the **Functional Literacy** level involving the ability to read and write for the

purpose of executing own self-determined objectives. Adams (1996) emphasizes this level by describing literacy as a window providing us with a view of the world that allows us to stay informed about current happenings around the world through media i.e. newspapers, magazines, television and internet. Lastly is the **Technical Literacy** level where reading, writing and problem solving skills are required to analyze a body of theoretical or technical knowledge within a specific field (Read & McKay, 1984 cited in Cretchley, 2000).

Apart from reading being necessary for our basic everyday functioning, literacy is deemed to have a role in the economic, social and political development of a country (Baatjes & Aitchison, 1999). Society tends to reward individuals who are literate and delay those who aren't. This is evident on not only a social level but on an economic level as well. Linda Macleod (cited in <http://www.essaysample.com>) of the National Associations Active in Criminal Justice reports that 65 % of people entering prisons have trouble reading and writing. Although this study was done in Canada, low literacy levels are a contributor to the problems associated with limited choices in life that may lead people into criminal activity. On the contrary, a person with a survival level of literacy skills is able to make more informed and wiser decisions thereby creating more opportunities for themselves. In a literacy survey done on adult prisoners in Ireland in 2001, similar results were yielded where it was found that a significant number of prisoners assessed possessed no literacy skills. Another remarkable finding in the same study was the correlation between poor literacy skills and particular kinds of crime (Morgan & Kett, 2003). Moats (2000) supports this view as well, as she states that 'individuals who are poor readers are much more likely than literate people to drop out of school; find their way to jail; or struggle to find and keep meaningful satisfying work' (p.4).

Although conclusions on a linear relationship between low literacy and criminal activity cannot be made, as there are many other variables involved that lead a person into criminal activity and low literacy is only one of those variables, considerable amounts of research show that low literacy can be a contributing factor in criminal activity (Morgan & Kett, 2003).

Literacy in South Africa

Increasing levels of literacy and reading difficulty are a concern in all parts of the world, and unfortunately it is not a unique concern in South Africa. Statistics show that 861 million people or 20% of the adults in the world are deemed illiterate, of which 70% live in the Sub-Saharan Africa, North Africa, Southern and Western Asia and Arab countries (UNESCO). In another survey 751 702 people of the South African population were estimated as being Learning Disabled (Wrong Diagnosis, April 2005). Below is a representation of the levels of illiteracy in South Africa separated into the different provinces.

Illiteracy by province

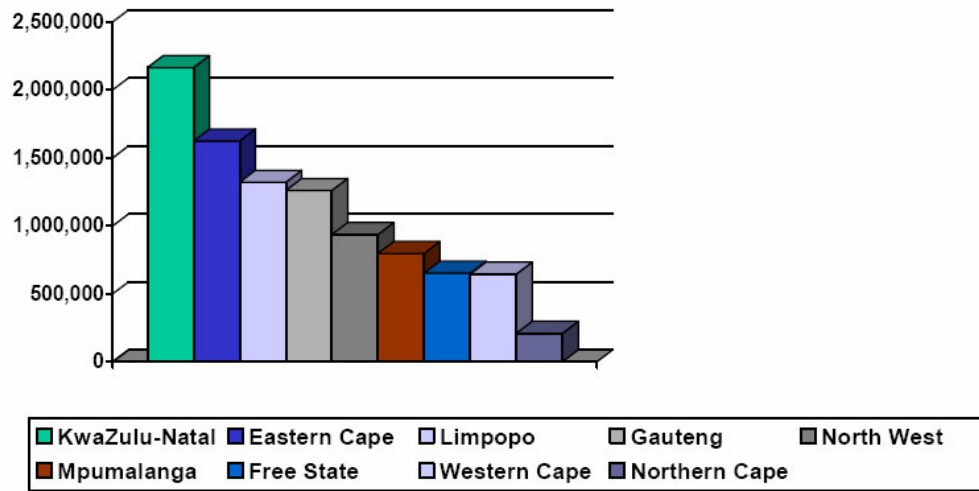


Figure 1. Graph depicting illiteracy by province in South Africa

From Kha ri Gude Mass literacy campaign (www.kharigude.co.za)

Another contributing factor to illiteracy in South Africa is the fact that South Africa has 11 official languages and society's perceptions of literacy are influenced by language. English is seen by many as the language of education, power and work (Lyster, 1992; Discussions with adult learners at Maryvale Adult Education Centre, 2000, Cited in Taylor, 2002). In Figure 2 below this is clearly seen, as illiteracy is more prevalent in languages other than English as a mother tongue language.

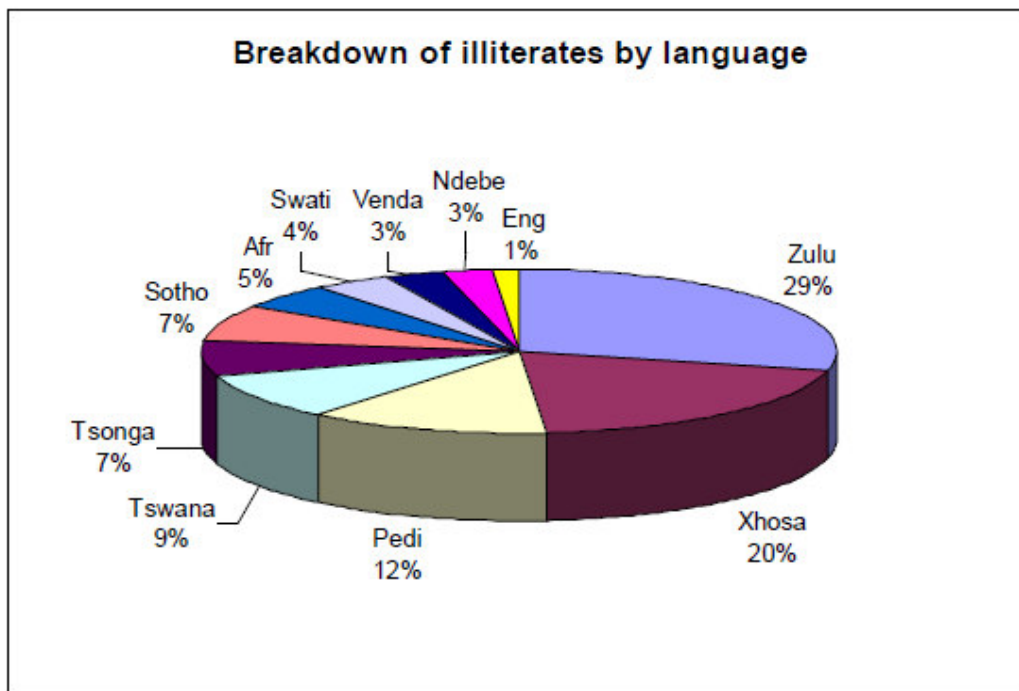


Figure 2.

Graph depicting illiteracy by language.

From Kha ri Gude Mass literacy campaign (www.kharigude.co.za)

It is a widely accepted fact that the process of reading and writing is a complex one and should be taught initially in the mother tongue of the learner (Clifford & Kerfoot, 1992; Lyster, 1992; Richek, List & Lerner, 1989 cited in Taylor, 2002). Researchers state that there are five definitions according to which a person's mother tongue can be determined. These include language of **origin**, which is the language that is learnt first, which is usually the language spoken by the parents or primary care takers in the home environment. Language of **competence** is the language that one knows best; language of **function** is the language used the most by the person; language of **attitude** is the language that the person identifies with and finally **world-view** is the language the person thinks and dreams in (Skutnabb – Kanyas, 1983, cited in Taylor, 2002).

Considering the information above and past South African policies regarding education, many South African adults are not proficient in the English language which has implications for the current situation schools are facing. Historically the need and importance of literacy was not clearly understood, which led many people either to oppose the process of learning or reading or they were denied access to education by the past policies associated with 'Bantu Education' (French, 1992). Now many South Africans prefer for their children to be educated in English, even if it is not their mother tongue. However with this comes a new dilemma as according to general learning theories, optimal learning occurs when children build on previous knowledge (Clifford & Kerfoot, 1992; Fordham, Holland & Millican, 1995; Miller & Dollard, 1947 & Rutherford, 1987 cited in Taylor, 2002). If the language of instruction is different to what the child is familiar with then optimal learning cannot take place (Clifford & Kerfoot, 1992 cited in Taylor, 2002). Since many South African adults are not literate, their children may grow up without literacy related stimulation from the home environment. These children in turn grow up to be parents who cannot provide that stimulation for their children.

Problems like these and the importance of literacy have been researched over the past 50 years. The United Nations declared literacy as a human right equal to the right to adequate food, healthcare and housing. In addition to this, literacy is also seen as an enabling right through which other rights can be claimed and protected. Many South Africans are unaware of their legal rights and literacy can assist them in increasing their awareness to these rights. The United Nations Literacy Decade is declared as 2003 to 2012 (PIRLS, 2006).

Many South African projects have been set up or are in the process of being set up to address the issue of illiteracy. The Deputy Minister of Education is taking an active role in

promoting reading and literacy. Mrs. Naledi Pandor, Minister of Education launched the Department of Education or Vodacom Masifunde Sonke Library project on Monday, 21 November 2005, in an attempt to make seven million adults literate before the end of 2012. All adults who had previously missed out on their schooling and those struggling to read and write were invited to join one of the 20 000 literacy classes, situated throughout South Africa (Mangena, 2003). 'Through this project the Department of Education hopes to revive the use of school libraries, to provide learners and educators with access to a wider range of information on their fingertip as part of curriculum delivery support.' (Mangena, 2003. p.1)

Projects like the Masifunde Sonke Library project and Read Education Trust have been set up in an attempt to create an awareness of the importance of literacy along with making people literate (Mangena, 2003). The extended benefits of these projects will also assist in achieving the Millennium Development Goals (MDGs). These goals attempt to address issues like poverty reduction, empowering women, eradicating HIV and AIDS and conserving our environment (Mangena, 2003).

Risk Factors in Reading Difficulty

Reading problems are found among every group and in every primary classroom (Moats, 2000). However some children are more at risk than others for developing reading difficulties. The reasons for this are based on the interactions between physical and environmental influences. It is acknowledged that certain physiological factors such as cognitive deficiencies, visual impairment, hearing impairment, Attention Deficit Hyperactivity Disorder (ADHD) and early language impairment may also result in reading

difficulties. The relationship between reading and each of these factors will be briefly reviewed.

Many factors contribute to a child being diagnosed with severe cognitive deficiencies, such as severe nutritional deficiency, low birthweight, fetal alcohol syndrome, lead poisoning and severe pathological conditions. Cognitive deficiencies place children at risk for achieving low reading ability (Snow, Burns & Griffin, 1998).

Hearing difficulty or deafness is a physical condition associated with reading difficulty. Chronic otitis media is an ear infection that causes hearing loss in the early years of a child's life. Although research in this area is ambivalent where Wallace and Hooper (1997 cited in Snow, Burns & Griffin, 1998) found only a mild association between reading disorders and otitis media, there is well documented research on the negative association between hearing difficulty or deafness and reading (Conrad, 1979; Karchmer, 1978; Waters & Doehring, 1990 cited in Snow, Burns & Griffin, 1998).

Early Language Impairment (ELI) is a condition diagnosed in children when general development is delayed by the age of three years old. ELI is also an indicator for other conditions that are associated with reading difficulty such as hearing impairment, autism and neurological conditions (Aram & Hall, 1989; Bashr & Scavuzzo, 1992 cited in Snow, Burns & Griffin, 1998).

Attention Deficit Hyperactivity Disorder (ADHD) is a common comorbid disorder to reading difficulties. Children diagnosed with ADHD struggle from the start of formal schooling and research shows that the difficulties experienced with reading difficulties increase with age

(Shaywitz, 1996; Shaywitz; Shaywitz, Pugh, Constable, Skudlarski, Fulbright, Bronen, Fletcher, Shankweiler, Katz & Gore, 1995).

Severe visual impairments make it impossible to read text, as reading is primarily a visual process (Smith, 1973 cited in Snow, Burns & Griffin, 1998). Even though reading can occur through Braille reading, both types of reading are based on the same principle (alphabetic principle), indicating that similar difficulties in reading can occur in both groups (Snow, Burns & Griffin, 1998).

While research in the area of neuroscience has confirmed that there is a relationship between reading ability and genetics (Shaywitz, 1996), the environment or context of a child must also be considered, as this plays a vital role in predicting reading ability. Environmental factors such as home environments, parental influence, parental level of education; school environments and socio economic status (SES) must be acknowledged.

SES might not have a direct link to reading difficulties but does have an influence on the home environment and quality of parental influence, which will influence the level of stimulation from the home environment. Children who come from very deprived environments often don't receive the resources like exposure to books, being read to, modelling of how to handle books, etc. According to Molfese, Molfese and Modgline (2001) oral or language skills, including reading skills are largely influenced by the educational stimulation received in the home (reading aloud, availability of books in the home, nature of family discussions, being read to frequently, and television - news) These children then attend school often with a lag of two years or more, thereby hindering their reading ability skills. A study by a speech and language therapist on the functioning levels of grade three

learners reported that over 60 % of those tested presented with a lag in their functioning (Caelers, 2004 cited in Grasko, 2006).

The above mentioned factors were taken into account when determining the sample for the current study and children who were known to possess any of these difficulties were excluded from the sample. It was necessary to do this to eliminate other possible confounding variables from having an impact on the test scores.

Another very critical issue to consider is the school environment. The belief that the quality of education one receives influences one's life path, was discouraged by Christopher Jencks and the 1966 Coleman Report (Hempenstall, 2004). However recent research has provided sufficient evidence to encourage this belief. In a longitudinal study it was found that effective teachers improved learners' performance by 50 % compared to ineffective teachers. Although there is general consensus that children need a good start to reading, many children struggle to learn to read in the first grade and as a result fall behind. These children then have particular difficulty catching up to their peers (Clay, 1991; Juel, 1988; Stanovich, 1986) and often develop a poor self esteem. This is further supported by evidence from studies that show the long term negative effects of poor instruction. Instruction is said to play a vital role, in how children perceive themselves and are perceived by others (Riddick, Sterling, Farmer & Morgan, 1999). Children with poor instruction within their first year of formal schooling are negatively impacted on by the unpleasant experience which influences their future schooling experiences (Pianta, 1990). Literature strongly supports the fact that in younger children there is a strong relationship between poor reading and self esteem, and that academic self esteem is more vulnerable to underachievement (Chapman, Lambourne & Silva, 1990; Trautwein, Lüdtke, Köller, Baumert, 2006). A line in the Matthew's Gospel reads 'for unto every one that hath shall be

given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath' (XXX: 29). It is borne from the belief that cumulative advantage in reading development lead to still further advantage and conversely, initial disadvantage in reading development become accentuated over time (Stanovich, 1986). This refers to the notion that learners who are strong readers will consistently become stronger reader's while weak readers tending to read less and less thereby delaying and impairing their development of reading skills.

The Matthew Effect suggests that early intervention is likely to be more effective than later intervention or remediation. Early intervention is effective as the gap that separates Grade one children likely to be successful in reading from those at risk for reading failure is relatively small. However, if children at risk of reading difficulties go undetected, the chances of them rectifying the difficulty become much more difficult if not impossible (Wren, 2003), and the gap between the good and poor readers widens progressively with each passing year.

Reading Development

Reading development can however follow a smooth process if the above mentioned factors (physical and environmental) are absent. Reading development is believed to follow stages in which skills are developed and enhanced. Many theories of reading acquisition have been developed over the years. One of the most popular is Frith's (1985), who proposed a stage model that provided a structure for reading development. In her model, children follow a stage like process and develop foundation skills for each subsequent stage. The sample group used in this study consisted of grade two learners

that should be functioning at stage two (alphabetic) moving onto stage three (orthographic) of Frith's reading stages, which will be reviewed in more detail, below.

According to Frith, the reading process begins at the logographic stage. Share and Gur (1999) concur with this, although they refer to this as the contextual dependency stage. This stage is also referred to as a pre phonetic level or pre-reading stage (Ehri & McCormick, 1998) and usually occurs in children from the age of five onwards. Children at this stage read only signs and labels of well known products i.e. Coco-cola or McDonalds. In this stage it is said that children attend to contextual clues to identify words. They therefore read only words that they may come across frequently in their environments (Ehri & McCormick, 1998). Words that look visually similar are often confused as no attention is given to the actual letters or the order of the letters (Frith, 1985 cited in Grasko, 2006). The child learns only the visual representation of the 'logos' that they are able to read.

Their focus however changes as they move onto the next stage and attention is given to features of print. Stage two of Frith's theory is when the child uses grapheme – phoneme sounding out principles to determine the word. Therefore if the child is confronted with a new, unfamiliar word and no graphic cues (logo: e.g. shape or colour of the CocaCola logo) are provided, the child will be unable to read the word (Share & Gur, 1999). In the beginning part of this stage children tend to make associations between certain parts of the word and a verbal sound of the word. For example Seymour and Elder (1986 cited in Harris & Coltheart, 1986) asked a child to read a list of words containing the letter k and the child read black for any word that contained the letter k in it, such as like, bkacl and pjoek. Another child read the word smaller as yellow based on the association made with the double l in the word yellow. However as this skill develops children are able to map the

sounds of the letters to each letter of the word and read the word, where non words were impossible to read, children now read words like lon or sej.

However for this shift from one stage to another to occur, the child needs some knowledge about the sounds of the letters. Although exposure to books and literature plays a vital role here, according to Moats (2000) it is not enough. Children need to be taught the associations between letters and the sounds they make.

In order for them [children] to shift their attention from environmental cues to the print itself, they need to know the alphabet. Because there are so many letter shapes to be learnt and to be associated with meaningless arbitrary sounds, it is likely that acquisition requires explicit instruction and practice. It is not picked up simply through exposure to the letters. (Ehri, 1987, p. 11).

Many researchers share the opinion that training children in phonological awareness skills at an early age is beneficial for beginning readers (Bryant & Bradley, 1985), as visual word (orthographic stage – advanced level of reading) recognition can only occur when a child is able to transfer the knowledge that print represents pictures which are comprised of letters that, in turn, map to speech sounds.

Frith's third stage involves processes such as observing similarities in spelling patterns to increase sight word reading and is called the orthographic stage of reading (Frith, 1985). Patterns like affixes, root words, onsets, rimes or syllables facilitate decoding speed and accuracy, thereby increasing the sight word pool (Ehri, 1995). Less memory is also required as instead of having to remember many individual letters (grapheme – phonemes) only smaller chunks (syllables) replace them (Ehri, 2005).

Ehri (1995) influenced by Frith's reading stages builds onto these stages and proposed a four stage reading model. Ehri (1995) proposed a pre-alphabetic phase in which word reading was done through associations made with visual features called 'cues' from the surrounding context. This phase is equivalent to Frith's logographic phase, however according to Ehri (1995) the term logographic gave the impression that novice readers had already developed their skills to a level of a mature reader (Beech, 2005). In a study done by Masonheimer, Drum and Ehri (1984) where the word PEPSI was altered to XEPSI with the original background for PEPSI. The participants failed to recognize the change and continued to read PEPSI. This is also called visual cue reading (Ehri & Wilce, 1985). Children at this phase struggle to read new words when they are presented out of context (Mason, 1980 cited in Ehri & McCormick, 1998) as arbitrary associations are made.

The shift from a pre-alphabetic to a partial alphabetic phase was assessed in 56 kindergarten pupils. They were divided into groups according to their level of reading ability (prereaders, novices and veterans). The three groups were presented with two kinds of word spellings: phonetic spelling of letters that represent the sounds in a word and visual spellings that had no correlation to the sounds of a word i.e.: the word mask was spelled MSK for the first group and uHo for the second. Results indicated that children in the beginning phases of reading depend on visual cues as they lack alphabetic knowledge and were more efficient in reading the visual spellings. However the children who were novice and veteran readers were able to use phonetics better to identify the words and were more efficient at phonetic spelling (Ehri & Wilce, 1985 cited in Ehri, 2005).

The English language relies on an alphabetic system that represents the parts that make up a spoken syllable (Snow, Burns & Griffin, 1998). Ehri coined the term 'phonetic cue

reading' to characterize her second phase of reading, the partial alphabetic reading phase. In this phase the reader uses parts of the word, commonly the first and the last letters, in an attempt to recognize the word. Therefore the visual appearance of the word and some alphabetical knowledge enhance the efforts of pronouncing a word (Beech, 2005). Further studies done by Stuart, Masterson and Dixon (2000 cited in Beech, 2005) in determining the effect of visual memory as opposed to alphabetic or phonological knowledge indicated that phonological knowledge is a stronger tool in helping readers to remember and identify words. Five year olds were pre-screened to determine their level of alphabetic knowledge. The children were then exposed to words and re-screened. The findings showed that the children with phonological or alphabetical knowledge performed better than those without it and the children without phonological knowledge relied on their visual memory skills to remember and identify words. Previous studies done in this area concur with this research (Ehri & Wilce, 1985 & Mason, 1980 cited in Ehri & McCormick, 1998).

Ehri's third stage is called the full alphabetic stage, where the reader is able to map grapheme to phonemes and use these principles to sound out words. The English language is represented by the alphabetic system, where units represented graphically by letters are abstract and meaningless. For example, the sounds that represent the word 'mat' are meaningless in isolation, except for the 'a' which can represent a meaningful word on its own. However in order to make the 'm' or the 't' meaningful or pronounceable, a vowel needs to be added (Daniels & Bright, 1996). Therefore in the alphabetic stage, the child learns how to map the sounds on the corresponding letters.

This is also a stage which lays the foundation for skilled reading (Ehri & McCormick, 1998) as children at this level are moving toward sight word reading over decoding letters (Beech, 2005). They begin by decoding words very slowly as they match each letter to the

corresponding sound and blend the sounds to identify the word. However this process speeds up as the child has more reading experience. The frequently encountered words are captured in a sight word pool and recognized and eventually are identified immediately without decoding the word (LaBerge & Samuels, 1974 cited in Ehri, 2005). Sight words are referred to words that have sometimes been read as little as four times and which no longer need to be sounded out (Reitsma, 1983). Studies done to determine the benefits of sight word reading were conducted using Stroop tasks. For example a card may have the word blue printed in red ink, or the word yellow coloured in purple. Readers are asked to identify the colour and ignore the words. Children in Grade one have shown to be efficient in these tasks (Guttentag & Haith, 1978 cited in Ehri, 2005) as their reading skills are not yet automatised to the point that the coloured ink and colour name can interfere with each other.

This is the main stage that differentiates Ehri's and Frith's theories. Ehri's theory is a more fine grained developmental theory, where Ehri split Frith's alphabetic stage into two parts, namely the partial alphabetic and the full alphabetic phase. Ehri also presents this progression gradually using the term phases and not so clearly defined like Frith using the term stages.

Ehri's fourth stage, the consolidated alphabetic phase, is the same as Frith's orthographic stage. This stage involves reading as depicted in the third phase; however speed and accuracy are highly developed. When a child is confronted with an unfamiliar word, they generally regress back to the third phase.

A very important concept used in Ehri's phases of reading is the term 'phase' as opposed to 'stage'. The word phase proposes that progression occurs to the point of automaticity,

and that each phase is not a prerequisite for the next. She does this to introduce flexibility in the process of reading (Ehri, 2002 cited in Beech, 2005; Ehri, 2005). This is further supported by Stuart and Coltheart's (1988) studies, which found that some children do not pass through the pre-alphabetic phase (Frith's logographic stage). She also suggests that the pre-alphabetic stage does not contribute to later reading skills (Ehri, 2002 cited in Beech, 2005; Ehri, 2005).

Assessment of reading

There is widespread agreement that early identification and thereafter, intervention, are required to prevent long term learning disorders (Bos, Mather, Friedman, Narr & Babur, 1999; Coyne, Kame'enui & Simmons, 2001; Foorman, Breier, & Fletcher, 2003; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004 cited in Simmons, Coyne, Kwok, McDonagh, Harn, & Kaneenui, 2008). Smith (cited in Phillips, Norris, Osmond & Maynard, 2002) reported that children carry over their strengths or weakness in reading ability to later grades. For example, in one of his studies it was found that 71 % of children who performed poorly in assessments in preschool, performed poorly in grade 3 as well, and 93 % of children who performed well in assessments in preschool continued to perform well five years later. However, research based on Response to Intervention (RTI) has shown that reading achievement is alterable through instruction, assessment and remediation thereby assisting those children who perform poorly preventing them from experiencing reading difficulties later on (Coleman, Buysse, & Neitzel, 2006; Denton, Fletcher, Anthony, & Francis, 2006; National Joint Committee on Learning Disabilities, 2005 cited in Simmons, Coyne, Kwok, McDonagh, Harn, Kameenui, 2008). South African research shows that after 1994, education policies adopted this belief as well by adopting inventive strategies to assist students by identifying those at risk through assessments and

effective strategies (Vandeyar, 2005). In order to do this, teachers need to gauge the level at which difficulties exist with the help of assessments, so that they can deliver instruction based on those assessments (Menzies, Mhduvir, Lewis, 2008). The Reading First Assessment Committee (RFAC) developed a set of criteria against which reading assessments of children from kindergarten up to grade three can be evaluated (Kameenui, Francis, Fuch, Good, O'Conner & Simmons, 2002 cited in Kammeenui, Fuch, Francis, Good, O'Conner, Simmons, Tindal & Torgesen, 2006). This raises the importance of reading assessment effectiveness in the primary grades.

The first reading assessment was developed by Mr. P.B. Ballard in 1914, and resulted in widespread development of tests in the field of educational psychology. Although many psychologists were very sceptical about the use of such tests (Gipps & Murphy, 1994) many resorted to using them in order to identify children at risk of reading failure and assist them in becoming successful readers. The Neale Analysis of Reading (Neale) is a standardized reading assessment tool, revised in 1989. The Neale-R was designed to measure accuracy, comprehension and rate of reading of children between the ages of 6 years and 12 years 11 months. The Neale-R can also be used with special needs students through to adult level. Together with the quantitative information, the Neale-R also allows for the diagnostic observations of reading behaviour. It takes approximately 20 minutes to administer. The Neale-R was used to assess reading ability in the current sample and was chosen based on its assessment of multifaceted skills of reading.

Another key indicator in assessing reading performance is IQ scores in addition to measures of reading ability. In the Diagnostic and Statistical Manual – Fourth Edition (DSM-IV), reading disorders are determined using IQ scores. Reading disorders in the DSM-IV are defined “as reading achievement below the expected level for a child’s age,

education, and intelligence, with the impairment interfering significantly with academic success or the daily activities that involve reading" (Sadock & Sadock, 2003. p.1180).

Historically, IQ tests have been widely used to determine a child's aptitude for learning or their potential for acquiring academic skills. Such thinking about IQ was characterized by Burt (1937), who stated that "capacity must obviously limit content. It is impossible for a pint jug to hold more than a pint of milk and it is equally impossible for a child's educational attainment to rise higher than his educable capacity" (p. 477). In other words, IQ sets an upper limit on a child's learning potential. Reading ability is compared to measures of general intelligence as measured by IQ tests when determining reading disorders. Initially research validated the use of intelligence tests as predictors of academic achievement (Kubiszyn, Meyer, Finn, Eyde, Kay, Moreland, Dies & Eisman, 2000; Lubinski, 2000 cited in Watkins, Glutting & Lei, 2007) thereby increasing the popularity of intelligence tests being used in child assessments each year (Kamphaus, Petoskey & Rowe, 2000; Sattler, 2001 cited in Watkins, Glutting & Lei, 2007). There has been however a subsequent decrease in the use of intelligence tests in assessments as many psychologists view them as unreliable and invalid measures in predicting academic achievement (Fiorello, Hale, McGrath, Ryan & Quinn, 2002; Hale, Fiorello, Bertin & Sherman, 2003 cited in Watkins, Glutting & Lei, 2007).

Jensen (1980) reviewed literature on the relationship between age and intelligence scores and found that in America the correlations between intelligence and school achievement fell within the range of 0.6 to 0.7 for elementary grades, 0.5 to 0.6 for high schools, 0.4 to 0.5 for college students and 0.3 to 0.4 for graduate schools, indicating that the correlation between intelligence and reading is more significant with children in the younger grades. Although overall intelligence scores has been found to have some correlation with reading

scores (Leppanen, Niemi, Aunola, & Nurmi, 2004; Robinson & Hanekom, 1994 cited in Cockcroft & Blackburn, 2008) other studies have shown verbal IQ to have a stronger correlation with reading ability than nonverbal IQ. More specifically, certain verbal skills like abstract verbal conceptualization (Adams, 1996), working memory (Baddeley, 2003), classification (Adams, 1996; Arlin, 1981) and comprehension (Stothard & Hulme, 1996). These skills are closely related to reading ability.

In a recent study by D'Angiulli and Siegel (2003), one hundred and forty-three children aged between 6 and 16 years old who were said to have reading or arithmetic difficulties were assessed in an attempt to determine if the Wechsler Intelligence Scale for Children – Revised (WISC-R) could predict patterns of performance in children with Learning Disabilities. The results portrayed a poor correlation between complete IQ scores and reading ability. Stage, Abbott, Jenkins and Berninger (2003) concur with previous research, that global IQ scores don't show a significant correlation with reading ability and that they are not the best predictors of reading ability. However studies do propose profiles of performance on IQ tests, especially within the verbal subtests of the WISC-R, as a useful tool for identifying children with learning difficulties (D'Angiulli & Siegel, 2003). More specifically, findings showed that the language components consisting of the Similarities and Vocabulary subtests, attention and memory subtests were significantly related to reading difficulty using the Wide Range Achievement Test (WRAT). However, the strongest correlations were found between the memory or attention factor, namely Arithmetic, Digit Span and Coding subtests and reading ability.

Although South African research with regards to the relationship between scholastic achievement and intelligence is limited, the few studies using South African intelligence tests do show significant correlations with reading ability. The Verbal and NonVerbal

Scales of the Junior South African Intelligence Scale (JSAIS) have significantly predicted reading success at school (Robinson & Hanekom, 1994 cited in Cockcroft & Blackburn, 2008). Similarly with the Senior South African Intelligence Scale – Revised (SSAIS-R) the Verbal Scale was found to be a more significant predictor of academic success than the Non-Verbal Scale (Van Eeden, 1991). Apart from certain of the subtests not having any statistical correlation with reading, it is also long and expensive to conduct a complete IQ test. It therefore becomes impractical to conduct this research using a complete intelligence test, as one of the aims of reading research, in general, are for interventions to be accessible to those that usually can't afford it.

Cockcroft and Blackburn (2008) were interested in whether specific cognitive abilities contribute to the process of learning to read and conducted a study to determine whether subtests of the SSAIS-R could predict reading ability. They used 64 pupils from a private school in Gauteng of which 32 were girls and 32 were boys. The following subtests of the SSAIS-R test were administered to determine the relationship between different cognitive functions and reading: Vocabulary, Similarities, Story Memory and Coding. The Vocabulary subtest in the SSAIS-R requires a child to select from a series of pictures, that one which matches a spoken word, thereby assessing receptive language, verbal intelligence, and verbal learning ability. In the Similarities subtest, the child is expected to verbalize the commonality between spoken words, thereby evaluating the ability to make associations and form concepts, generalize, categorize and summarize information and grasp the concept of likeness. The story memory subtest involves a short passage read aloud to the child and he/she must attempt to recall as many details of the story as possible, thereby assessing attention span, sequencing, attention and short term memory. For the Coding subtest, the child is given a key to match symbols to a random set of numbers within a time limit, in doing so measuring visual-associative learning ability,

processing speed and visual tracking and scanning (Foxcroft & Roodt, 2005; Van Eeden, 1991). Results yielded moderate significant correlations for the Vocabulary, Similarities and Story Memory subtests of the SSAIS-R and the Neale-R. No significant correlations were found with the Coding subtest.

As stated earlier intelligence tests that have shown patterns of correlation between reading and intelligence are the Wechsler tests (D'Angiulli & Siegel, 2003; Mosley, 1980). The Wechsler intelligence tests have been developed as a result of the evolution of the social environment throughout the past century. The Wechsler tests have been frequently updated over the last 60 years incorporating new research and advance in the field of intellectual assessment. The Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV) continues this trend from the WISC-III. The WISC-IV was developed in 2003, and is a commonly used assessment tool in the screening of children. Using an assessment tool that is commonly used will ensure the identification of children with reading difficulties without having to conduct an extra reading assessment, which are expensive to conduct and therefore avoided. If a similar result as found in Cockcroft and Blackburn's (2008) study can be found with a more recent and frequently used test, reading difficulties could be identified at early stage of the child's academic career. Even though this will not eliminate the reading problem in South Africa, it would help with the early identification of children at risk for reading difficulties. The WISC-IV differs slightly from the SSAIS-R used by Cockcroft and Blackburn (2008). The WISC-IV consists of 15 subtests and 4 indexes that yield results on a Verbal, Nonverbal and Full Scale IQ scores. The subtests are Vocabulary, Similarities, Comprehension, Information, Word Reasoning, Arithmetic, Cancellation, Letter-number sequencing, Coding, Picture Completion, Block Design, Digit Span, Matrix Reasoning, Cancellation, Picture Concepts. Based on the positive correlations found in Cockcroft and Blackburn's (2008) study, the Vocabulary,

Similarities and memory (Story Memory) tests of the WISC-IV were chosen as some of the tests administered in this study.

Vocabulary is seen to have a significant relationship to reading (Cockcroft & Blackburn, 2008; Mosely, 1980; Muter, Hulme, Snowling & Stevenson, 2004) in children and adults (Carrol, 1993). The Vocabulary subtest, which involves giving definitions to words read aloud to the best of their ability. It assesses the cognitive skills of receptive language, verbal intelligence and verbal learning ability. Vocabulary is believed to be acquired from the second year onward (Bates, Bretherton, Snyder, Beeghly, Shore, McNew, Carlson, Williamson & Garrison, 1988 cited in Snow, Burns & Griffin, 1998), and continues to increase through the preschool and school years. Further Stanovich (1986) suggested that children with limited vocabularies tend to read less and as a result this hinders their vocabulary development which disrupts further growth in reading ability (Matthew Effect). Reading is a receptive skill, which is why it is strongly believed that exposure to the spoken language is where reading begins. Scarborough (1990) observed that children with poor receptive vocabulary skills at the age of three years displayed reading disabilities later on.

It is estimated that children acquire approximately seven words per day (2, 700 – 3, 000 words per annum) (Just & Carpenter, 1987; Nagy & Herman, 1987; Smith, 1941). Beck and McKeown (1991) agree with the above. However they point out that it may be more appropriate to say that children become more aware of seven words per day, as the process for acquiring a new word into the vocabulary of a child is a much longer learning process than just identifying a word. Landauer and Dumais (1997) support the suggestion of Beck and McKeown (1991) by stating that exposure to new words alter the preexisting semantic relationships among the words in the child's vocabulary. The home environment

therefore plays an important role in growing a child’s vocabulary. Individual differences have also been shown to be reliably related to demographics. For example, one study found that first graders from higher-income backgrounds had about double the vocabulary size of those from lower-income ones (Graves & Slater, 1987; Hart & Risley, 1995). This is depicted in the table below.

Table 1.

Exposure to quality and quantity of words according to the different Socio Economic Classes.

Actual Difference in Quantity of Words

In a typical hour, the average child would hear:

Welfare	616 words
Working Class	1, 251 words
Professional	2, 153 words

Actual Difference in Quality of Words Heard:

Professional	32 affirmations, 5 prohibitions
Working Class	12 affirmations, 7 prohibitions
Welfare	5 affirmations, 11 prohibitions

From Hart, B., & Risley, R. T. (1995). *Meaningful differences in everyday experience of young American children*. Baltimore: Pual H. Brookes.

Literature supports the fact that vocabulary growth is evident from a young age if comprehension skills and exposure to literacy are constant. However, the rate of growth is

variable in individual children (Beck & McKeown, 1991; Nagy & Anderson, 1984). This makes attempts that have aimed to measure the size of children's vocabulary very difficult due to the actual definition of vocabulary (for example, knowing the meaning of a word) and the method adopted to measure this (Beck & McKeown, 1991; Nagy & Anderson, 1984). It has been argued that to be able to measure vocabulary the source of words that should be used is important. For example if words from a dictionary are to be used, then it is important to consider the type of items selected and whether categories such as proper names, technical terms or scientific names should be used. Further to measure the size of vocabulary it is important to consider the theory of relatedness of words. For example the American Heritage School Dictionary gives the words meekness and meekly the same definition as meek. Thorndike (1921 cited in Nagy & Anderson, 1984) grouped adverbs ending in -ly under their base forms (i.e.: sad, sadly). This creates difficulty in determining what should be included in an assessment of vocabulary. The SSAIS-R measures receptive Vocabulary by using pictures as a description of the oral word given, compared to the Vocabulary subtest in the WISC-IV which measures expressive vocabulary by asking children for definitions of certain words. On the whole though, the cognitive skills measured by the SSAIS-R, are similar to those measured by the WISC-IV namely, receptive language, verbal intelligence and verbal learning ability.

Cockcroft and Blackburn (2008), in their study using the SSAIS-R and the Neale Analysis of Reading - Revised (NEALE - R) to analyze the same relationships as assessed in this study, found the Vocabulary subtest of the SSAIS-R correlated significantly with all components of the Neale-R. Stothard and Hulme (1996) further suggest that high verbal abilities facilitate vocabulary learning from context, so that children with high verbal ability know more words to begin with, can read them, and when they encounter unknown words

in their reading, can also learn from them. The Vocabulary subtest assesses a child's fund of knowledge thereby determining their verbal abilities (Wechsler, 2003).

The Similarities subtest of the WISC-IV involves orally presenting two words that represent common objects or concepts and the child must describe how these two objects are similar. It taps into the cognitive abilities of making associations and forming concepts of likeness, which match those skills measured on the Similarities subtest of the SSAIS-R.

Analogies require identification of similarities between words or mapping letters to sounds.

The ability to abstract similarities and to organize them meaningfully is a valuable skill needed for reading, especially when reading words that have similar strings of letters in them and when reading unfamiliar or nonsense words (Cockcroft & Blackburn, 2008). It has already been determined that a child begins to read long before formal schooling commences (Scarborough, 2001). For instance at the age of three, most children recognize that golden arches "stand for" MacDonald's (Moats, 2000). Frith and Ehri refer to this as the logographic stage. Goswami (1988) propose that beginner readers from the age of five years old can use analogies to read words. For example the word 'whale' can be read by identifying similarities between it and different parts of the words 'when' and 'sale' (Das, Parilla & Papadopoulos, 2000 cited in Cockcroft & Blackburn, 2008). This is further supported by Goswami (1988) who conducted an experiment where children were taught new words like *beak* and were told that this would provide a clue to help identify the words that followed (namely, *peak*, *weak*). In most stages of reading, analogies are used to assist in identifying words i.e.: in the pre-alphabetic phase children draw analogies with visual representations. In the partial alphabetic phase, analogies are made with certain parts of a word as well as mapping sounds to certain letters. This becomes more evident in the third phase where children decode words by identifying the sounds of letters and

blending them to identify the words. Thereafter analogies are made to chunks of words to identify new words. Forming connections allows readers to remember how to read words with conventional sounds and also allows connections to be made for words that are spelled irregularly (Ehri & McCormick, 1998). Correct decoding of words will also enhance rate of reading, thereby increasing comprehension (D'Angiulli & Siegel, 2003).

Scarborough (2001) in analyzing correlations between predictor variables and later reading scores measured the concept of association in children as one of her predictor variables. Her study divided the predictor variables into three categories: print related knowledge, oral language abilities and non verbal abilities. Findings showed a significant correlation to print related measures followed by oral and nonverbal abilities. Her study also showed that later prediction of reading could be improved by combining print related and oral language abilities. This suggests that children are able to make abstract associations from a very young age. However these are not consistent across all contexts.

When a child is able to make the association that the golden arches stand for MacDonald's, they are utilizing the skill of association as measured in the similarities subtest. As evidenced in the discussion above, children are able to make associations by the age of 3-year-old. However they are not able to apply these across all contexts and domains without specific practice. This skill needs to be taught through formal teaching (Frith, 1985). Even though the content of associations in the subtest is different to the ones required for reading, it is the underlying skill of forming concepts of likeness that is being measured in the Similarities subtest. Other skills that are assessed with this subtest are auditory comprehension, memory, verbal expression and the child's ability to differentiate between essential and non-essential features (Wechsler, 2003).

Concept formation is another very critical skill implicated in reading and reading comprehension (Das, Parilla & Papadopoulos, 2000 cited in Cockcroft & Blackburn, 2008). The skills needed for concept formation are also tapped by the Similarities subtest of the WISC-IV. Concepts are believed to be acquired through the classical principles of association which are contiguity, recency, frequency, and similarity (Adams, 1996).

The memory subtest in the WISC-IV is the Digit Span Subtest. This subtest requires the child to repeat a sequence of numbers which are orally presented to. This is called digits forwards. This subtest includes a second part as well involving a series of numbers orally presented which the child needs to repeat in reverse sequence. This is called digits backwards. The aim of this subtest is to measure auditory short-term memory, sequencing skills, attention and concentration (Foxcroft & Roodt, 2005; Wechsler, 2003). All of these skills are important in the process of reading as a child needs to have the skill of memory to recall not only what was read but also to remember the sound each letter makes. Digit Span is a subtest that measures working memory ability which is a vital skill for reading (Gathercole, Service, Hitch, Adams & Martin, 1997; Swanson & Howell, 2001 cited in Georgiou, Das & Hayward, 2008).

Another skill said to play a vital role in the process of reading is auditory sequential memory (ASM) (Hirshoren, 1969; Kirk, 1968; Rugel, 1974 cited in Klein & Schwartz, 1979). Studies done in this area have shown that ASM differentiates between good and poor readers (Senf & Freundall, 1971 cited in Klein & Schwartz, 1979) as studies have shown deficits in sequential memory and attention skills in children with reading difficulty (Bannatyne, 1971; Bannatyne, 1974; Rugel, 1974 cited in Klein & Schwartz, 1979). From the WISC-R subtests, Digit Span subtest requires auditory sequential memory. Linked very closely to auditory sequential memory skills is attention to detail. Literature indicates that

the ability to store information in a correctly ordered sequence is fundamental to reading ability (Das, Parilla, Papadopoulos, 2000 cited in Cockcroft & Blackburn, 2008; Savage, Cornish, Manly & Hollis, 2006). Although the majority of the literature points to sequential memory skills contributing to reading and comprehension in particular, some studies show that less skilled and good comprehenders share the same ability to repeat back sentences and short stories (Oakhill, Cain & Bryant, 2003).

Bowers, Steffy and Tate (1988) identified short-term memory as one of the abilities that was predictive of reading ability. Poor short-term memory was also associated with lower verbal intelligence. Lower verbal intelligence refers to the very basic, foundational skills that are crucial in developing skilled reading (Jorm & Share, 1983; LaBerge & Samuels, 1974; Perfetti, 1985). Short term memory would be expected to play a role in both reading comprehension as well as decoding. For instance, if a child experiences difficulty decoding words, then their short-term memory may become overloaded and their ability to understand and remember what has been read may be affected (Shankweiler, 1989). In a previous study it was found that skilled and less-skilled comprehension is not differentiated by performance on traditional tests of passive short-term memory (e.g., digit span and word span) (Oakhill, Yuill, & Parkin, 2005), but that poor comprehension is linked to difficulties with working memory tasks (i.e., memory tasks that require them to switch between storage and processing functions), which is measured by the Digits Span (backward) subtest.

Seymour and Elder (1985 cited in Harris & Coltheart, 1986) conducted numerous studies with children in the first phase of reading. These studies indicate that children are able to read limited words based on the visual pattern of the word. For example Frith's term to describe this phase is logographic which come from the idea that children recognizing

popular 'logo's' like McDonalds and CocaCola. However further studies done by Seymour and Elder (1985 cited in Harris & Coltheart, 1986) indicate that the above is not always true. Children are able to read words recognizing particular sequencing of letters, which goes beyond recognizing overall shapes or colours.

The WISC-IV also provides four index scores. The four index scores consist of the Verbal Comprehension Index (VCI), the Perceptual Reasoning Index (PRI), the Working Memory Index (WMI) and the Processing Speed Index (PSI). The Verbal Comprehension Index is composed of subtests measuring verbal abilities utilizing reasoning, comprehension, and conceptualization, and the Perceptual Reasoning Index is composed of subtests measuring perceptual reasoning and organization. The Working Memory Index is composed of subtests measuring attention, concentration, and memory, and the Processing Speed Index is composed of subtests measuring the speed of mental and grapho-motor processing (Wechsler, 2003). The Verbal Comprehension Index and Working Memory Index show the strongest correlation with reading ability.

Working Memory has proved to be one of the major contributors to reading comprehension (Alloway, Gathercole, Willis & Adams, 2005; Baddeley, 1986; Daneman & Carpenter, 1980; Engle, Cantor & Carullo, 1992; Friedman & Miyake, 2004; Gathercole, Brown & Pickering, 2003; Swanson & Howell, 2001 cited in Georgiou, Das & Hayward, 2008). It is defined as information that is stored in memory for a short period of time that is manipulated in the same way, hence the name working memory (Baddeley & Hitch, 1974; Gathercole, 2007 cited in Georgiou, Das & Hayward, 2008). This concept has evolved from the unitary term known as short-term memory (Baddeley, 1992) and the terms are sometimes used interchangeably. Divisions between long and short term memory have been proposed as far back as the 1960's. Concepts of short term memory originally

included sensory registers and storage components for incoming information and shared close links with long term memory (Baddeley, 2003). This is an extremely important skill used in reading. For the past 80 years, research has reiterated the fact that the learning of new material is aided by knowledge already acquired (James, 1899; James, 1958 cited in Kamil, Mosenthal, Pearson & Barr, 2000), since “he [the child] interprets the new by means of the old concept” (Laing, 1903. p. 27).

According to Pickering (2001) four components have been implicated in the working memory model: Phonological Loop, Visuospatial Sketchpad, Episodic Buffer and Central Executive.

Research has shown that the phonological loop is the most closely related to reading as it is based on speech information. The phonological loop is made up of two sub components: a phonological store and an articulatory rehearsal component process. The function of the phonological store is the holding of speech-based information (Baddeley, 1990) and the articulatory rehearsal component responsible for reviving memory traces (Baddeley, 1990). Cognitive tasks that make use of the phonological loop when learning to read are language comprehension and vocabulary acquisition. The visuospatial sketchpad is responsible for maintaining nonverbal information (such as colours, shapes, tastes, etc). The episodic buffer is a recent concept that was added on by Baddeley in 2000, and is said to be “responsible for the integration of cognitive vents across different representation domains” (Gathercole, 2007, p.234 cited in Georgiou, Das & Hayward, 2008). The central executive is said to be responsible for the controlling cognitive processes. Swanson and Alexander (1997, cited in Georgiou, Das & Hayward, 2008) propose working memory to play a vital role in word reading and reading comprehension. This was further supported

by later studies done in this area (Swanson, 2000; Swanson & Howell, 2001 cited in Georgiou, Das & Hayward, 2008).

Working memory is measured in the current study by means of the Digit Span subtest and is said to be a natural processing-dependent ability, not associated with socio-economic factors, previous education or primary caregiver's level of education (Gathercole & Pickering, 2002), therefore making it a more culture-free, fluid cognitive skill measure (Campbell, Dollaghan, Needleman, & Janosky, 1997).

Other Factors that impact on reading development

In addition to the cognitive factors discussed, there are a multitude of other factors that contribute to reading failure (Ramus, in press). A few of these are highlighted below:

Phonological Awareness

Among the most prevalent and well researched of the factors that contribute to the development of reading is phonological awareness (Muter, Hulme, Snowling & Stevenson, 2004; Parrila, Kirby & McQuarrie, 2004; Rack, Snowling & Olson, 1992; Siegel, 1993; Siegel & Faux, 1989; Siegel & Ryan, 1988; Snowling, 1980; Stanovich, 1988).

Phonological awareness, and in particular phonemic awareness, is the understanding of the basic alphabetic principle and requires an awareness of the spoken language. The National Research Council concurs with Snow, Burns and Griffin's (1998) definition in distinguishing phonological awareness from phonemic awareness:

The term phonological awareness refers to a general appreciation of the sounds of speech as distinct from their meaning. When that insight includes an understanding

that words can be divided into a sequence of phonemes, this finer-grained sensitivity is termed phonemic awareness. (Snow, Burns, & Griffin, 1998, p. 51)

Therefore phonemic awareness is a component of phonological awareness. The awareness of the phonological structure of language and speech gradually develops from tasks initially involving a child to become aware that speech or language can be broken down into smaller parts like words. Tasks used to achieve this are, rhyme songs and segmentation of sentences. More complex tasks would follow a process of being able to decode or isolate the phonemes of a word to combining the phonemes of a word to manipulating the phonemes in a word. The most complex level is manipulating phonemes which involve adding, subtracting and substituting the phonemes in a word to create new words, thereby mapping the sounds each letter makes (Taylor, 2002).

It has been suggested that phonological awareness precedes the acquisition of reading. Alternatively, learning to read may be a prerequisite for becoming aware of the phonological structure of words. Another commonly believed hypothesis and that which is supported by many is that the relationship is reciprocal where early phonographic awareness assists insight into the alphabetic code, which in turn supplements the level of phonological awareness (Bentin, Hammer, Cahan 1991; Perfetti, Beck, Bell and Hughes, 1987; Wimmer, Landerl, Linortner & Hummer, 1991). Furthermore, Ehri (1991) identified phonological processing as a pre-requisite for reading, without which the acquisition of reading skills becomes very difficult. He also proposed that children with phonological ability acquire reading skills faster than children without it. Calfee, Chapman and Venezky (1972), support the notion of phonological awareness developing at the same age that the reading is taught. The study was conducted on five and a half year old learner's who were questioned on phonological awareness. For example: a) whether two words sounded the same at the end and b) to provide a word that rhymes with the presented word. These

children were able to do this successfully 39% of the time suggesting that most had limited phonological awareness. It is evident that phonological skills play a vital role in reading acquisition.

Comprehension

The core purpose of reading is to obtain meaning from what is read, be it basic messages like directions or professional reading for academic purposes. Reading words without comprehending what the words mean, is not really reading. Previously, comprehension as a reading skill was not given much importance and was assumed to be present if pronunciation was correct. However present day comprehension tests place an emphasis on understanding. The Word Reasoning subtest from the WISC-IV measures the ability to identify the common concept being described in a series of clues, which measures cognitive logical thinking ability, verbal comprehension and ability to synthesize different types of information and generate alternative concepts. The tasks on this subtest are similar to the tasks measured on the Delis-Kaplan Executive Function System (D-KEFS) (Delis, Kaplan & Kramer, 2001 cited in Wechsler, 2003), the Riddles subtest of the K-ABC and cloze tasks. Verbal reasoning skills such as verbal comprehension, analogical and general reasoning ability, verbal abstraction, domain knowledge, the ability to integrate and synthesize different types of information, and the ability to generate alternative concepts are measured (Ackerman, Beier & Bowen, 2000; Alexander & Kulikowich, 1991; Delis, Kaplan, Kramer, 2001; DeSanti, 1989; McKenne & Layton, 1990; Newstead, Thompson & Handley, 2002; Ridgeway, 1995 cited in Wechsler, 2003).

Yuill (1996 cited in Snow, Burns & Griffin, 1998) used the method of riddles to assess comprehension. The participants in his study were aged between seven and eight years

old and were divided into two groups, experimental and control. The experimental group was exposed to riddles to assess multiple interpretations and the control group read amusing texts focusing on the sub-lexical awareness rather than meta-comprehension skills. Findings showed that the experiment group performed better in tasks of comprehension on a post-test done after two months.

The reason this subtest was added in this study, was to determine if a relationship between the subtest and the Comprehension subtest on the Neale-R due to the fact that both seem to tap similar skills.

Vocabulary is seen as a supplement to comprehension as reading written text places an emphasis on vocabulary knowledge (Snow, Burns & Griffin, 1998). For example, if a beginner reader comes across the word 'pig' and attempts to identify it by decoding the word 'p / i / g', they recognize the word more easily as a word they have heard or read before. Understanding what the word means facilitates meaning of what is being read. Without knowing what the word 'pig' means, the child won't be able to understand the meaning of a simple sentence like 'the pig has very smooth skin'. Attention is also aids comprehension and allows the child to decode words correctly. Skills in attention are vital to reading in many different phases of the reading process, especially when discriminating letters in words that look very similar (e.g., q – p and d – b), and when reading unfamiliar or nonsense words (Das, Parilla & Papadopoulos, 2000 cited in Cockcroft & Blackburn, 2008) . Attention skills are also required as a supplement to sequential skills which are used in decoding words. It is important to note that not all research supports vocabulary skills in comprehension (Ehrlich & Remond, 1997; Oakhill, Cain & Yuill, 1998; Stothard & Hulme, 1992).

Decoding skills also influence comprehension of what is read. D' Angiulli and Siegel (2003) in their attempt to determine the pattern of performance in children with learning disabilities found that children struggling to decode single words lead to difficulty in understanding the sentences they were trying to read. This is probably due to the slow pace at which words are read, which creates long breaks between decoding each word, thereby missing the understanding of what was read.

The Comprehension subtest of the WISC-IV was also included in the current study, even though pure comprehension is not being assessed. Instead, this subtest measures social learning or comprehension. Although less attention in literature has been placed on social learning (Borgatti & Cross, 2003), a growing body of literature has focused on this topic as a cognitive process in the last 30 years (Argyris & Schon, 1978; Draft & Weick, 1984). Borgatti and Cross (2003) view social interaction as a vehicle for knowledge acquisition and acknowledge the importance of social relationships. Consistent with their views, Granoveter (1973) and Burt (1992) agree that the creation of knowledge as a social process is very valuable. However a person's ability to grasp and remember new concepts and words strongly depends on their background knowledge (Snow, Burns & Griffin, 1998) which is usually dependent on a person's vocabulary knowledge (Robbins & Ehri, 1994 cited in Snow, Burns & Griffin, 1998). In the Comprehension subtest of the WISC-IV, the child is questioned about understanding of general principles regarding social behaviour and social situations. It aims to measure the cognitive abilities of generalization skills, ability to categorize and summarize information and ability to draw on past experiences (long term memory) to make moral and social judgments.

Gender

An additional question addressed by this study concerned the topic of gender differences in cognitive and reading ability. There have been numerous research reports examining the biological, psychological, cultural, and political influences which are presumed to influence and shape gender differences in cognition, emotion, language, and behaviour. For example, it is well established that females excel over males across a variety of language related tasks (Bayley, 1968; Broverman, 1968; Harris, 1978; Hampson & Kimura 1992; Harshman, 1983; Hyde and Lynn, 1988; Kimura, 1993; Koenigsknecht & Friedman, 1976; Lezak, 1983; McGlone, 1980; McGuinness, 1976; Moore, 1967 cited in Joseph, 2000; Maccoby & Jacklin, 1974 cited in Lloyd, Walsh & Yailagh, 2005; Shibley & Marcia, 1988). Females also produce more social–emotional vocalizations (Brody, 1985; Burton & Levy, 1989; Gilbert, 1969; Joseph, 1993, Joseph, 1996, Joseph, 1999; Tannen, 1990 cited in Joseph, 2000), thereby learning more about personal relationships whereas males are more visual-spatially orientated (Joseph, 2000). Many of the commonly-cited gender stereotypes go unchallenged as social accepted wisdom, with the majority of the research being directed toward underachieving boys (Ofsted, 2003a & Ofsted, 2003b cited in Jones & Myhill, 2004). Boys are often encouraged to identify with a set of ‘macho’ values that reject the values of education (Mac & Ghail, 1994; Martino, 1999 cited in Jones & Myhill, 2004). Similarly boys are often stereotyped as being weaker at language skills and seen as less committed readers and disliking writing activities (Millard, 1997; Gorman; White; Brooks; Malcure & Kispal, 1988 cited in Jones & Myhill, 2004). Boys are generally seen as more mathematically and spatially skilled, while girls are seen as more verbally orientated (Bee & Boyd, 2004; Liederman, Kantrowitz & Flannery, 2005). This is probably why the ratio of boys being referred for reading problems is much higher than girls (Liederman *et al.*, 2005). Bjorklund (2005) concur and suggest that the fact that more boys than girls are

regarded as reading disabled is strong evidence for a biological basis to account for this gender difference.

Shibley and Marcia (1988) in an attempt to reassess the gender differences in verbal ability analysed 165 studies on gender functioning. They reported overall slight female superiority, however effect sizes were so small that differences in verbal ability between gender's seemed non-existent. Among the variables assessed were vocabulary, analogies, and comprehension with the analogies subtest showing slight male superiority in performance. Other contrasting results were also found within the analyses where studies done in 1985 using the Scholastic Aptitude Test (SAT) showed male superiority in performance on verbal abilities. Further analyses were conducted on gender differences at different ages as well with no significant differences emerging. This contradicts the work of Maccoby and Jacklin (1974 cited in Shibley & Marcia, 1988) who suggest that girls verbal abilities mature before that of boys therefore are expected to perform better in 'high-level' verbal tasks like analogies and comprehension. Although majority of the research supports female superiority in verbal tasks, differences are only presented after the age of 10 or 11 (Anastasi, 1958; Denno, 1982; Maccoby & Jacklin, 1974 cited in Shibley & Marcia, 1988).

Cockcroft and Blackburn (2008), in a study consisting of 64 grade 2 learners, found that boys unexpectedly achieved significantly higher than the girls on two verbal subtests (Vocabulary and Similarities) of the SSAIS-R. These results support tentative suggestions that gender differences are beginning to even out. According to Feingold (1988 cited in Cockcroft & Blackburn, 2008) and Flynn (1998 cited in Cockcroft & Blackburn, 2008), gender differences with regards to verbal reasoning in American and Israeli males and females prove to be decreasing with each passing decade. This change is attributed to equal exposure of the genders to educational and social environments which are the main

contributors to verbal abilities (Bradshaw & Nettleton, 1983). Some recent studies have found differences in cognitive functioning between genders, however the effect sizes were found to be small (Logan & Johnston, 2009). Another possible explanation to the above scenario, is the issue of different forms of reading (Hall & Coles, 1999 cited in Logan & Johnston, 2009). Boys have been found to read more newspapers (Hall & Coles, 1999 cited in Logan & Johnston, 2009) and articles or information of the internet (Mullis, Martin, Gonzalez & Kennedy, 2007 cited in Logan & Johnston, 2009). This kind of reading is usually not a part of traditional reading assessments and therefore may go unnoticed, unless informal self report measures are used (Logan & Johnston, 2009) and this may also contribute to the absence of differences in reading ability between males and females.

Other factors that have been identified to contribute to the gender differences in cognitive functioning are attitudes to reading and frequency of reading. High positive attitudes have obviously yielded higher average reading achievement (Mullis, Martin, Gonzalez & Kennedy, 2003 cited in Logan & Johnston, 2009; Mullis *et al.*, 2007 cited in Logan & Johnston, 2009). Logan and Johnston (2009) identified girls as having much better comprehension skills, reading more frequently and having a more positive attitude compared to boys.

In conclusion, this study aims to identify if specific subtests of the WISC-IV are related to reading ability as measured by the Neale-R. In addition another aim is to determine the functioning of the different gender groups and identify the differences (if any) in reading ability exhibited by males and females.

Chapter Three

Method

Research design:

This research was exploratory in nature, with the aim of drawing conclusions between reading ability and IQ subtest scores. This study attempted to investigate the relationship between the independent variable, namely performance on the WISC-IV subtests and the dependent variable, reading ability as assessed by the Neale Analysis of Reading – Revised (NEALE-R). The research design was a non-experimental, ex-post facto, correlational design. A non-experimental method was adopted aimed at exploring the natural occurrence of a phenomenon as opposed to manipulating variables. An ex-post facto method was used due to the pre-existing characteristics of the participants, and a correlational design was adopted because of the assessment of the relationship between variables.

Sample:

The sample was a convenience sample and consisted of volunteers. The 33 participants were grade two boys and girls from a English medium school in Lenasia, Gauteng. All of the grade two children at the school were invited to participate in the study. The age of the whole sample ranged from approximately 7 to 8 years old. Grade two learners have had some basic reading instruction. The testing was conducted individually by a qualified psychometrist.

The exclusion criterion consisted of children that were diagnosed with ADHD, Learning Disorders, Speech Disorders or auditory difficulty which were determined by the parent questionnaire. The sample consisted of 17 males and 16 females. All 33 participants shared the same home language of English.

Instruments:

This study consisted of two standardised assessments and one questionnaire which will be discussed in more detail below. Of the two standardised instruments one constituted an intelligence scale, namely the Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV) and the other a reading assessment, namely the Neale Analysis of Reading Ability – Revised (Neale-R).

The Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV) (Wechsler, 2003)

The WISC-IV was designed to obtain a differential profile of intelligence-related cognitive abilities. It is standardized for English speaking learners between the ages of six years and zero months and sixteen years and eleven months. The test's norms were derived from a sample of White, African American, Hispanics, Asians, Mixed race complying with these criteria (Wechsler, 2003). Although there are no WISC-IV norms for the South African population, the aim of the current study was not to compare the WISC-IV subtest scores to the norm population, but rather to examine their relationship to reading.

The WISC-IV consists of 15 subtests and four indexes which are used to construct the Verbal, Non-verbal and Full Scale IQ scores. The subtests are Vocabulary, Similarities, Comprehension, Information, Word Reasoning, Arithmetic, Cancellation, Letter-number

sequencing, Coding, Picture Completion, Block Design, Digit Span, Matrix Reasoning, Cancellation, Picture Concepts, of which five were chosen for this study. Due to time constraints, the full IQ test was not administered; the five subtests used in this study were Vocabulary, Similarities, Comprehension, Word Reasoning and Digit Span. Those that contribute to the Verbal Scale are Vocabulary, Comprehension, Word Reasoning and Similarities. The Digit Span subtest falls in the Non-Verbal Scale.

The Vocabulary subtest involves activities where the child needs to give definitions as best as they can for words that the researcher reads out aloud. It assesses receptive language, verbal intelligence and verbal learning ability. According to Frith's (1985) theory a child needs some form vocabulary knowledge to be able to read effectively. Likewise with consistent reading, vocabulary is developed.

The Similarities subtest consists of verbal activities where the child is orally presented with two words that represent common objects or concepts and needs to describe how they are similar. It examines the ability to make associations and form concepts and to grasp the notion of likeness. This subtest was chosen as according to Frith's (1985) theory on reading, understanding abstract similarities (analogies) is an important skill in acquiring reading skills. This includes looking for similarities between new words and words already known for example, using the word 'bottle' to read the word 'throttle' (Ehri, 2005).

The Comprehension subtest involves the child by asking them questions based on their understanding of general principals and social situations. It aims to measure generalization skills, ability to categorise and summarise information and to be able to draw on past experiences to make moral and social judgments. These skills are important skills for reading comprehension to occur.

The Word Reasoning subtest involves identifying the common concept that is being described in a series of clues, which measures the skills of logical thinking ability, verbal comprehension and ability to synthesise different types of information and generate alternative concepts.

The Digit Span subtest is divided into two parts; the first part involves a sequence of numbers orally presented to the child that the child needs to repeat in the correct sequence back to the researcher. This is called digits forwards. The second part involves a series of numbers orally presented to the child but the child needs to repeat the numbers backwards this time. This is called digits backwards. The aim is to measure auditory short-term memory, sequencing skills, attention and concentration (Foxcroft & Roodt, 2005; Wechsler, 2003). Digit Span also assesses memory and attention to detail. Both these skills are important in the process of reading as a child needs be able to recall not only what was read but also be able to link it to information from long term memory. This assists in comprehending what was read as well. Attention is also important as it aids comprehension and allows the child to decode words correctly.

The WISC-IV also provides a measure on four index scores. The four index scores consist of the Verbal Comprehension Index (VCI), the Perceptual Reasoning Index (PRI), the Working Memory Index (WMI) and the Processing Speed Index (PSI). The Verbal Comprehension Index is composed of subtests measuring verbal abilities utilizing reasoning, comprehension, and conceptualization, and the Perceptual Reasoning Index is composed of subtests measuring perceptual reasoning and organization. The Working Memory Index is composed of subtests measuring attention, concentration, and working

memory, and the Processing Speed Index is composed of subtests measuring the speed of mental and graphomotor processing (Wechsler, 2003).

Evidence for internal consistency of the WISC-IV subtests was obtained using the split half method. Due to some subtests loading on the processing speed index, the split-half coefficient is not a proper estimate of reliability. Therefore a test-retest method was adopted. The test-retest reliability was estimated for five age groups (6 – 7, 8 – 9, 10 – 11, 12 -13 and 14 – 16) using Person's product-moment correlation. The WISC-IV scores possess adequate stability across time for all five age groups (Wechsler, 2003).

The average corrected stability coefficient for Vocabulary is excellent (.92); the average stability coefficient for Similarities, Digit Span, Block Design, coding, Letter – Number Sequencing, Matrix Reasoning, Comprehension, Symbol Search, Picture Completion, Information and Word Reasoning are good (in the range of 0.80) and other subtests are adequate (in the range of 0.70) (Wechsler, 2003).

The mean scores for the standardised sample for all subtests are higher than the scores from the first testing, with the effect sizes ranging from .80 (Comprehension) to .60 (Picture Completion). Generally, test-retest gains are less distinct for the subtests on the Verbal Comprehension index and the Working Memory Index than the subtests on the Perceptual Reasoning index and the Processing Speed index (Wechsler, 2003).

Reliability for the WISC-IV was obtained through a test-retest method. The reliabilities for the subtests chosen for this study ranged between 0.74 – 0.86 for the ages 7 – 8 years respectively. The reliabilities for the individual subtests for 7 - 8 years respectively are: Similarities subtest $r = 0.85$ and $r = 0.86$; Digit Span subtest $r = 0.81$ and $r = 0.84$;

Vocabulary subtest $r = 0.85$ and $r = 0.86$; Comprehension subtest $r = 0.74$ and $r = 0.78$;
Word Reasoning subtest $r = 0.81$ and $r = 0.83$ (Wechsler, 2003).

Neale Analysis of Reading Ability – Revised (Neale-R) (Neale, 1989)

The NEALE-R is a test of English reading ability which assesses reading accuracy, rate and comprehension. It consists of six pages of prose, each page consisting of a passage that the child reads as a narrative. The passages are designed to be meaningful to particular age levels. The age levels are from six years to thirteen years old. The difficulty level of passages gradually increases by including more complex vocabulary and sentence structures. There are four comprehension questions following the first passage and eight for the subsequent five passages. These are orally presented to the child by the examiner.

If the child makes more than two errors in a passage, an easier passage is accorded and conversely if a child makes less than two errors a progressively more difficult passage is given until a ceiling has been reached. All errors made will be recorded and categorized in one of six groups, namely mispronunciations, substitutions, refusals, additions, omissions or reversals (Neale, 1989).

The internal consistency levels of the standardized sample were calculated using Cronbach's generalised co-efficient alpha for accuracy and comprehension. There are two alternate versions of the test (Forms One and Two) for purposes of evaluating reading ability and progress over time (Spooner, Baddeley & Gathercole, 2004). (Form one was used in this study and the internal reliability for Form One is $r = 0.71$ (Rate), $r = 0.89$ (Comprehension). Although the Neale is standardized on a sample of British learners, the stanine scores of the learners that participated in the study have been correlated with their

IQ test scores, derived from the subtests of the WISC-IV (Neale, 1989). Thus, the focus was not on their performance relative to the norm sample.

Biographical Questionnaire

A Biographical Questionnaire was sent out to determine the primary / home language and relevant biographical information. All of the children who attend the school come from middle-to upper income homes. Since socio-economic status has been found to have an impact on reading ability, it was seen as important to determine this variable and hold it constant (Mosely, 1980; Seymour, 2000). A question on the parent's occupation was placed in the questionnaire. Based on the feedback, the parents of all participants held semi-professional jobs, creating a similar socio economic background. (Refer to Appendix C)

Procedure:

All Grade two children were invited to participate in the study. Those children who were willing to participate and whose parents/guardians had given consent were included in the sample. The sample group was then divided into two groups. For half of the sample, the WISC-IV was administered first, followed by the Neale-R, and for the other half the order was reversed. However, the order of the WISC-IV subtests remained constant for all learners. This was done to eliminate any possible effects that order of presentation of the tests may have had.

A suitable time was discussed with the teachers in order to create minimal disruptions in the classroom as well as proposed to be beneficial to the child's educational and emotional well being. A suitable room was also chosen to avoid major distractions, make sure the

lighting was appropriate, enough fresh air could be circulated and appropriate furniture was available. Once this was set, the teacher sent one child at a time for the assessment. The children were then introduced to the researcher and explained the process and purpose of the research in very simple terms and also that they could decide if they did not want to participate and that there were no consequences to their decisions. The tests were administered by a qualified psychometrist.

The researcher attempted to create a calm and relaxed atmosphere to reduce any anxiety the children may have been experiencing. This was done by taking some time to establish rapport with the client at the beginning of the assessment. When the researcher needed to rate responses, it was done using codes and symbols and not ticks and crosses. This was done to once again reduce any performance anxiety that could have been experienced.

Ethics:

The first ethical consideration was consent, because of the age of the participants and their inability to give consent, it was vital that an informed letter was sent to the parents stating exactly what the research was about, the positives and negatives of the research and the harms and benefits it may have on their children. It was also deemed important that the parents discuss the research with their children and determine if they would like to participate in the research. The study was therefore done on a voluntary basis, and participants and their parents were advised that they may withdraw at any point with no prejudice. The children who participated gave verbal assent after being explained the process and were given an opportunity to withdraw with no consequences and no questions asked.

Another issue that was considered was that of confidentiality. Anonymity was not ensured as the researcher needed the children's names in order to correlate the scores from the two different tests. However the results were coded before being analysed.

Any reading difficulties that were identified were communicated to the respective parents and teachers were also made aware of these difficulties with the permission of the parents.

Ethical clearance was obtained from the University of Witwatersrand research committee as well as permission from the school principal before the research commenced. (See Appendix F for the University Ethics Certificate)

Chapter Four

Results

Introduction

This research was done with the aim of finding an association or relationship between cognitive abilities, as measured by the subtests on the WISC-IV and reading skills as measured by the Neale-R. An additional question addressed by this study was to determine if there were any gender differences in performance on the WISC-IV subtests and on the Neale-R.

Descriptive Statistics

Descriptive Statistics include a brief description and summary of the available information about the sample. It reduces large amounts of data into a more manageable and meaningful form.

Table 1 contains the means and standard deviations for the subtests of the WISC-IV and the Neale-R. The first five subtests show the descriptive statistics for the WISC-IV subtests and the last three are the descriptive statistics for the Neale-R subtests. For the statistical analysis, raw scores were converted to stanines in the case of the Neale-R and standard scores in the case of the WISC-IV. The Satterthwaite test was used to check for equivalence of variance. All subtests were found to have equal variances.

Table 1.

Descriptive statistics for total sample (N=33)

Variable	Mean	Median	St. Dev	Minimum Score	Maximum Score
Similarities	9.30	9.00	2.72	5	15
Digit Span	9.36	9.00	2.70	3	16
Vocabulary	6.36	6.00	1.65	3	10
Comprehension	8.70	9.00	2.21	4	13
Word reasoning	9.30	9.00	2.34	6	15
Accuracy	4.36	4.00	1.19	2	6
Rate	4.42	4.00	1.41	2	8
Comprehension	4.36	4.00	1.69	1	7

The sample consisted of 17 male participants, when the sample was split into gender groups. Table 2 below shows the descriptive statistics for all the males in the sample.

Table 2.

Descriptive statistics for males in the sample (n = 17)

Variable	Mean	St Dev	Min	Max
			Score	Score
Similarities	9.35	2.53	5	14
Digit Span	9.47	2.10	6	14
Vocabulary	6.24	1.86	3	10
Comprehension	9.24	1.92	6	13
Word reasoning	8.88	2.15	6	13
Accuracy	4.12	1.22	2	6
Rate	4.59	1.58	2	8
Comprehension	4.29	1.69	1	7

The sample consisted of 16 female participants as depicted in table 3 below. Table 3 shows the descriptive statistics for all the females in the sample.

Table 3.

Descriptive statistics for females in the sample (n = 16)

Variable	Mean	Std Dev	Min	Max
Similarities	9.25	3.00	5	15
Digit Span	9.25	3.30	3	16
Vocabulary	6.50	1.46	4	9
Comprehension	8.13	2.42	4	13
Word reasoning	9.75	2.52	6	15
Accuracy	4.63	1.15	2	6
Rate	4.25	1.24	2	6
Comprehension	4.44	1.75	1	7

Normality

Three assumptions need to be investigated for data to be suitable for parametric statistical analysis. One of the assumptions is a normal distribution of the data. The Kolgorov-Smirnov test was done to check for this. The histograms for each subtest revealed generally normal distributions of scores (Refer to appendix E for histograms). The second assumption necessary for parametric analysis is random independent sampling. The sample used in this study was a convenience sample of volunteers, thus it was not randomly selected. The order of the tests was randomly allocated to participants. The third assumption is use of interval measurement scales. Both the WISC-IV and the Neale-R utilized interval scales of measurement. The fourth assumption for parametric analysis is

the homogeneity of variance (Howell, 1997), which was done using the Satterthwaite test where equivalence of variance was achieved.

Correlations

Since the sample size was small, both parametric and non-parametric analyses were conducted. Thus both Pearson’s Product Moment and Spearman’s correlation coefficients were conducted for the whole sample and then separately by gender in order to determine any relationships between the eight variables, namely five WISC-IV subtests and three Neale-R reading components. Depicted below in table four are the correlations for the complete sample.

Table 4.

Pearson’s Correlation Coefficients between all variables in the total sample (N = 33)

Variable	Similarities	Digit Span	Vocab	Comp	Word Reasoning
Accuracy	0.25	0.21	0.07	-0.11	0.26
Rate	0.21	0.05	0.25	0.18	0.33
Comp	0.13	0.18	0.22	0.04	0.45

No statistically significant correlations were found with $\alpha = 0.05$, which is likely to be a result of the small sample size. Table 5 summarizes the results from the Spearman's Correlation that was conducted.

Table 5.

Spearman's Correlation Coefficients between all variables in the total sample (N = 33)

<i>Variable</i>	Similarities	Digit Span	Vocab	Comp	Word Reasoning
Accuracy	0.27	0.19	0.02	-0.10	0.23
Rate	0.24	-0.02	0.25	0.21	0.34*
Comp	0.09	0.22	0.16	0.05	0.41*

*p = < 0.05

Since the Spearman's correlational analysis is more lenient than the Pearson's correlational analysis two statistically significant correlations were found. As presented in table 5, moderate significant correlations were found between the variables word reasoning and rate ($r = 0.34$; $p < 0.05$) and word reasoning and comprehension ($r = 0.41$; $p < 0.05$).

Spearman's Correlational analyses were carried out with the separate gender sub-samples as well. Table 6 depicts intercorrelations within the male sub-sample.

Table 6.

Spearman's Correlation Coefficients for Males (n = 17)

Variable	Similarities	Digit Span	Vocab	Comp	Word Reasoning
Accuracy	0.56*	-0.08	0.12	-0.09	0.36
Rate	0.35	-0.06	0.34	0.38	0.42
Comp	0.14	-0.09	0.08	-0.07	0.53*

*p = < 0.05

The next table indicates intercorrelations within the female sub-sample.

Table 7.

Spearman's Correlation Coefficients for Females (n = 16)

Variable	Similarities	Digit Span	Vocab	Comp	Word Reasoning
Accuracy	-0.02	0.40	-0.04	0.08	0.03
Rate	0.08	0.05	0.13	0.03	0.33
Comp	-0.04	0.42	0.23	0.11	0.32

*p = < 0.05

From tables 6 and 7 it is evident that correlations for the male sample differed from those for the female sample. Statistically significant correlations were found in the male sample only. These were between the Similarities subtest of the WISC-IV and the Accuracy subtest of the Neale-R ($r = 0.56$; $p < 0.05$) and between the Word Reasoning subtest of the WISC-IV and the Comprehension subtest of the Neale-R ($r = 0.53$; $p < 0.05$).

t-Tests

The *t*-test is used to determine if the mean of one group is significantly different from that of a second group. It was done here to determine whether the groups of females differed

from the males in their functioning on the various subtests. Table 8 below depicts this value for all the variables.

Table 8.

Independent *t* tests between boys' and girls' data (N = 33)

Variable	Boys		Girls		<i>t</i>
	Mean	SD	Mean	SD	
Similarities	9.35	2.52	9.25	3.00	0.10
Digit Span	9.47	2.10	9.25	3.30	0.23
Vocabulary	6.24	1.86	6.50	1.46	-0.46
Comprehension	9.24	1.92	8.13	2.42	1.44
Word reasoning	8.82	2.15	9.75	2.52	1.13
Accuracy	4.12	1.22	4.63	1.15	1.24
Rate	4.59	1.58	4.25	1.24	0.65
Comprehension	4.29	1.69	4.44	1.75	-0.25

Conclusion

Analyses were conducted using both the Pearson's and Spearman's Correlation Coefficients, for all the subtests in this study. Two significant correlations were found with the Word Reasoning Subtest on the WISC-IV and the Rate and Comprehension subtest of the Neale-R. Analyses conducted on the separate gender groups indicated two significant

correlations within the male sample only with a significant correlation between the Similarities subtest of the WISC-IV and the Accuracy subtest of the Neale-R and the second correlation between the Word Reasoning subtest of the WISC-IV and the Comprehension subtest of the Neale-R. T-tests conducted between the males and females yielded no significant results.

Chapter Five

Discussion

The main aim of this research was to determine if specific WISC-IV subtests were related to reading ability. As discussed in Chapter Two, the literature review suggests the need for new reading assessments to help identify children at risk of reading difficulties. The worldwide literacy crisis has created a demand for reading assessments, specifically in South Africa, where the statistics are discouraging, especially in populations who cannot afford reading assessments. The WISC-IV is a commonly used intelligence test in assessments conducted on children. It was therefore suggested that if the subtests of the WISC-IV were related to reading ability then children at risk for reading difficulties could be identified much easier, thereby giving them an opportunity to remediate their difficulties. The second aim of this research was to determine if any gender differences existed in terms of functioning on the various measures. Considerable literature has focused on the differences in overall functioning between males and females and the differences in performance in reading ability between males and females are no different (Joseph, 2000).

The literature review discussed the various cognitive skills that are used in the process of reading (Wagner & Torgesen, 1987). Despite this, only a few statistically significant correlations were found between the WISC-IV subtests and the Neale-R reading test in the current study. In particular significant correlations were expected between the Similarities, Vocabulary, Digit Span, Comprehension and Word Reasoning subtests and the Neale-R subtests of Accuracy, Rate and Comprehension was expected as they appear to be drawing on related cognitive skills. From the subtests of the WISC-IV chosen for this study, four of the five subtests used in the study load onto the WISC-IV Verbal Comprehension Index (Adams, 1996; Arlin, 1981; Stothard & Hulme, 1996), which plays a

main role in reading acquisition and one subtest which loads onto an important skill needed for reading namely, working memory (Baddley, 2003).

Due to the small sample size and since some of the data distributions were not normal, both parametric and non-parametric analyses were conducted. Correlations run on the complete sample will be discussed first and thereafter the correlations between the gender groups will be discussed for each of the subtests from the WISC-IV. For the parametric analysis, Pearson's Product Moment correlations were conducted on the whole sample but yielded no significant correlations. However, Spearman's correlations revealed two statistically significant correlations. It is important to note that results from the Spearman's correlations should be interpreted with caution as the Spearman's correlation coefficient tends to be more lenient compared to the Pearson's correlation coefficient.

From the correlations on the complete sample, no significant correlations were found between the Vocabulary, Similarities, Comprehension and Digit Span subtests of the WISC-IV. The Word Reasoning subtest of the WISC-IV and the Neale-R subtests however was significantly correlated with the Rate and Comprehension subtests of the Neale-R.

The significant correlation between the Word Reasoning subtest of the WISC-IV and the Comprehension subtest of the Neale-R, implies that the two subtests measure similar cognitive skills ($r = 0.41$; $p < 0.05$). The Comprehension subtest of the Neale-R assesses basic verbal comprehension, which is similar to the skills assessed by the Word Reasoning subtest of the WISC-IV which are verbal comprehension, analogical and general reasoning ability, verbal abstraction, domain knowledge, the ability to integrate and synthesize different types of information and the ability to generate alternative concepts (Ackerman, Beier & Bowen, 2000; Alexander & Kulikowich, 1991; Delis, Kaplan,

Kramer, 2001; DeSanti, 1989; McKenne & Layton, 1990; Newstead, Thompson & Handley, 2002; Ridgeway, 1995 cited in Wechsler, 2003). This result supports the findings of Yuill (1996, cited in Snow, Burns & Griffin, 1998) where riddles were used to assess comprehension ability in children aged between seven and eight years old. The use of riddles as a teaching method significantly improved comprehension.

The Word Reasoning subtest was also found to correlate significantly with reading rate on the Neale-R ($r = 0.34$; $p < 0.05$). A possible explanation of these findings could be the fact that an increase in the speed of reading facilitates better comprehension. For instance, if a child struggles to decode words, they probably spend more time in attempting to decode the words correctly, thereby slowing down their reading rate. In the process the child is so busy concentrating on decoding the words, they tend to forget what they have read already, in that way decreasing their comprehension. These findings are consistent with Frith's (1985) theory on reading, whereby she states in the orthographic stage, children have better reading comprehension than at the previous stage (alphabetic stage). This is because at the orthographic stage, the child has mastered the art of recognising words quickly and visually without recourse.

Surprisingly, a statistically significant correlation was not found between the Word Reasoning subtest of the WISC-IV and the Accuracy component of the Neale-R, as literature indicates that reading accuracy skills influence reading comprehension (D'Angiulli & Siegel, 2003), since if a word is decoded correctly, then understanding is more likely to occur, however on the contrary if a word is spelt incorrectly, either misunderstanding or no understanding is likely to occur. For example: this supports the idea that if words are pronounced correctly, comprehension would occur naturally.

When correlations were run for the separate gender groups, a statistically significant correlation was found between the Word Reasoning subtest and the Comprehension subtest ($r = 0.53$; $p < 0.05$) of the Neale-R for the male subgroup. These results are the same as the correlation found within the whole sample for these variables which is obviously coming from the boys group.

The literature on gender differences and academic achievement is extensive, however, despite all the work that has been done, researchers have reached consensus on only a handful of findings. For example, it is widely accepted that females score higher on average than males on tests of verbal abilities (Bee & Boyd, 2004; Liederman, Kantrowitz & Flannery, 2005), and that males score higher on average than females on tests of mathematical and spatial ability (Maccoby & Jacklin, 1974 cited in Lloyd, Walsh & Yailagh, 2005). Therefore based on the above research it was expected for the girls to perform better in the Word Reasoning (verbal ability) subtest than boys. However no significant correlations were found in the girls sample with the Word Reasoning subtest.

Within the total sample, no significant correlations were found between the Similarities subtest of the WISC-IV and the subtests of the Neale-R. This is contrary to expectations, since the literature review, suggested that there should be significant correlations between all three components of the Neale-R and the WISC-IV subtests. For the Accuracy component, skills of looking for concepts of likeness and association were seen to supplement the decoding of words accurately (Ehri & McCormik, 1998). Therefore, a significant correlation was expected between the Similarities subtest of the WISC-IV and the Accuracy component of the Neale-R. The expectation of a correlation between the Rate and Comprehension component of the Neale-R and the Similarities subtest of the WISC-IV was based on the work of D'Angiulli and Siegel (2003) where correct decoding

lead to increase in rate of reading and therefore better comprehension of what was being read. The lack of significant correlations between the Neale-R components and the Similarities subtest of the WISC-IV may result from the type of variables being measured in the subtests and the small sample size.

The Similarities subtest, however showed some significant correlations with the Neale-R when the correlations for the separate gender groups were run. A statistically significant correlation was found between the Similarities subtest and the Accuracy subtest ($r = 0.56$; $p < 0.05$) on the Neale-R for the male subgroup of the sample.

This significant correlation is a valuable finding in the study of gender differences in reading. Shibley and Marcia (1988) noted female superiority in their studies on verbal ability (including analogies subtests). However similar studies done in 1985 indicated male superiority in this area (Shibley & Marcia, 1988). Cockcroft and Blackburn (2008) also indicate similar findings to that of the 1985 studies of Shibley and Marcia where boys were found to achieve significantly higher than girls on two subtests of an intelligence test, with the Similarities subtest being one of them. However other studies show a decline in the differences in overall gender functioning, which is partly due to the equal social and educational stimulation received by both boys and girls (Feingold, 1988 cited in Cockcroft & Blackburn, 2008; Flynn, 1998 cited in Cockcroft & Blackburn, 2008).

With regards to the Vocabulary subtest of the WISC-IV, existing research indicates that vocabulary is a significant predictor of reading ability (Mosely, 1980; Muter, Hulme, Snowling & Stevenson, 2004). Word knowledge (vocabulary) is highly correlated with reading comprehension ability in both children and adults (Carroll, 1993), and thus a correlation between the Vocabulary subtest and the Comprehension subtest of the Neale-

R was expected. However in the current study, the Vocabulary subtest of the WISC-IV showed no significant correlations with any of the reading measures on the Neale-R. This finding is difficult to explain as literature states that a good vocabulary has been related to the ability to access higher level cognitive functions such as comprehension skills (Mosely, 1980; Muter, Hulme, Snowling & Stevenson, 2004). Further, a good vocabulary enables readers to read much faster and more accurately. Although, the precise relation between the two variables is not clear, knowledge of word meanings (vocabulary) is related to the ability to understand text, and if there are too many unknown words in a story, it is easy to lose the sense of the whole. Conversely, limited vocabulary knowledge does not always impair comprehension, as already noted by several researchers who have demonstrated that children can experience text comprehension difficulties even when vocabulary knowledge is controlled for (Ehrlich & Remond, 1997; Oakhill, Cain, & Yuill, 1998; Stothard & Hulme, 1992).

It is also important to bear in mind that the various reported studies which assessed the association between reading acquisition and vocabulary skills used different methods of assessing reading and vocabulary and this may account for the different findings. For instance, Cockcroft and Blackburn (2008) conducted their study using the SSAIS-R, where the Vocabulary subtest assesses receptive vocabulary skills as opposed to the expressive vocabulary skills assessed in the WISC-IV. In the SSAIS-R, vocabulary is assessed using pictures that a child needs to select that matches appropriately with a spoken word, whereas in the WISC-IV the child needs to give definitions as best as they can for words that the researcher reads out aloud. Both Vocabulary subtests overlapping aspects of verbal intelligence and verbal learning ability. Therefore although the same skills were measured by both subtests, the method adopted in each test could have influenced the differing results. The work of Stothard and Hulme (1996) supports the finding of Cockcroft

and Blackburn (2008) as it was found that verbal abilities are facilitated through context. The pictures used in the Vocabulary subtest of the SSAIS-R, provide a context which possibly assists the child in identifying the correct association with the spoken word.

Beck and Mckeoum (1991) and Nagy and Anderson (1984) experienced similar problems with differing methods. They too attempted to estimate the size of children's vocabulary, but encountered difficulties in the different procedures used.

In the current study, correlations were also run separately for the two gender groups, but no statistically significant correlations between Vocabulary and the Neale-R subtest were found. These results could be attributed to similar reasons as stated above. A meta-analysis of gender differences in verbal ability of 165 studies reported a slight female superiority in performance. However, differences between the genders were so small that it seems as if gender differences are non-existent. In this meta-analysis, Vocabulary, Analogies (Similarities), Comprehension were among the skills measured (Shibley & Marcia, 1988). Further Maccoby and Jacklin (1974 cited in Shibley & Marcia, 1988) report that signs of differentiation on verbal ability skills become evident only from the age of 11 years old. The participants of the current study were well below the age of 11 which could possibly account for the relatively equal performance of the boys and girls.

The Comprehension subtest of the WISC-IV measures social and moral judgement abilities in children. Although research shows that social learning adds value to overall comprehension, it is possible that it does not make up as big a part of overall comprehension as was expected, as no significant correlations were found within the whole sample or within the separate gender samples between the Comprehension subtest of the WISC-IV and any of the Neale-R components. Literature indicates that a child's

ability to grasp, retain and understand new concepts is dependent on existing knowledge (Robbins & Ehri, 1994 cited in Snow, Burns & Griffin, 1998). Therefore the skills measured in the Comprehension subtest of the WISC-IV would be expected to supplement the comprehension skills of the Word Reasoning subtest of the WISC-IV.

The Digit Span subtest of the WISC-IV was the only subtest used in the study that loaded onto the Working Memory Index of the WISC-R. As discussed in the literature review, working memory plays a vital role in the process of reading (Gathercole, Hitch, Service & Martin, 1997; Swanson & Howell, 2001 cited in Georgiou, Das & Hayward, 2008; Wechsler, 2003). The ability to retain verbal information in working memory is essential for reading and learning, so it would be expected that verbal memory measures would be significantly correlated with reading achievement. However in this study no statistically significant correlations were found between the Digit Span subtest and any of the Neale-R components. This is surprising as sequential, or serial cognitive processing is seen as more important during the initial stages of reading where a child needs to phonologically process a word. Based on the studies of Seymour and Elder (1985 cited in Harris & Coltheart, 1986) on the role of attention and sequential memory in identifying words, a statistically significant correlation between the Accuracy component of the Neale-R and the Digit Span subtest of the WISC-IV was anticipated, however this was not the case. A possible explanation for the results could be attributed to the fact that the sample participants in the current study were in the middle of their second year of formal reading instruction. The skills tapped by the Digit Span subtest could have still been in the process of acquisition.

Literature indicates that the ability to store information in a correctly ordered sequence is fundamental to reading ability (Das, Parilla, Papadopoulos, 2000 cited in Cockcroft &

Blackburn, 2008; Savage, Cornish, Manly & Hollis, 2006), especially reading comprehension. However, other studies indicate that the readers who are less skilled in comprehension abilities tend to remember short sentences or stories as well as good comprehenders (Oakhill, Cain & Bryant, 2003). A prediction studies have yielded similar results (Scarborough, 1998). It is clear that, on average, kindergartners' abilities to repeat sentences or to recall a brief story that was just read aloud to them are more strongly related to their future reading achievement than are their scores on Digit Span, word span, and pseudo-word repetition measures. Sentence or story recall, in fact, compares favorably with other predictors of reading (Seigneuric, Ehrlich, Oakhill & Yuill, 2000 cited in Oakhill, Cain & Bryant, 2003).

When correlations were run within the separate gender groups no components of the Neale-R test correlated significantly with the Digit Span subtest. These findings once again were not in coherence with the expectations, as per the literature review. Overall two statistically significant correlations was found within the male sample between the Word Reasoning subtest of the WISC-IV and the Comprehension component of the Neale-R and the Similarities subtest of the WISC-IV and the Accuracy subtest of the Neale-R, but no significant correlations were found within the female sample. This was surprising as literature indicates that girls have better verbal skills than boys (Bee & Boys, 2004; Liederman, Kantowitz & Flannery, 2005). However, literature also suggests that this assumption is decreasing rapidly based on the equality of exposure to social and educational environments for boys and girls (Feingold, 1988; Flynn, 1998 cited in Cockcroft & Blackburn, 2008).

T-test analyses were also run on the gender groups to compare the males' and females' overall functioning on all of the variables. No significant differences were found, which can

be attributed to the similarity in exposure and opportunity for both genders or that gender differences may only emerge later (approximately 10 or 11 years old) (Anastasi, 1958; Denno, 1982; Maccoby & Jacklin, 1972 cited in Shibley & Marcia, 1988).

In conclusion, statistically significant correlations were found only between the Word Reasoning subtest of the WISC-R and the Rate and Comprehension measures on the Neale-R. Two other statistically significant correlations were found when the sample was divided into gender groups, within the male sample only, which is contradictory to the majority of the literature in the area of gender differences in cognitive functioning. The two significant correlations found were between the Similarities subtest of the WISC-IV and the Accuracy subtest of the Neale-R and the Word Reasoning subtest of the WISC-IV and the Comprehension subtest of the Neale-R.

Limitations of the study and suggestions for further research

A major limitation identified within this study was the size of the sample of participants. This seemed to limit the amount of statistically significant correlations. Therefore it is suggested that the study be carried out with a bigger sample group.

There were problems experienced in comparing studies due to different methods of assessing reading or cognitive skills across studies, which creates difficulties when attempting to compare studies. A suggestion to overcome this limitation is to replicate the study using the same measures as those used in the current study.

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Appendix A



UNIVERSITY OF THE WITWATERSRAND

PSYCHOLOGY

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT

Private Bag 3, Wits 2050, South Africa. Telephone: +27 11-717-4500/2/3/4. Fax: +27-11-717-4559

To Mr. Swanepoel

My name is Sunita Patel and I am a Masters Psychology student at the University of the Witwatersrand. I am researching reading ability in beginner readers for the practical component of my course this year. I would like to invite your school to participate in this project.

The aim of this research is to identify the relationship between the WISC-IV subtests and reading ability. Participation will involve the administration of two tests, one of reading ability and the other of general ability. The tests will be administered in two sessions each lasting about 20 minutes and they are presented as fun 'projects/tasks', they should not have any adverse effects on the children and are not related in any way to the school curriculum. Participation in the test is voluntary and the children will be able to withdraw from the test at any time without any consequences or prejudice.

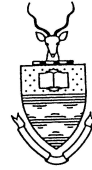
Please be assured that absolute confidentiality and anonymity is guaranteed, as all the answer sheets will be coded. No child will be individually identified in any written or spoken report and all information will be used exclusively for research purposes and will not be shown to anyone but the researchers. Confidentiality is also ensured since only group trends will be determined, from which it will be provided to the school in the form of general patterns in this particular grade.

Thank you for your interest and please do not hesitate to contact me on 0723763275 or email email4sunita@gmail.com if you should want more details or my supervisor Dr. Kate Cockcroft at 011 717-4511 or email kate.cockcroft@wits.ac.za.

Yours sincerely
Sunita Patel

Kate Cockcroft

Appendix B



UNIVERSITY OF THE WITWATERSRAND

PSYCHOLOGY

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT

Private Bag 3, Wits 2050, South Africa. Telephone: +27 11-717-4500/2/3/4. Fax: +27-11-717-4559

Dear Parent/Guardian

My name is Sunita Patel and I am a Masters Psychology student at the University of the Witwatersrand. I am researching reading ability in beginner readers for the practical component of my course this year. I would like to invite your son/daughter to participate in this project.

The aim of this research is to identify the relationship between the **Wechsler Intelligence Scale for Children-Fourth edition (WISC-IV) subtests and reading ability. The WISC-IV is an intelligence test for children.**

Participation will involve the administration of two tests, one of reading ability and the other of general ability. The tests will be administered in two sessions each lasting about 20 minutes and they are presented as fun 'projects/tasks', they should not have any adverse effects on your son/daughter and are not related in any way to the school curriculum. Dr. Samuels has granted permission for the tasks to be completed during the school day on the school premises, at a time, which is not detrimental to your child's well being or education. Please note that participation in the test is voluntary and that your child will be able to withdraw from the test at any time without any consequences or prejudice. **You may refuse consent for your child to participate, if you so wish.**

Please be assured that absolute confidentiality is guaranteed, all the answer sheets will be coded. No child will be individually identified in any written or spoken report and all information will be used exclusively for research purposes and will not be shown to anyone but the researchers.

Confidentiality is also ensured since only group trends will be determined, from which it will be provided to the school in the form of general patterns in this particular grade.

Thank you for your interest and please do not hesitate to contact me on 0723763275 or email email4sunita@gmail.com if you should want more details or my supervisor Dr. Kate Cockcroft at 011 717-4511 or email katecockcroft@wits.ac.za . If you are willing to allow your child to participate in the study, please discuss the study with him or her and if you are both willing to participate, please sign the attached form and return it to the class teacher at your earliest convenience. Due to time constraints, it is unfortunately only possible to include the first fifty replies in this research.

Yours sincerely
Sunita Patel

I,
..... (parent/guardian)
of..... (child's name), have discussed
this study with my child and hereby give consent for him/her to participate in it. By agreeing to
participate in this research, I acknowledge the confidentiality and anonymity of the test. As the test
participation is completely voluntary he/she may withdraw at any time. I understand that all the
information gained during the research is completely confidential and will not be discussed to
anyone besides the researchers.

.....
Signature

.....
Date



UNIVERSITY OF THE WITWATERSRAND

PSYCHOLOGY

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT

Private Bag 3, Wits 2050, South Africa. Telephone: +27 11-717-4500/2/3/4. Fax: +27-11-717-4559

Biographical Questionnaire

Name of Child: _____

Date of Birth: _____ Gender: _____

1. Has your child repeated a grade?

2. If yes, which grade?

3. Has your child been diagnosed with any Language; Speech or Auditory problems?

4. If yes, what are they?

5. What is his/her home language?

6. Occupation of father?

7. Occupation of mother?

8. Do you read to your child at home?

9. How often do you read to your child?

10. Who listens to your child read his/her reading homework?

Appendix D



UNIVERSITY OF THE WITWATERSRAND
PSYCHOLOGY
SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT

Private Bag 3, Wits 2050, South Africa. Telephone: +27 11-717-4500/2/3/4. Fax: +27-11-717-4559

Child's letter of assent – to be signed on the day of the testing

Dear.....

Thank you for agreeing to do this project with me. I am at university and am doing this assignment for one of my subjects.

I will do two fun tasks with you. First, we will do one task, then we will have a break and have something to eat and drink and then we will carry on again for a little while.

If you get tired or don't feel like carrying on you can stop at any time you like.

Thank you for helping me with this project.

I.....(child's name) would like to do this experiment and know that I can stop at any time if I don't feel like carrying on.

.....

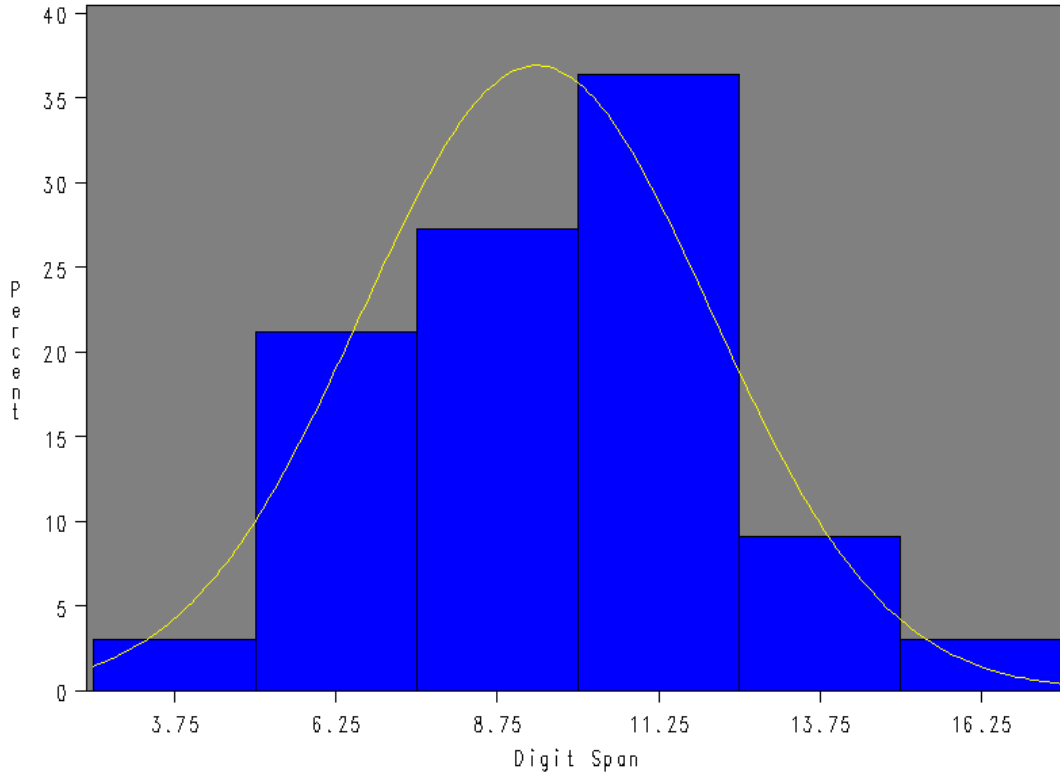
Signed

.....

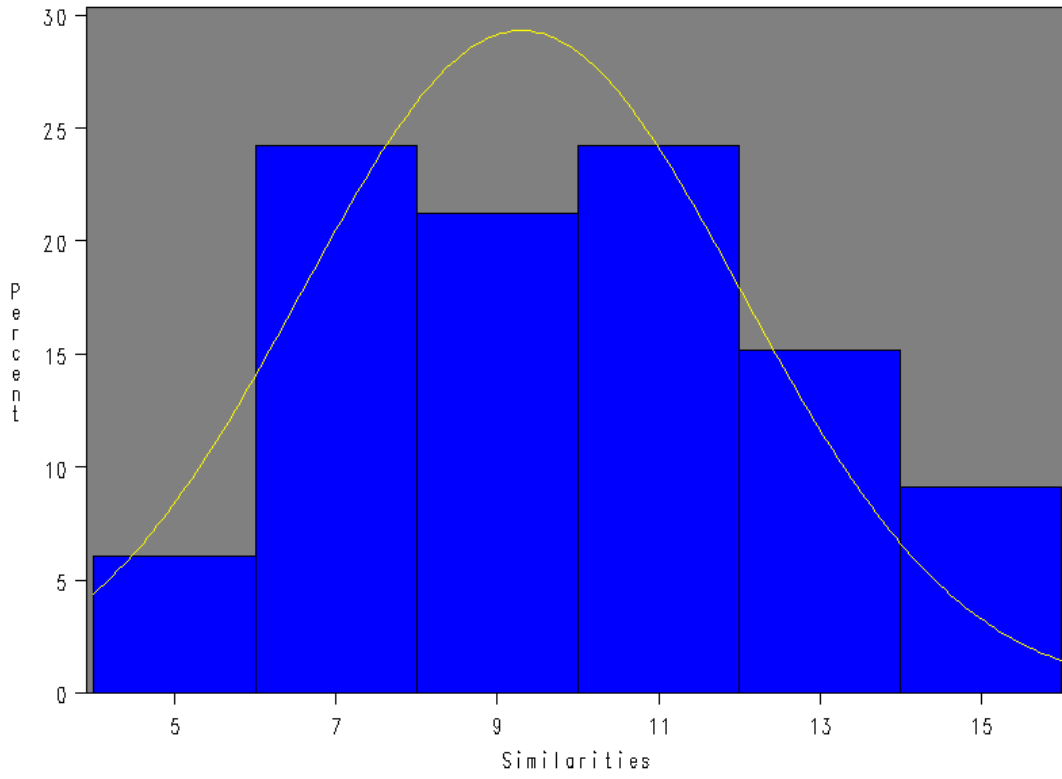
Date

Appendix E: Histograms for all subtests and components of measures.

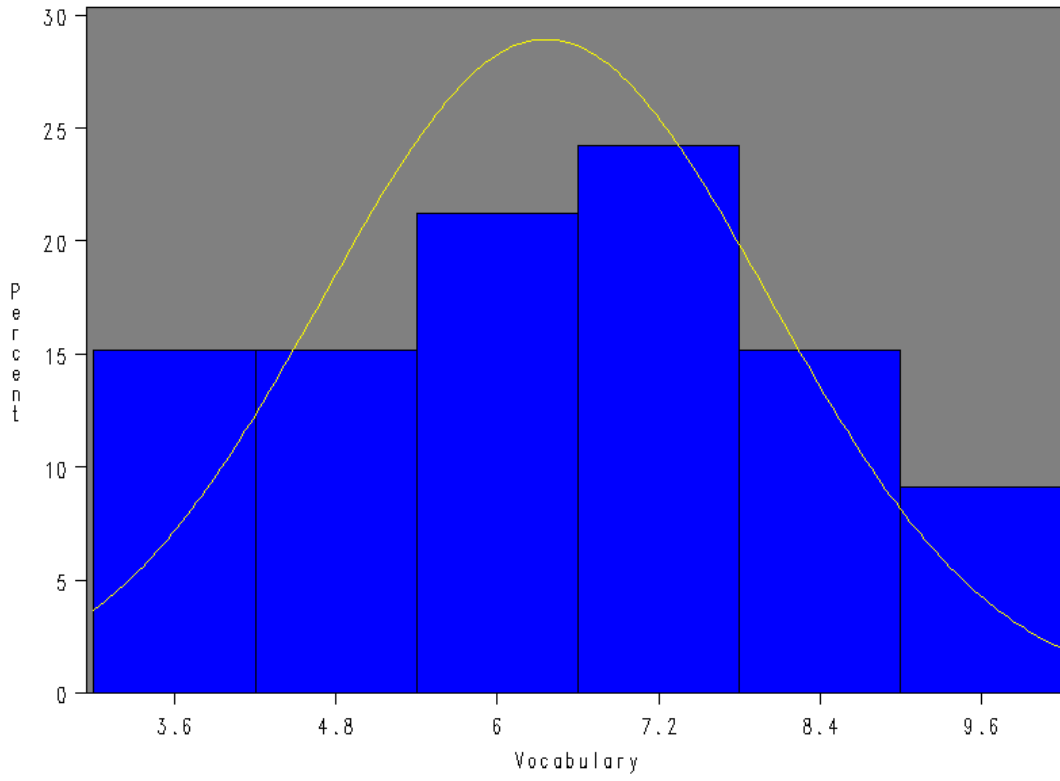
Distribution of sample for Digit Span subtest of the WISC-IV.



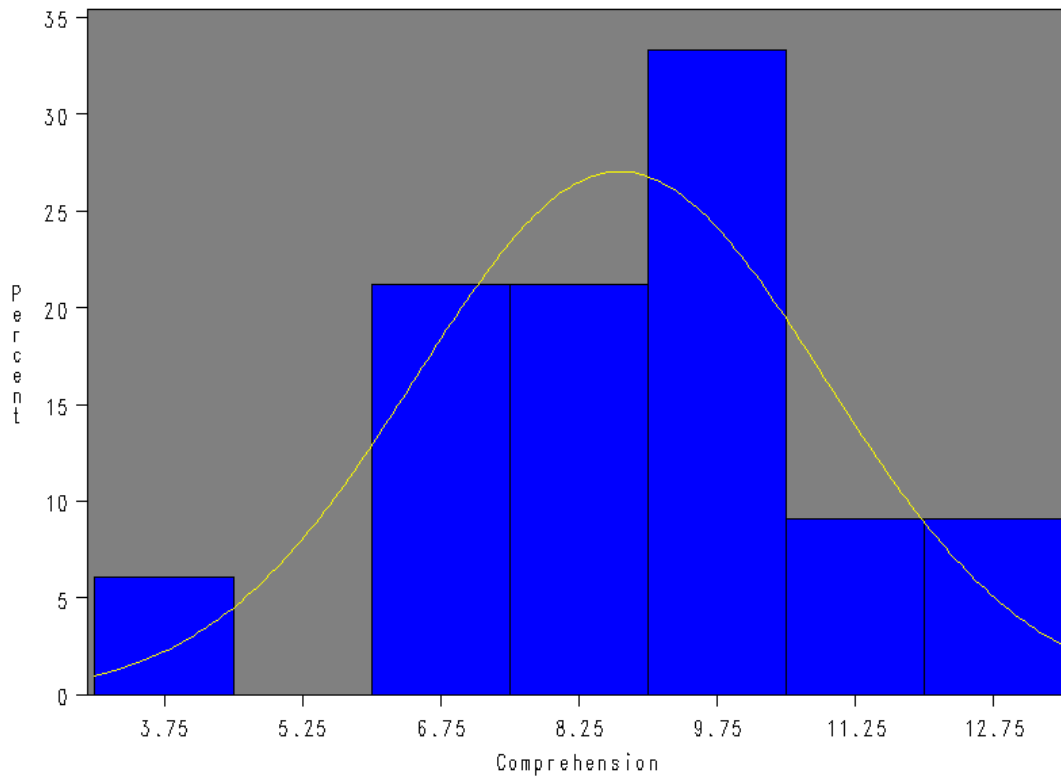
Distribution of sample for Similarities subtest of the WISC-IV.



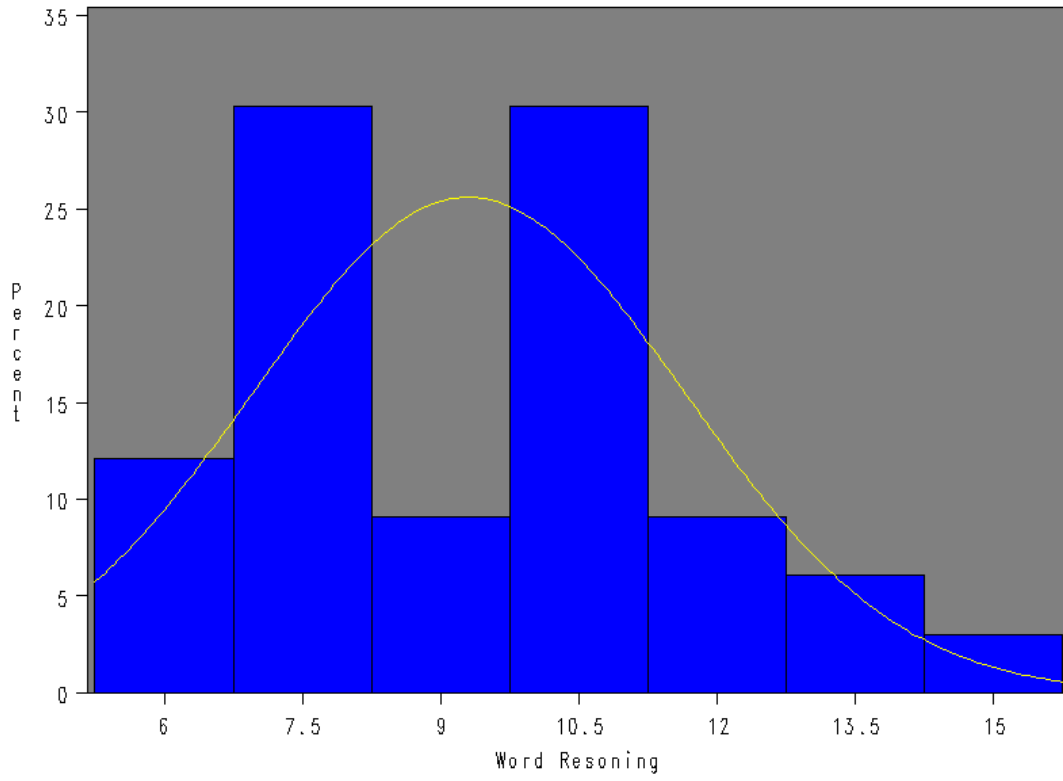
Distribution of sample for Vocabulary subtest of the WISC-IV.



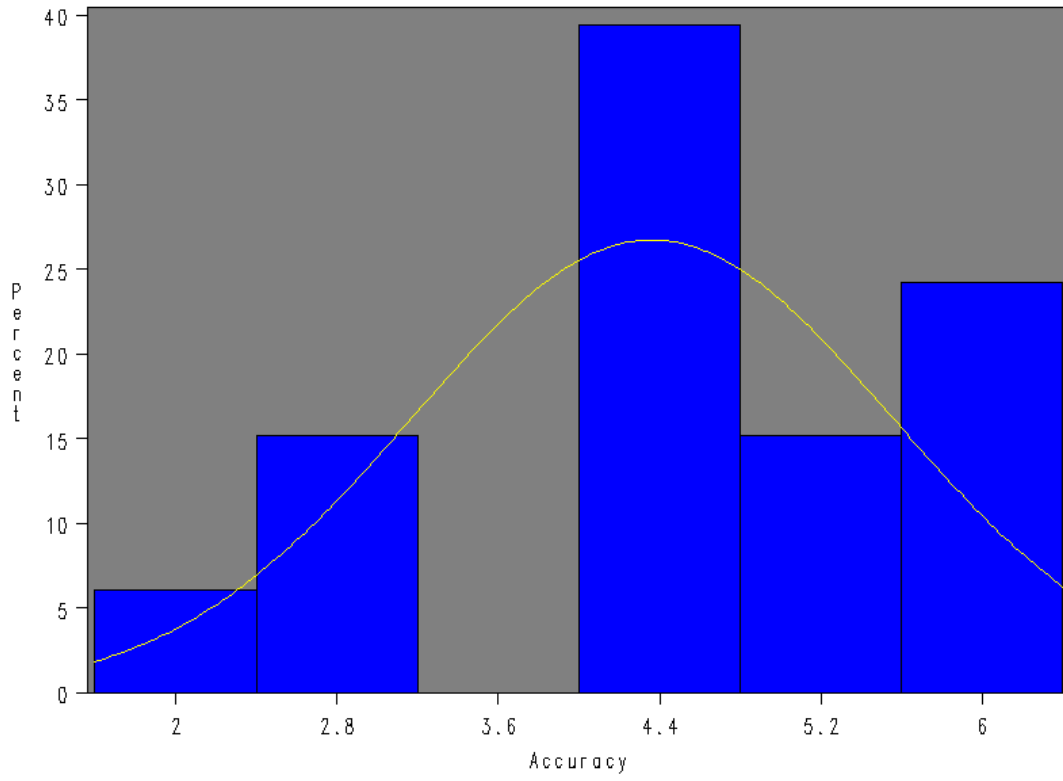
Distribution of sample for Comprehension subtest of the WISC-IV.



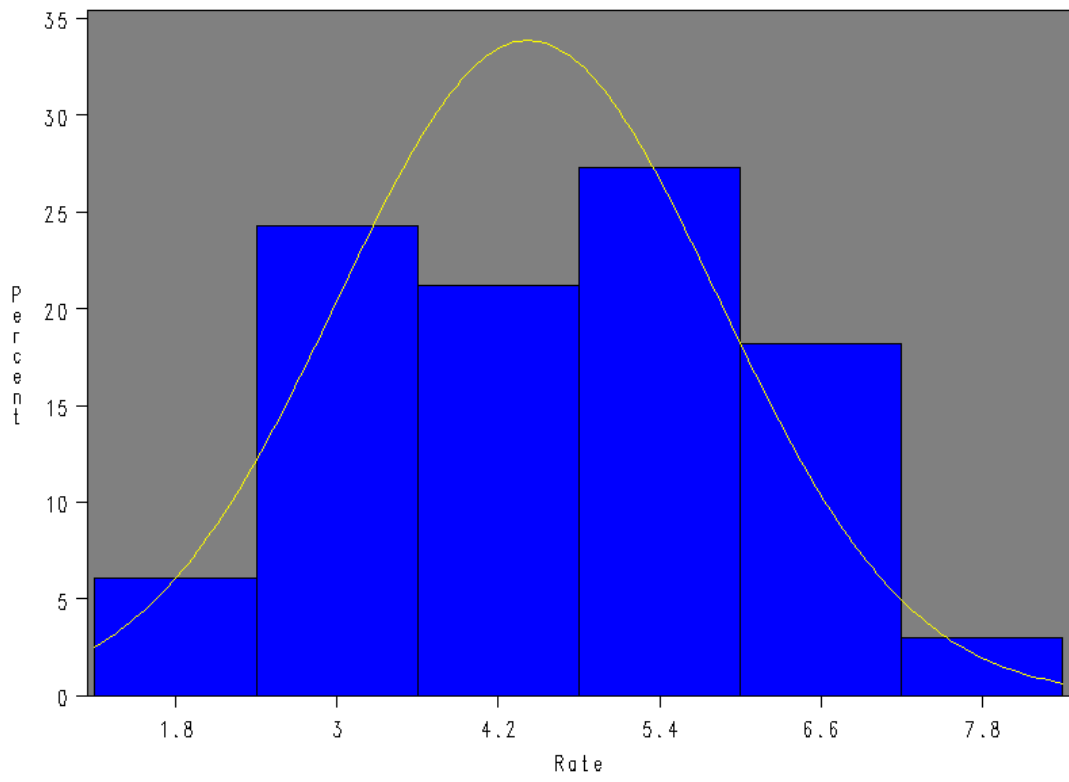
Distribution of sample for Word Reasoning subtest of the WISC-IV.



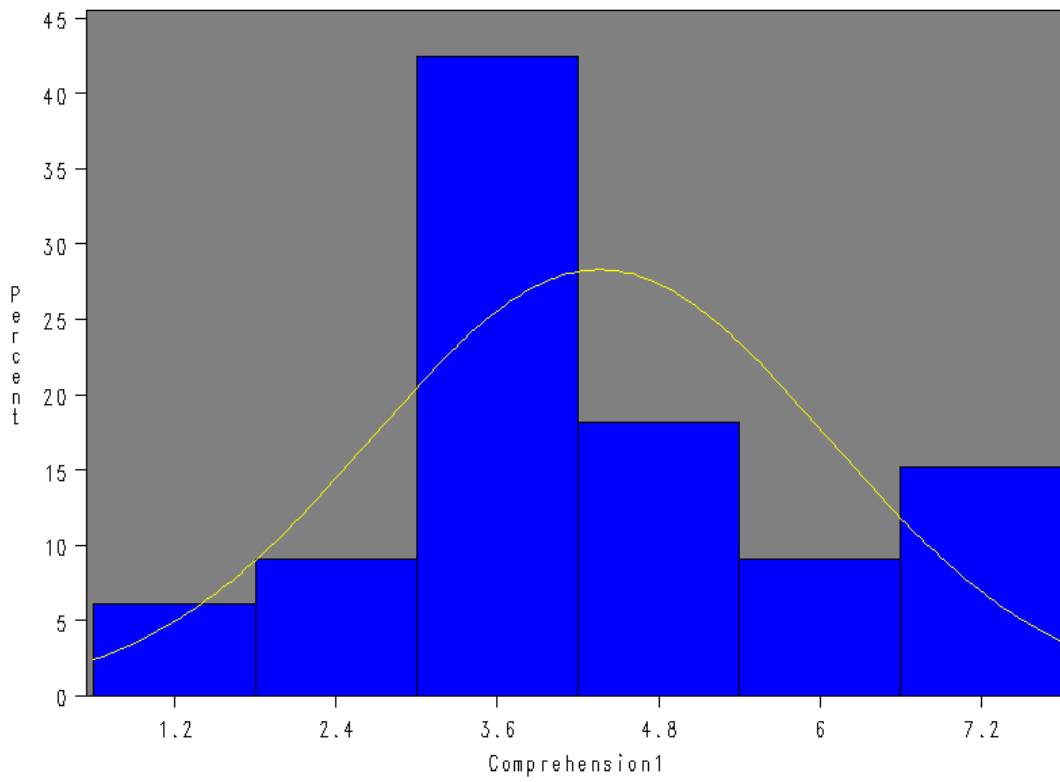
Distribution of sample for Accuracy component of the Neale-R.



Distribution of sample for Rate component of the Neale-R.



Distribution of sample for Comprehension component of the Neale-R.



Appendix F

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

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

CLEARANCE CERTIFICATE

PROTOCOL NUMBER H070611

PROJECT

The Relationship between the Wechsler Intelligence Scale - fourth edition (WISC-IV) and reading ability

INVESTIGATORS

DEPARTMENT

Mrs S Patel

DATE CONSIDERED

School of Human and Community Development/Psychology
07.06.15

DECISION OF THE COMMITTEE*

Approved unconditionally

NOTE:

This ethical clearance is valid for 2 years and may be renewed upon application

DATE 07.07.13

CHAIRPERSON *M Vorster*
(Professor M Vorster)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Dr K Cockroft
School of Human and Community Development

DECLARATION OF INVESTIGATOR(S)

to be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we
arantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as
proved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

is ethical clearance will expire on 1 February 2009

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES