

Chapter One: Introduction

1.1 Introduction:

“Reading *and writing are both* cultural imperatives in today’s information based society ... and will become increasingly important as avenues to reward and success” (Kaminski & Good, 1998, p.113, in Broom, 2001, p.xv, *emphasis added by author*).

As suggested by the above quote, the ability to read and write fluently in at least one language, is likely to be amongst the most, if not *the* most, essential tool at the disposal to an individual who desires to be an effective, contributing and competitive member of their modern day society. These societies tend to be inherently structured around and built upon the assumption that the majority of its members are able to read and write and therefore seldom accommodate for the specific needs of those who are unable to do so fluently. Skilled readers and writers typically take their ability in this regard for granted since, through practise, reading and writing has for them become an automated and almost unconscious process which they are likely to seldom, if ever, consciously need to think about doing (Carreker, 2000; Mash & Wolfe, 2005).

However, the complexities involved therein become apparent through an exploration of the multiple cognitive and perceptual processes involved in skilled reading and writing and the acquisition thereof, as well as the nature of the difficulties that can arise when these underlying cognitive processes are interrupted. Whilst to date, it has been widely accepted that visual, phonological and semantic processing are all vital for reading and writing to occur, the interrelationship between these and the importance of each in skilled reading and writing and the acquisition thereof is still not clearly understood and continues to be heavily debated in the literature.

In this regard, Luria (1966) described *two overarching dichotomous cognitive information processes*, namely simultaneous and successive processing. Together, these cognitive processes allow the human brain to meaningfully integrate perceived stimuli, thereby facilitating appropriate, productive and efficient interaction with the environment. Optimal

cognitive processing equips the individual to effectively comprehend and adequately approach the demands of tasks encountered, including the ability to read and write. *Simultaneous processing*, as defined by Luria (1966), is a mental process by which the individual integrates separate elements of perceived stimuli into a single perceptual or conceptual whole or group. According to Luria (1966), simultaneous processing has strong spatial and logical-grammatical components. The spatial aspects of simultaneous processing involve both the perception of stimuli as a group and the internalised formation of complex visual images. In the synthesis of spoken and written language, the logical-grammatical dimension of simultaneous processing allows for the integration of words into ideas through the comprehension of word relationships, prepositions, and inflections, thus allowing for the synthesis of parts into integrated groups. Luria (1966) considers that this occurs both through the examination of the stimuli during the activity and through recall of the stimuli.

Successive processing on the other hand, also referred to as *sequential processing*, is a mental process by which the individual integrates stimuli into a specific order that forms a chain-like progression. Successive processing is therefore an essential requirement when stimuli must follow each other in a strictly defined order (Luria, 1966). As defined by Luria (1966), successive processing has both strong serial and syntactic components. Firstly, the serial aspect of successive processing involves the perception of stimuli in sequence and the formation of sounds and movements in order. In this regard, an example of a task requiring successive/ sequential processing is the serial organisation of speech which involves the synthesis of “separate sounds and motor impulses into consecutive series” (Luria & Tsvetkova, 1990, p. xvi). Secondly, the syntactic aspect of successive processing allows for the comprehension of the meaning of narrative speech and written text, especially when the “individual elements of the whole narrative always behave as if organised in certain successive series” (Luria, 1966, p. 78). That is, the serial presentation of a narrative derives the meaning.

Therefore, it is apparent that whilst to the skilled reader, reading and writing appear to be simple and almost unconscious natural abilities, upon greater exploration it becomes clear that these are however very difficult skills to learn and acquire, requiring the input and coordination of *multiple complex cognitive and perceptual processes* and abilities and an extended period of apprenticeship before fully mastered (Oakhill, 1996). In addition, since reading and writing are such imperative tools to acquire and to become fluent in as a result of

the emphasis placed thereupon in both the educational system and Open Labour Market, the method most effective in their remediation in children is also heavily disputed. The ongoing debate in this regard has been shown to have particular relevance to children suffering specific learning disorders affecting in particular their ability to read and write and to learn to do so via conventional means (Olson, Torrance & Hidyance, 1993).

1.2 Learning Disorders:

Learning disorder or *learning disability* is a generic term referring to a heterogeneous group of disorders that may arise as a result of genetic variations, biochemical factors or specific events occurring during the pre- to post-natal period of development or any other subsequent events resulting in neurological impairment to the infant, child or, on occasion, adult (Kolb & Whishaw, 1995; Mash & Wolfe, 2005).

According to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Revised Text (DSM IV TR) (American Psychiatric Association, 2000), learning disorders are diagnosed when an individual's achievements on individually administered standardised measures of written expression, reading and mathematics are not commensurate with that expected of their age, schooling and level of intelligence. Learning disorders therefore, are intrinsic to the individual and may affect learning and behaviour in any individual from any ethnic or cultural background, including those with potentially average or above average intelligence, as measured by standardised intelligence tests who, although by definition are not deaf, blind or mentally retarded, are unable to learn effectively within the traditional mainstream educational system (Kirk, 1972, in Jansen, 1996; Kolb & Whishaw, 1995).

Estimates have shown that, according to this definition, approximately 10 - 15% of all children in South Africa could therefore be considered learning disordered (Murray, 1969; Werner, 1996), providing evidence as to the widespread nature of the disorders which thus pose a significant problem on both an individual and societal level. Learning disorders not only affect the child's ability to progress within the school environment, but also influences the perceptions of significant others as to what such a child's academic and vocational potential are considered to be, thereby singularly having the ability to significantly influence that child's life in its totality from birth to death by determining of what the child's life and future choices could comprise. In addition, in South Africa, the issue of the prevalence of

learning disorders in childhood is further complicated to a large degree by environmental deprivation which still affects a large proportion of the population as a result of continued unemployment, lack of education and poverty due to the legacy of Apartheid, which too, in itself, can result in developmental delay (Jansen, 1996; Werner, 1996).

1.2.1 Learning disorders of reading and written expression:

According to the DSM IV TR (2000), various types of learning disorders exist, delineating between disorders of reading, mathematics, written expression and learning disorders not otherwise specified. The focus of this research was to investigate gains apparent following remediation in the cognitive and English reading, writing and spelling abilities of children suffering disorders of these skills, as per their below average performance in these specific areas of development to date. Learning disorders in this regard occur more commonly in males as opposed to females. They comprise disorders occurring in one or more of the basic psychological processes involved in understanding or using language, be it spoken or written. (Mash & Wolfe, 2005; Myers & Hammill, 1976, in Prior, 1996).

A reading disorder is associated with reading achievement below the expected age, intelligence and education of a child. It is characterised by an impaired ability to recognise words, slow and inaccurate reading and poor comprehension. In addition, children suffering attention deficit hyperactivity disorder (ADHD) are at high risk for a reading disorder. Conversely, children with reading disorders are at higher risk for attentional problems, as well as disruptive behavioural disorders and depressive disorders, the latter which affects particularly older children and adolescents. Studies show that 25 % of children with a reading disorder also have ADHD (Sadock & Sadock, 2003; Mash & Wolfe, 2005).

A disorder of written expression on the other hand, is characterised by writing skills that are significantly below the expected level for a child's age and intellectual capacity. These difficulties impair the child's academic performance and writing in everyday life. The many components of a writing disorder include poor spelling, errors in grammar and punctuation and poor handwriting. Spelling errors are amongst the most common difficulties for a child with a writing disorder, with spelling mistakes most commonly comprising phonetic errors (Barker, 2004; Sadock & Sadock, 2003). Furthermore, it is common for children who struggle to learn to read proficiently, to frequently experience difficulties with spelling due to the resultant deficiency in their store of word-specific knowledge (Critchley, 1991; Prior, 1996).

Disorders of reading and written expression can occur comorbidly, or independently of each other (Mash & Wolfe, 2005; Sadock & Sadock, 2003).

1.2.2 Learning disorders and successive and simultaneous mental processing:

Das, Naglieri & Kirby (1994) note that children suffering these types of learning disabilities are likely to be *either less able* than other children *to use simultaneous or successive processing*, or, *less inclined* to use a particular type of cognitive processing. In this regard, research to date has tended to show that groups of learning disordered children tend to exhibit higher simultaneous processing scores than successive processing scores when assessed, although these group differences are not always consistent across studies (Das, 2002).

In examining the information processing strategies of children suffering learning disabilities, *problematic sequential processing* has therefore been implicated as a major factor in reading and spelling difficulties (Bain, 1993; Das, 2002; Naglieri, 1999). *Reduced simultaneous processing* has also been found to be linked to disorders of reading and written expression however, resulting particularly in reduced comprehension skills and difficulty in reading and writing with meaning. In spelling, for example, Das (2002) notes that simultaneous processing difficulties will lead to a child failing to make use of a visual code or image for the word or syllable being spelt. The speller would also fail to perform a visual check after spelling to ensure that the word does correspond to a familiar pattern.

1.2.3 Learning disorders and multi-sensory teaching:

Furthermore, it has been suggested that children with specific difficulties in reading and written expression find it difficult to learn and retain *phonological skills*, even if these are specifically taught (Birsh, 1999; Prior, 1996). Children with learning difficulties therefore characteristically take longer periods of time to develop the alphabetic principle (Frith, 1980; Prior, 1996), thereby requiring *multi-sensory teaching* to facilitate their development of the skills involved in learning to spell, read and write (Birsh, 1999; Potter, 2003).

It is frequently the case that these children require, in particular, extra reinforcement and emphasis to be placed upon the establishment of *phonological awareness* through participating in a programme that specifically targets knowledge of letter sequences involved in the different vowel sounds utilised in the English language. These children, whose needs in this regard tend not to be met by the conventional graded reading material typically used in mainstream schooling, may also require additional intervention focusing specifically on the

basics of reading, writing and spelling (Birsh, 1999; Bryant & Bradley, 1985; Carreker, 2000; Potter, 2003).

1.3 Introduction to High Mental Imagery Remedial Techniques:

In this regard, the *Spelling, Imagery, Reading and Revisualisation Programme*, otherwise known as the Targeted Revisualisation Programme, conceptualises high mental imagery techniques as integral to the process of learning of the English language by children. This approach has been conceptualised and refined by Professor Charles Potter, Educational and Research Psychologist from the Department of Psychology of the University of the Witwatersrand, over the past twenty years based on his extensive remedial work with children and adolescents suffering learning disorders resulting in their inability to learn to read and/or write in the English language efficiently and via conventional, typically phonologically based, means (Potter, 2003).

Targeted revisualisation is based largely upon the theoretical underpinnings of Jean Piaget and Alexander Luria. It is a method of remediation designed for implementation with children suffering learning disorders affecting, in particular, their English reading, writing and spelling abilities. Through the use of multi-sensory teaching methods and mental imagery to aid the learning of words, the child's orthography of the English language is mediated and their ability to analyse and memorise words and use them in context developed. The model of instruction followed in the programme is hierarchical in nature, conceptualising the remediation of reading, writing, spelling and dictation as involving five sequential levels through which the child must progress to obtain mastery thereof (Potter, 2003).

By following a *hierarchical and sequential framework* and utilising *high mental imagery techniques as central to the approach* taken to the remediation of the development of oral and visual communication abilities, this approach purposes to link language and visuo-spatial modalities on receptive, integrative and expressive levels (Potter, 2003). The child is taught to use perception, mental imagery and language in combination through a process referred to as '*targeted revisualisation*'. Single words are first visually imaged and spelled orally, then revisualised and written, demanding the use primarily of *simultaneous mental processing* as well as the *serial* component of one's *successive processing abilities*. The development of sequential memory and particularly the *syntactical* component of *successive mental processing* is later emphasised through extension of this revisualisation process to sentences

and paragraphs (Potter, 2000; 2001). The specifics of the implementation of this high mental imagery approach to remediation will be outlined in greater detail in chapter two.

1.4 High Mental Imagery Techniques and Simultaneous and Successive Mental Processing:

Mental imagery has been found to be universal in nature and therefore numerous attempts have been made to maximise its use particularly with children and in their acquisition of reading, writing and spelling skills (Wippich, Mecklenbrauker & Halfer, 1989). However, it logically follows from this, that for gains to occur in reading, writing and spelling, underlying cognitive gains must occur. Research studies related to mental imagery to date however, have tended to focus on success in task outcome (i.e. reading, writing and spelling) rather than the cognitive processes and difficulties that occur therein and which are causative or predisposing to these.

In this regard, studies previously conducted by Sfetsios (2002) and Potter (2004) have demonstrated that *associated cognitive gains*, as evident upon intellectual/cognitive testing, are also apparent upon post-testing after the consistent usage of high imagery remedial techniques over a period of time with a participant suffering learning difficulties in their English language skills. Very scanty literature is available exploring the specific link between high imagery remedial techniques and simultaneous and successive processing abilities or indeed cognition in general however, and no published studies appear to be available describing previous investigations that have been done to research this particular relationship. It is the author's opinion that the simultaneous/successive processing dichotomy is an important way to conceptualise cognition and the processes that occur therein, which is in keeping with the conceptualisations of numerous of theories underlying the usefulness of high mental imagery techniques, particularly as operationalised in this study, such as Luria's (1966; 1973) theory of cognition and Paivio's (1971, p. 53) "*dual coding model*" in which he hypothesised around the relationship between verbal and perceptual codes. Further studies investigating this particular association therefore appear to be indicated and overdue.

1.5 Research Aims:

The primary focus of this study therefore, was to investigate the effectiveness of high mental imagery techniques in improving the successive and simultaneous processing abilities of Grade V learners suffering from learning disorders of reading and written expression.

As subsidiary aims, this study also purposed to explore the usefulness of high mental imagery techniques in improving the English spelling, reading and writing abilities of these learners. In this regard, this research intended to provide further evidence pertaining to the validity of the conclusions drawn by pilot studies investigating these subsidiary aims conducted over the past several years through the Department of Psychology of the University of the Witwatersrand.

1.6 Research Rationale:

Pilot studies conducted over the past several years through the Department of Psychology of the University of the Witwatersrand, have shown targeted remedial tuition utilising high mental imagery techniques, as specified by the Targeted Revisualisation Programme developed by Professor Charles Potter of the University of Witwatersrand, to be related to improvements made in the English spelling, reading and writing abilities of children with learning disorders affecting their performance in these areas. The existence of an association between the use of mental imagery and these children's ability to correctly utilise English words in context, both verbally and in writing, has also been highlighted through previous research findings (Abelheim, 2002; Els, 2003; George, 2001; MacReadie, 2001; Picton, 2002; Ravencroft, 2002; Sampson, 2002; Sfetsios, 2002; Wilson, 2001).

Preliminary research data collected to date has suggested that not only is the use of high mental imagery techniques as effective as traditional phonologically based tuition methods in improving the learners' abilities in this regard, but that it also tends to yield greater improvements in comparison. Results available have tended to show that not only do improvements made by children who have been tutored utilising a high mental imagery approach to the remediation of these abilities parallel the improvements made by children tutored via a phonologically based approach, but that these children tend to show markedly greater improvements in comparison to those made by the latter on corresponding abilities (Abelheim, 2002; Els, 2003; George, 2001; MacReadie, 2001; Picton, 2002; Ravencroft, 2002; Sampson, 2002; Sfetsios, 2002; Wilson, 2001).

Furthermore, preliminary data collected per single case study basis by Potter (2004) and Sfetsios (2002), suggests that not only are improvements evident in a child's English language

abilities as a result of the consistent usage of high imagery techniques over a period of time, but that gains are also apparent in the child's underlying cognitive processing and neuropsychological abilities, as revealed by comparison of results obtained in psychological assessment batteries administered prior to and after a temporal period of participation in the programme, the extent of which can not be explained purely by maturational factors (Potter, 2004; Sfetsios, 2002). Although potential links apparent between the high mental imagery techniques utilised, cognitive gains apparent and improvements in the English language abilities made have been suggested by these study results, limited research has been conducted specifically in this regard to date.

This study therefore purposed to specifically explore whether the consistent usage of high mental imagery techniques is related to gains made by a child in their cognitive skills and, in particular, their successive and simultaneous cognitive processing abilities, as apparent upon psychological pre and post testing. In this regard, this research intended to facilitate a more in-depth exploration into the possible underlying cognitive gains that occur as a result of the utilisation of high mental imagery techniques, as suggested by the preliminary research data collected to date. This research also purposed to explore in more detail any links which may be apparent between the high mental imagery techniques utilised, any cognitive gains made as well as the participants improved English language abilities.

Should high mental imagery techniques, through continued research, be shown to be effective in consistently improving the English reading, writing and spelling abilities of children with specific learning disorders, it could be demonstrated to be valuable to introduce and integrate these techniques into the existing South African remedial schooling system, particularly because of its inexpensive nature and the relative ease with which it can be implemented and maintained. Research demonstrating associated cognitive and neuropsychological gains in children suffering specific learning disorders as well as the possible links between these gains, the gains made in the child's English language abilities and the high mental imagery techniques utilised, will provide further evidence to substantiate any additional benefits such a child may experience as a result of the usage thereof and to support the usefulness of its implementation.

In addition, the gathering of further evidence of the effectiveness of high mental imagery techniques with children suffering learning disorders affecting their abilities in English

reading and written expression within the South African context, and in particular cross culturally, will also serve to substantiate the need for increased investigation into the usefulness of its implementation with children suffering learning disorders affecting their abilities in English reading and written expression within an international context, following which the more widespread implementation and integration of the programme into international remedial schooling systems could also be explored.

1.7 Research Questions:

This research therefore focuses on the following questions:

Primary research questions:

1. Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their *successive processing ability*?
2. Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their *simultaneous processing ability*?

Subsidiary research questions:

3. Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their *spelling ability*?
4. Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their *reading ability*?
5. Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their *writing ability*?

1.8 Summary of Chapter:

This chapter has provided an introduction to the study through the specification of its aims and rationale. The research questions which the researcher intended to address as a result of

the execution of this study were also elaborated upon at the end of the chapter. In summary, this research purposed to investigate the effectiveness of high mental imagery techniques as a form of remediation in improving the successive and simultaneous cognitive processing abilities and English spelling, reading and writing abilities of Grade V learners with learning disorders of reading and written expression.

In addition, this chapter provided a brief overview of the key concepts essential to this research project including successive and simultaneous mental processing, the relationship between reading, writing, visual imagery and mental processing, as well as learning disorders. This chapter described the potentially negative impact of learning disorders of reading and written expression on academic performance and progression within the mainstream schooling environment, as well as how children suffering from these learning disorders often struggle to learn to read and write via conventional remedial strategies. The importance of attempting to develop more effective methods to remediate these abilities, particularly for children who have been shown to be “treatment resistant” to traditional phonologically based remedial techniques to date, was then discussed, elaborating specifically upon the possible useful role that high mental imagery remedial techniques could play in this regard.

1.9 Outline of this Research Dissertation:

The remainder of this research dissertation will discuss in greater detail the association that this exploratory study suggests to exist between the utilisation of high mental imagery remedial techniques and the improvement of the simultaneous and successive mental processing abilities and English reading, writing and spelling skills of Grade V learners suffering disorders of reading and written expression. Chapter two discusses the background and procedure of the high mental imagery remedial approach that was utilised with the experimental group in this study in greater detail. Chapter three provides a critical overview of available literature underpinning the research questions that this study purposed to investigate. Chapter four then outlines the research methodology followed to implement this study in accordance with the principles of aggregated case study methodology. Chapters five and six provide an overview and comparison of the case study results found by this study and discuss these results and the implications thereof further. Chapter seven outlines the conclusions that can be drawn based on the study results. Finally, chapter eight delineates the limitations that were present in this study as well as suggestions for further research in this

area. Tabulated raw data, summaries of the participants' remedial sessions held and copies of relevant documentation are included in the accompanying appendices.

1.10 Glossary of Terms:

The following terms are defined in accordance to their usage within this research project:

Alphabetic principle: The relationship between letters comprising a written word, ordered from left to right, and the phonemes in the spoken word, ordered in a specific temporal sequence (Birsh, 1999).

Bottom-up processing: Processing that is influenced directly by environmental stimuli and by the physical stimulus perceived, prior to proceeding upwards to consider the involvement of higher order cognitive processes (Eysenck & Keane, 2000; Sternberg, 1999).

Crystallised intelligence: "Knowledge and experience accumulated over a lifetime of experience" (Sternberg, 1999, p. 510).

Consonant blend: Two or more adjacent consonants whose sounds flow smoothly together i.e. whose sounds 'blend' together (Birsh, 1999).

Decode: Word recognition in which the phonic code is broken, thereby allowing for the determination of the pronunciation of a word through the noting of the position of its vowels and consonants e.g. *con / so / nant* (Birsh, 1999).

Digraph: Two adjacent consonants or vowels in the same syllable, representing a single speech sound (e.g. *ch* in *such* and *ea* in *seat*) (Birsh, 1999).

Disorder of written expression: According to the DSM IV TR (American Psychiatric Association, 2000), a disorder of written expression is characterised by writing skills that are significantly below the expected level for a child's age and intellectual capacity.

Eidetic imagery: The ability to retain an accurate, detailed visual image of a complex scene or pattern or the ability to mentally 'see' an image of the original sensory experience (Gray & Gummerman, 1996; Jaensch, 1930).

Fluid intelligence: “Process orientated intelligence, requiring rapid understanding of novel relationships” (Sternberg, 1999, p. 513).

Grapheme: The pictorial qualities of a written word that allows it to be understood without being sounded out; a group of letters that conveys a meaning (e.g. *i*, *igh*) (Kolb & Whishaw, 1995)

Iconic store: A sensory store in which visual information is held for a very brief period of time (Eysenck & Keane, 2000).

Lexicon: A dictionary-like store of words in the brain, containing their meanings and knowledge of the way in which they can be combined, and information about the ideas with which they can be associated (Kolb & Whishaw, 1995).

Morpheme: The smallest meaningful unit of speech (Kolb & Whishaw, 1995).

Morphological: Relating to or concerned with the formation of admissible words in a language (Kolb & Whishaw, 1995).

Orthography: The writing system of a language, referring in particular to the correct or standardised spelling according to established usage (Birsh, 1999).

Phoneme: “The smallest unit of speech sound that can be used to distinguish one meaningful utterance from another in a given language” (Sternberg, 1999, p. 518).

Phonics: Paired association between letters and letter sounds (Birsh, 1999).

Phonological awareness: Both the knowledge of and sensitivity to the phonological structure of words in a language, involving the ability to notice, think about, or manipulate sound segments in words. Phonological awareness progresses from rhyming to syllable counting; to

detecting first, last and middle sounds; to segmenting, adding, deleting and substituting sounds in words (Birsh, 1999).

Phonological dysgraphia: A condition in which familiar words can be spelled reasonably well, although non-words cannot be spelt without difficulty (Anderson & Anderson, 1998; Eysenck & Keane, 2000).

Phonological dyslexia: A condition in which familiar words can be read reasonably although impairment exists in the ability to read unfamiliar words and non-words (Anderson & Anderson, 1998; Eysenck & Keane, 2000).

Phonology: Information concerning the sound of words and parts of words (Eysenck & Keane, 2000).

Pseudoword: A word which can only be pronounced by identifying the sounds represented by individual letters and letter combinations, and then blending the sounds together to form a word e.g. *trake* (Jones, Torgensen & Sexton, 1987).

Reading Disorder: According to the DSM IV TR (American Psychiatric Association, 2000), a reading disorder is 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.

Revisualisation: A general definition of revisualisation is "a memory task in which the person must recall the configuration (shape of a letter or word) in the absence of visual clues" ("Parent support for children with challenges", n.d.). More specifically, as defined by Potter (2002, p. 2) in the context of analysing, memorising and retrieving words from memory, revisualisation is "the process of analysis of an image formed in response to a stimulus, the process of comparison of the image with the form of the original stimulus, and the process of coding outputs of the image into written or graphic form".

Semantic: Concerning the meaning of words and the relationship among words as they are used to represent knowledge of the world (Birsh, 1999).

Simultaneous processing abilities: “Involves the integration of stimuli into groups, or the recognition that a number of stimuli share a common characteristic” (Das et al, 1994, p.15).

Successive (sequential) processing abilities: “Involves the integration of stimuli into a particular series where the elements form a chainlike progression” (Das, et al, 1994, p.15).

Surface dysgraphia: A condition in which irregular and non-words are spelt with difficulty whilst regular words are spelt reasonably well (Eysenck & Keane, 2000).

Surface dyslexia: A condition in which regular words can be read although impairment in the ability to read irregular words exists (Anderson & Anderson, 1998; Eysenck & Keane, 2000).

Syntax: The structure of a sentence; grammar (Birsh, 1999).

Top-down processing: Stimulus processing that is affected initially by factors such as the individual’s past experiences and expectations and high-level cognitive processes prior to the consideration of the sensory data and perceptual stimulus (Eysenck & Keane, 2000; Sternberg, 1999).

Transparent Orthography: An orthography of the English language based on a seven-vowel system, in which *a, e, i, o* and *u* are mediated as vowels in all positions in words, and *y* and *w* are mediated as consonants in positions at the beginning of words and as vowels in positions near or at the end of words (Potter, 2000).

Visual Imagery: The mental representation of visual knowledge not presently visible to the eyes (Sternberg, 1999).

Visualisation: The ability to form a mental image of an object (Kolb & Whishaw, 1995).

Word superiority effect: The effect that has said to occur when a target letter is more readily detected in a letter string when the string forms a word than when it does not (Eysenck & Keane, 2000).

Chapter Two: High Mental Imagery Techniques

2.1 Introduction to High Mental Imagery Techniques:

The *Spelling, Imagery, Reading and Revisualisation Programme*, otherwise known as the Targeted Revisualisation Programme, conceptualises high mental imagery techniques as integral to the process of learning of the English language by children. This approach has been conceptualised and refined by Professor Charles Potter, Educational and Research Psychologist from the Department of Psychology of the University of the Witwatersrand.

2.1.1 High mental imagery techniques and targeted revisualisation:

Targeted revisualisation assumes that, as hypothesised by Luria (1973), different types of memory related to each of the primary sensory modalities, as well as to their integration, exist. Learning to read and spell for example, requires a process of mediation of the form and structure of words. This would therefore involve the *development of multi-sensory association and integration of memories*, thereby enabling the child to reproduce words in their written form and to use language sequentially and in an integrated manner. To facilitate this, a *seven vowel system* (a; e; i; o; u; as well as y and w when in position at or near the end of words) instead of a 5 vowel system is taught to mediate the structure of the English orthography, making it more transparent to the child (Potter, 2000; 2001; 2003).

In light of this, specific words containing more than one vowel are targeted. Through reading sentences and passages, all words containing vowel digraphs and combinations as well as polysyllabic words are identified, forming the substrate for further analysis. These are then learned through dual coding/ multi-sensory processes involving colour coding of vowels and analysis of the word structure through syllabification. The correspondence between spoken and written forms of words is established, along with how vowel combinations represent sound structures. The association between language encountered in reading and language represented in writing is also mediated through the use of writing and typing on the computer. Vowels and syllables are colour coded as an aid for word analysis (Potter, 2001; 2003).

Multi sensory teaching in this regard, therefore refers to learning activities that include the use of two or more sensory modalities simultaneously in order to take in or express information. Different sensory modalities are therefore used in combination by representing words

explicitly, sequentially, directly and systematically, thereby aiding children who, in particular, experience phonological difficulties (Birsh, 1999; Moates & Farrell, 2000).

The targeted revisualisation approach closely follows the Piagetian understanding of the use of *perception and mental imagery*, viewing language and thought as separate yet concurrently developing systems utilised in the service of thought and forming integral parts of the learning process which serve as a basis for establishing reading and spelling competence. The literature on mental imagery suggests that while some children are able to use visual and eidetic imagery in this process, this is not characteristic of all children (Potter, 2001; 2003). In this regard, the programme utilises the term *visualisation* to imply that mental imagery is used in the learning of words. Likewise, the term *revisualisation* is used to imply that the image stored during visualisation is drawn out of memory before it is coded into output. Mental imagery is also used to revisualise the word, encoding it into oral and written output (Potter, 2000; 2001).

This high mental imagery approach therefore teaches the child to use perception, mental imagery and language in combination through a process referred to as '*targeted revisualisation*'. Single words are imaged and spelled orally, then revisualised and written. The development of sequential thought and memory is later emphasised through extension of this revisualisation process to sentences and paragraphs (Potter, 2000; 2001).

Error analysis, through use of the Phonic Inventories (Appendix x), is conducted at all stages of the high mental imagery remedial intervention to gain an understanding of the rule systems used by the child to analyse and create written language. These errors also serve as indicators to suggest the level of instruction at which the remediation should be aimed to ensure its specificity to each child's individual needs, with specific errors forming the individual teaching targets developed uniquely for each child (Potter, 2001; 2003).

The Targeted Revisualisation programme consists of five different hierarchical levels, which initially follow the first two levels of the Phonic Inventories, moving thereafter onto polysyllabic words and morphological endings in the context of passages. Emphasis is placed on context throughout the programme, initially considering words in sentences in the lower levels and progressing thereafter to paragraphs in stories in the higher levels. Laddering and flexibility between levels, coupled with creativity however, is advised in its implementation in

order to allow for variety and to maintain the level of interest of the child (Potter, 2000; 2001).

The role of the *tutor* in remediation via a high mental imagery approach is to serve merely as a guide in the process of learning, observing while the child acts and intervening only as required to mediate the rules involved in the construction of the English language, continually encouraging independence. The child is also encouraged to apply the rules and skills learned in the sessions in accordance with the high imagery remedial principles independently, so that they may also be implemented and reinforced not only within the remedial sessions but also in real life i.e. within the classroom and homework situation (Potter, 2000; 2001).

2.2 The Phonic Inventories (See appendix x):

Much of the literature available emphasises the *central and foundational role that phonological and phonic abilities* play in the acquisition of the processes required in learning to read, write and spell, highlighting in particular, the importance of the development of phonic competencies in children. The targeted revisualisation approach to remediation has been formulated on the premise that knowledge of these abilities and of the rule systems acquired and used by a child in reading and writing, can be helpful in targeting instruction specifically to meet a child's particular needs. To determine which phonic rules a child has established and which still remain problematic, three Phonic Inventories have been developed by Potter (2000; 2001) to be utilised for diagnostic purposes in this regard at the outset of the high imagery remedial intervention.

The Phonic Inventories were constructed in accordance with evidence from spelling research that suggests that, unlike with reading, phonological spelling commences initially with a focus on *phoneme-grapheme correspondence* and only later begins to make use of larger phonological chunks (Frith, 1980; Potter, 2000; 2001).

In this regard, the Phonic Inventories (Potter, 2000; 2001) are interpreted within the developmental framework of the acquisition of reading and spelling skills as outlined by Frith (1980). Frith (1980) proposed that reading proceeds by the successive acquisition of three consecutive processing strategies, including the logographic, substantially alphabetic and orthographic strategies. The *logographic strategy* comprises visual word recognition through

the identification of salient features of familiar words, such as *yellow* recognised through the *ll*. The *substantially alphabetic strategy*, as described by Frith (1980), develops thereafter once the child commences to read under formal instruction, thereby learning letter-to-sound and grapheme-to-phoneme correspondences. During this second stage, the child is able to ‘sound out’ unfamiliar words and decode ‘regular’ words successfully, although remains unable to do so for ‘irregular’ words. The final stage as proposed by Frith (1980), entails the *orthographic strategy* which is non-phonological in nature, corresponding to the automatic, skilled strategy as employed by adult readers, by which familiar whole words and orthographic units such as ‘*pre*’ in *present* are recognised. This strategy is therefore a flexible one that permits decoding of familiar words and unfamiliar words by analogy with familiar orthographic sequence.

According to Frith (1980), as mentioned above, the acquisition of these three strategies is not only apparent in *word recognition development* (i.e. in reading) but also in the *production of words* (i.e. in writing). Thus, according to Frith (1980), the logographic strategy develops first for reading, transferring thereafter to spelling. The alphabetic strategy becomes apparent in spelling first however, only transferring to reading at a later stage. Like the initial strategy, the orthographic strategy is also primarily available for reading first, only transferring thereafter to spelling.

In view of Frith’s (1980) theory, the focus of a remedial reading, writing and spelling programme would need to be on the second stage, purposing to establish the alphabetic principle as applied to the English language as used in writing. The structural analysis and decoding of words in terms of their morphological characteristics would be the primary focus of stage three. It is this principle that has been established in the construction of the Phonic Inventories (Potter, 2000; 2001).

2.2.1 Interpretation of the phonic inventories:

After completion by the child, the Phonic Inventories are then *analysed for errors* and the errors subsequently *categorised*, thus enabling the tutor to pinpoint those phonic rules familiar to the child, and those which still need to be developed. More specifically, the Phonic Inventories have been designed to reflect and provide information about three different types of rule systems. The first, corresponding to Level One of the Inventories, relates to the use of short vowels with beginning and ending consonant blends. The second level involves the use

of vowel digraphs and purposes to establish the phonic strategies used by the child in the building of words containing long vowel sounds whilst simultaneously also determining which phonic rules the child has not yet established. Finally, Level Three focuses on the use of multiple syllables, prefixes and morphological endings in words and comprises of groups of words, with each word-group having been formulated from a single root word (Potter, 2001).

Analysis of the errors made in the Phonic Inventories is conducted using a system of categorisation which records the type of error made as well as its position in the word. This system can be applied quickly and easily by the marker. The errors are then clustered, reflecting twelve different categories of errors on the three levels of the Phonic Inventories. This enables a profile of competencies and a hierarchy of phonic development to be constructed by the tutor for the child (Potter, 2001).

The categories include, firstly, errors made on the initial consonant of a word, where a child may incorrectly spell the first consonant of a word, i.e. writing *wet* instead of *vet*. Secondly, the child may make an error on the initial blends/clusters of a word, where two consonants working together at the beginning of the word are written incorrectly, i.e. the *sc* in *scream* may be written as *sk*. Medial vowel errors occur when a single vowel in the middle of the word is written incorrectly, i.e., the child may write an *e* instead of an *i* in the middle of the word, as in the writing of *sken* instead of *skin*. When the child incorrectly writes two vowels that blend together, a medial vowel digraph error is said to have occurred, i.e. the child may write *ea* instead of *ai* for example in *sead* as opposed to *said*. Ending consonant errors occur when the child writes the incorrect consonants at the end of the word. Errors in ending blends/clusters occur when letters that work together at the end of the word are written incorrectly i.e. the child may write *ch* instead of *tch* in *scratch*. Long and short vowel confusions occur when the child is uncertain with regards to the use of the *e* at the end of the word to make the medial vowel into a long sound i.e. the child may write *bak* instead of *bake*. When the child writes the incorrect consonant corresponding to the sound in the word, consonant/sound confusion is said to occur i.e. the child may write *t* instead of *f* for example in writing *tail* instead of *fail*. Reversals/transposals occurs when the child turns the written letter around, i.e. the child may write *b* instead of *d* or *q* instead of *p* or could also non-sensibly reverse letters such as *j* or *a* etc. Errors made with the spelling and usage of prefixes occur when the child misspells the prefix at the beginning of the word i.e. *pre* may be spelled

as *per*. Suffix errors occur when the child spells the suffix at the end of the word incorrectly i.e. the child may spell *ness* as *nes*. Finally, syllabification errors occur when the child cannot hear when one syllable starts and the other ends i.e. when *manner* is written as *maner*, indicating that such a child has difficulty in identifying the syllables constructing the word (Sfetsios, 2002).

In this way, the Phonic Inventories enable the tutor to establish exactly where the child's strengths and weaknesses in this regard lie, the knowledge of which can then be used as the basis for specifically structuring of the remediation programme. This link between diagnosis based on error analysis and the activities involved in the programme is an essential feature of the initial stages in the Targeted Revisualisation Programme (Potter, 2000; 2001).

2.3 The Graded Application of High Imagery Techniques: Levels of Targeted Revisualisation:

The *graded application* of high mental imagery techniques is essential pending on the development and learning disorder of the child. In this regard, targeted revisualisation as outlined by the programme consist of five levels of remediation, and has been formulated upon the assumption that the child has developmentally reached a level of readiness for reading, and in particular of phonological awareness prior to commencement of their involvement on the programme. If these have not yet been established however, it is recommended that readiness activities be introduced to the child before progressing onto Level One activities of the programme (Potter, 2000; 2001).

2.3.1 Level one:

Level One of the programme purposes to establish the alphabetical principle in its application to the reading and writing of one syllable words containing short vowel sounds, individual consonants and consonant blends/clusters at the beginning and end of words. This is done through the utilisation of words families which contain similar sounds/rhymes (e.g. a group of eight words ending with the letters */et/* as in *net* and *pet*) and word families which demonstrate a rule as applied to the writing of words containing single vowels (e.g. the letters *ll*, *ff* and *ss* are all doubled when following a short vowel, and the letters *ck* make the sound */k/* as in the word *kick*). Level One activities therefore focus on the establishment of the development of a system for analysing and synthesising consonants and short vowel sounds in words (Potter, 2000; 2001).

In the learning phase of this stage, the words are targeted, imaged and then verbally spelled from the image which has been formulated in the child's mind. The words are then revisualised and written by the child in their workbook, following which each level is tested through dictation, the errors made in which are also then subsequently mediated and targeted. To allow for the contextualisation of the words introduced in the programme and to facilitate the integration of the processes of language, perception, imagery and cognition as involved in their use in written language, the child is also encouraged to write short sentences using other short vowel words in conjunction with the targeted words at this stage. The rules as related to word and sentence construction are also further reinforced through reading. The reading of books based on a phonic or linguistic system is therefore also introduced, through which the child becomes increasingly exposed to text which is comprised primarily of words which can be decoded through the application of phonic rules (Potter, 2000; 2001).

The aim of the programme at Level One therefore, is not only to target the rules involved in the construction of short vowel words, but also to introduce multi-sensory teaching methodology to the child. A low frequency of errors made on Level One of the Phonic Inventories by the child, indicates the consolidation of their ability with the tasks and the rules involved in utilising words containing short vowels (Potter, 2000; 2001).

2.3.2 Level two:

In contrast to Level One, Level Two of the programme focuses on the establishment of a more sophisticated understanding of the alphabetical principle as applied to the reading and writing of mono-syllabic words comprising long vowel sounds based on vowel combinations. This is also done through the introduction of word families which the child is then encouraged to incorporate into short sentences composed of an increasing variety of other words including colour words, prepositions and past tense forms of the verb "to be". An understanding of how syllables are used in combination to formulate polysyllabic words, and how combinations of words based on short and long vowel sounds are used to write sentences is also remediated. These are also then imaged and revisualised by the child at this stage (Potter, 2000; 2001).

The transparency of the orthography of the English language is increased at Level Two through introducing the child to the seven vowel system as previously described. At this stage, the child also copies and colour codes target words, word families and sentences

through the utilisation of the target words in both writing and on the computer. As in Level One, the child is encouraged to formulate mental images of targeted words and sentences as well as to pictorially and colourfully illustrate their work and the words being learned, in keeping with the multi-sensory approach to remediation. A greater range, complexity and length of reading materials are also introduced at this level (Potter, 2000; 2001).

The aim of Level Two therefore, is to mediate the structure and rule systems used to correctly generating written language in English both in spelling and writing. This is done through a highly structured programme and through the analysis of words drawn from the accompanying reading programme. The child is introduced to Level Three activities only once it is evident that they have understood the idea that long vowel sounds in English are normally represented by vowel combinations and when it is apparent that the child approaches writing activities by using a rule system for discriminating and representing words containing both long and short vowels (Potter, 2000; 2001).

2.3.3 Level three:

Paragraph revisualisation is introduced at Level Three of the programme in view of both developing the basic sequencing and memory skills required for writing and for identifying how vowel combinations blend together to formulate sounds in the written English language. The structural and phonemic analysis of words with more than one vowel (i.e. either single syllable words using vowel digraphs, or polysyllabic and compound words) continues at this stage. These are identified and listed by the child from sentences and paragraphs, and then analysed through colour coding in both writing and typing and subsequently polysyllabic words divided into separate syllables following which mental imagery is employed to facilitate the learning thereof. Once the target words have been learned and revisualised as separate language units, they are then revisualised in sequence, in the context of the original paragraph. The text is then recreated by the child in the form of written dictation (Potter, 2000; 2001).

Since research and clinical practice have revealed that not all children have or are able to use eidetic imagery in the revisualisation progress, depending on the child's own ability and skill in this regard, other forms of visual, auditory and kinaesthetic imagery based on remembering a sequence of letters spelled out loud can be employed to store words in memory (Potter, 2000; 2001).

At Level Three therefore, the child's ability to store images of the structure of words forms the focus of learning. Testing through dictation is the means through which the tutor can check whether the child has established these memories and whether they are accessible and if the child is able to revisualise previously stored images and relate these to the spoken word and its written form. In addition, the integrative skills required for dictation are also taught and tested at Level Three, including the ability to listen to the dictated text, revisualise and encode the words sequentially and then recreate the text in its written form. Errors made by the child in recreating text from memory are thus considered as being diagnostic of difficulties they are experiencing in revisualisation, encoding and sequencing of written output. Errors made are subsequently listed and again targeted one by one (Potter, 2000; 2001).

As a wider range of words are therefore targeted in the spelling and paragraph revisualisation at this level and as the difficulty and range of the reading and spelling programme increases, more complex words can be targeted and structurally analysed and more complex rules for the decoding of written language subsequently added to the child's rule system (Potter, 2000; 2001).

2.3.4 Level four:

Whilst at Levels Two and Three, descriptive and narrative writing is used informally in creative writing activities to mediate spelling in context, at Level Four the notion that there are formal conventions and rules which apply to the construction of both oral and written language, is introduced. This is done through activities involving the use and analysis of written language, with errors made by the child forming the targets for mediation and the basis of planning of further activities. Level Four of the programme therefore purposes to target both the fluency and accuracy of reading and writing. Expository, descriptive and narrative writing skills are taught formally in view of establishing the concept that a paragraph is simply a series of sentences formulated about a single image or idea, and that ideas can be arranged around a central theme (Potter, 2000; 2001).

Level Four activities therefore involve working from materials available commercially (e.g. reading laboratories), providing written answers to inferential and factual-based questions, as well as placing continued attention on the decoding and encoding text. Texts authored by others are read so that central and supporting ideas can be identified and single sentences used

to summarise and sequence paragraphs. Similarly, comics and picture stories are used to summarise a flow of ideas as represented by a sequence of images and to construct paragraphs around the unfolding stories. Mind maps are used to plan written text after the principles underlying paragraph formation have been understood by the child. Mind mapping is also utilised to introduce and plan stories according to themes and sub themes whereby single words are used to represent and sequence ideas and images (Potter, 2000; 2001).

In this way, expository writing abilities are facilitated through tasks involving the reading of text and by then providing written answers to factual and inferential questions. Narrative writing abilities on the other hand, are taught through invoking sequences of images or pictures. Similarly to the previous stages, at this level, mental imagery is utilised to memorise words and to structure and paragraph language. Errors made while working on these writing tasks at this level are used to establish the child's knowledge of the rule systems as applied to punctuation and paragraphing and the structure of the written language. It is these rules which form specific targets for mediation at this stage (Potter, 2000; 2001).

2.3.5 Level five:

Level Five activities are formulated upon the assumption that children suffering learning disorders require input into both the structural and communicative aspects of language, which this level therefore focuses on remediating. The structural aspects of language include gaining an understanding of the conventions of English grammar, the ability to cope with a variety of questions pertaining to the literal and metaphorical meaning of words, factual and inferential text comprehension, as well as the ability to understand different registers/tones of language and the use of language within these different registers. The communicative side on the other hand, includes the ability to utilise language for different communicative purposes, to be able to adapt to and accommodate for different types of communicative media and conventions, and to understand language used by others in different communicative media and conventions. A variety of structural and communicative activities and exercises are therefore introduced to the child in Level Five with the intention of facilitating their ability to cope with and possibly excel in the oral and written language activities encountered in mainstream English language programme at school (Potter, 2000; 2001).

In this regard, Level Five also aims to facilitate the child's development of the necessary organisational and study skills to work independently on class work and homework activities

and to assist the child to develop the skills and ability to appropriately identify learning resources at their disposal such as dictionaries, encyclopaedias, computer programmes, spell-checkers etc., as well as supportive personnel within their environment such as teachers, parents, elder siblings, peers etc. who can help assist them in unfamiliar situations. Level Five starts initially by providing the child with maximum support available. However, since the ultimate goal of the tutor in this regard is to develop the child's learning skills, study skills and independence, the child is encouraged to increasingly take the lead with the tutor gently shifting roles from that of a central mediator of learning in the child's life, to being only one of many available, thereby encouraging the child to take responsibility for their own learning and acquisition of knowledge (Potter, 2000; 2001).

2.4 Summary of Chapter:

This chapter purposed to describe the hierarchical, multi-level, multi-sensory high mental imagery approach utilised to tutor the children suffering learning disorders of reading and written expression involved in this study. This targeted high mental imagery remedial technique follows the specifications outlined by the Targeted Revisualisation Programme as proposed by Professor Charles Potter of the University of the Witwatersrand who conceptualised the approach. The Phonic Inventories (developed by Potter; 2000; 2001), utilised prior to the implementation of a high mental imagery approach to the remediation of English abilities, were then discussed. In essence, the Phonic Inventories assist the tutor to establish the specific strengths and weakness of the child in their ability to read and write in English. In this way the subsequent remedial programme established for the child can be individually structured for them in accordance with a high mental imagery approach.

Chapter Three: Literature Review

3.1. Introduction:

In recent years, reading and writing and the cognitive processes involved therein have been subject to intensive psychological study (Carrol, 1986). According to Rayner & Pollatske (1989, p.23, in Ellis, 1993), reading refers to the ability of an individual to “extract visual information from a page and to comprehend the meaning of the text”. Inherent to writing on the other hand, as defined by Rayner & Pollatske (1989, p.28), is “some sort of spatially arranged message that is usually perceived by the eyes, but could also be perceived by a tactile sense”, as in Braille, which is a valid writing system for the blind. As such, Liberman (1996, in Shaywitz, 1996) notes that although reading and writing therefore, as integrated parts of the language system, are combined with and reflective of spoken language in many ways, they are far more difficult skills to master. Similarly, Liberman (1996, in Shaywitz, 1996) argued that while verbal communication is an inherently natural ability to which human beings are genetically predisposed, reading and writing, as societal inventions, are not, and must instead be learned at a conscious level. Theorists today therefore recognise both *reading and writing to be highly complex behaviours* involving multiple cognitive processes and stages, our understanding of which, despite ongoing research and debate, is still limited (Funnell, 2000).

In this regard, the methodology utilised to teach and improve a learner’s ability to read, write and spell in accordance with the high mental imagery techniques as outlined in the second chapter of this dissertation, has been formulated based upon numerous theories proposed to date concerning the specific nature of the various cognitive processes involved in learning to read, write and spell, as well the manner in which these functions manifest in relationship to the language being targeted (with reference to this study, the English language in particular), and the way in which English is represented in its written form (Potter, 2003).

As described by Potter (2003), the procedures of targeted revisualisation and high imagery remedial techniques are based upon theories of, i) the neuropsychological basis of learning, ii) how sound and letters are used to form words in English and, iii) how children utilise recall imagery when learning or failing to learn to read, write and spell.

In this regard, this literature survey shall firstly explore the neuropsychological basis of learning as considered by Luria and more recent literature as to how this relates to the concept of intelligence and in particular to simultaneous and successive cognitive processing. Literature pertaining to cognitive processes that various theorists consider may be involved in reading, writing and spelling and the development thereof shall then be explored. Emphasis shall be placed on the role of simultaneous and successive processing in reading and writing and disorders of reading and written expression. Attention shall also be given to the remediation of simultaneous and successive processes and reading, writing and spelling. Finally, attention shall be given to the nature of mental imagery, the use of mental imagery as a remedial technique and the relationship between mental imagery, cognitive processing and reading, writing and spelling and the improvement thereof.

3.2. The Neuropsychological Basis of Learning:

Russian Neuropsychologist, Alexander *Luria* (1973), conceptualised the neuropsychological developmental model in which he described the brain as comprising a set of neurological systems or loops, each of which he believed contributed to its overall information processing ability. Luria's (1973) theory in this regard, proposing that the ability to perform complex mental activities such as mathematical equations is dependent upon the *coordinated action and input of multiple parts of the brain*, contrasts directly with the popular idea of localisation of function, which suggests that isolated individual components of the brain are dedicated solely to the performance of single skilled functions. Similarly, Luria (1973) proposed that the neuropsychological developmental model must be employed to gain an understanding of the complex and vastly intricate and extensive neuropsychological processes involved in perception, memory, attention and cognition, all of which are often deficient to some extent in children suffering learning disorders (Jansen 1996).

In this regard, Luria (1973) hypothesised that cooperation and interaction across relatively large anatomical regions of the brain could account for the control and functioning of all human cognition and perception and proposed the existence of three functional units to comprise the brain. However, although denoting the existence of *three discrete anatomical and functional units*, Luria (1973) stressed their interdependence and emphasised how their interaction is essential to produce optimal performance on any task. For example, to perform a complex cognitive activity such a reading successfully in accordance with Luria's model

(1973), a certain level of wakefulness is required (the role of the first functional unit), as well as the ability to see and appropriately perceive what is being read through the visual system (performed by the second functional unit). Finally, the ability to maintain some level of control over one's attention, intention, learning and behaviour are also essential to be able to read and understand what is being read (actioned by the third functional unit).

Luria (1973) described the *first functional unit*, comprising of the limbic system and the brainstem, and especially of the reticular activating system, as being primarily responsible for the modulation of arousal and activation. He hypothesised that those connections from the first functional unit upwards to numerous cortical and subcortical areas of the brain usually provided for increased activation of those parts, with the corresponding downward connections, especially from the frontal lobes or third functional unit to the first functional unit as being responsible for the reduction of arousal. Naglieri (1989) notes that it is only when a proper waking condition is achieved, that an individual can receive and process information. Appropriate levels of arousal also provide the opportunity for the specific direction of attention. Insufficient performance of this first functional unit therefore leads to difficulties with information coding (simultaneous and successive cognitive processes) and planning due to an under arousal of the second and third functional units.

The *second functional unit*, as described by Luria (1973), comprises the posterior cortex, including the occipital, parietal and temporal lobes. Each of these lobes consists of primary, secondary and tertiary areas that process sensation and perception at ever increasing levels of integration and meaning. The primary areas of the auditory, occipital and parietal lobes register basic sensory information provided by the ears (auditory sensation), eyes (visual sensation) and skin (somatic sensation) respectively. The secondary regions are thereafter responsible for the integration of these sensations into perceptions. At higher levels of integration, these perceptions are then integrated so that all of the sensory information provided at one point in time can be integrated in totality. In this regard, Luria (1966, p. 78, in Naglieri, 1989) stated that "there is strong evidence for distinguishing two basic forms of integrative activity of the cerebral cortex, by which different aspects of the outside world may be reflected". As described by Luria, in these two forms are simultaneous and successive processes. In this manner, the tertiary or association regions of the second functional unit can produce extremely complex integration and elaboration of information which thereby allows for the performance of complex activities involving the coordinated action of multiple

cognitive processes such as the ability to, amongst many others, understand what one is reading and writing, visualise real and imaginary scenes and objects, as well as to perform more complex tasks involving symbolic thought and the manipulation of mental imagery.

Furthermore, it is considered that *hemispheric specialisation begins*, with the left hemisphere remaining predominantly concerned with the processing of visual information and the right hemisphere concerned primarily with non-verbal processing. By five years of age, it is thought that the secondary areas are functional and crucial for modality-specific learning (Jansen, 1996). Thus, disturbances that occur in the synthesis of information are considered to be a result of lesions sustained by the second functional unit, thereby causing the inability to process cross-modal information which is essential for the skills required in spelling, reading and arithmetic (Morgan, 1988, in Jansen, 1996).

The *third functional unit*, as proposed by Luria (1973), takes the longest to fully develop, the maturation of which is thought not to fully occur until puberty, comparable with the Piagetian cognitive stage of formal operations. This unit, which comprises of the frontal lobes, is primarily responsible for higher order executive functioning and control over thought processes and actions. Executive control in this regard, implies the selection of information and actions which are optimally suited to the ongoing situation. This is done primarily through the inhibition of unwanted information or behaviour. The frontal lobes are therefore responsible for higher order tasks such as abstract reasoning, higher order organisation and meaning, pre-planning of movement, cognitive flexibility and socially acceptable behaviour, as well as the making and executing of plans (Kolb & Whishaw, 1995). As noted by Das (1984, in Naglieri, 1989) and Arlin (1977, in Naglieri, 1989), planning is the essence of human intelligence as it involves the aptitude for asking new questions, solving problems and self-monitoring, as well as the application of information coding processes.

The *frontal lobes* in particular however, cannot function independently, and are thus richly interconnected to every other part of the brain, with especially thick interconnections to the limbic system and first functional unit. Proper functioning of this system allows for the maintenance of appropriate, focused, organised thinking and behaviour, as well as optimal "cortical tone", referring to the overall level of arousal/activity of the brain (Kolb, & Whishaw, 1995; Luria, 1973). The last portion of the frontal lobes to develop is the tertiary zone of the *prefrontal cortex* (Jansen, 1996). The abundant cortical and subcortical

connections found in this zone are essential in integrating all information across modalities, thus controlling executive and intentional aspects of functioning (Jansen, 1996). Prefrontal lobe development increases control over the arousal unit and regulates attentional processes and the level of arousal (Kolb & Wishaw, 1995; Luria, 1973).

Furthermore, Luria (1973) provided examples of *external devices* that can be utilised to trigger the memory, such as the implementation of mnemonic strategies in the memorisation of facts. According to Luria (1973), these external aids are essential components to the establishment of functional connections between individual parts of the brain and integration of the three functional units. It is through these devices that Luria (1973) conceptualised previously independent areas of the brain integrating into components of a single functional system. Therefore, Luria (1973) suggested that activities such as remembering the spelling of a word has a neurological basis, and conversely, that external experience or learning produces new neurological connections. Furthermore, Luria (1973) suggested that the cortical development of higher order mental processes are continually changing, at first requiring a number of external aids for its performance and expanded in nature, whilst gradually becoming more condensed and converted into automatic motor responses.

With consistent practice, Luria (1973) postulated that the actual physical neurological location of the process in the brain also essentially changes. For example, Luria (1973) proposed that it is through practice that the functional structure of the writing process is fundamentally altered, thereby becoming a *single “kinetic melody”*. Therefore, whilst vital in the early stages of formation of an activity, the involvement of the auditory and visual areas of the cortex are no longer essentials in its subsequent stages of development, when the activity becomes more reliant on a different system of concertedly working zones.

In this regard, research conducted by Shaywitz, Pugh, Todd, Constable, Fulbright and Gore (1994, in Shaywitz, 1996), has indicated a tentative neural architecture for skilled reading of printed text. In particular their research, highlighting clearly the *multiple simultaneous and successive cognitive processes* occurring concurrently in the task of reading, suggested that the *identification of letters* activates sites in the extrastriate cortex within the occipital lobe, *access to meaning* draws on areas within the middle and superior temporal gyri of the brain, and *phonological processing* occurs within the inferior frontal gyrus.

Ongoing debate as to the current usefulness and relevance of Luria's model of cortical processing exists however. With reference to Luria's theory, Rains (2002, p. 60) considered that, "although in certain respects it is highly oversimplified, retaining, for example, the vague notion of association cortex, it nevertheless serves as a useful framework for thinking about cortical processing". Rains (2002) therefore suggested that, despite the difficulties with certain aspects of Luria's model, it still provides a useful framework as a means of guiding thinking about neuropsychological processing.

It is considered therefore, that despite Luria having conceptualised his model prior to the existence of modern technology and current neuroimaging techniques, this still proves to be useful today. Kolb and Whishaw (1996, p.171) for example, consider that Luria's formulation is of particular use since it makes use of the "known anatomical organisation of the cortex to provide a simple explanation for observations that Luria made daily in his clinic". Kolb and Whishaw (1996) consider however, that the limitation of Luria's theory is that recent anatomical and physiological data has raised questions as to the plausibility of some of his model's basic assumptions.

In this regard, Zillmer and Spiers (2001, p. 26) suggest that "Luria's hypothesis is particularly attractive to clinical neuropsychologists because it can account theoretically for most observations of brain-injured patients". Zillmer and Spiers (2001) argue that Luria's theory also offers an explanation as to why it is clinically evident that particular neurological lesions generally result in consistent impairment. Furthermore, Zillmer and Spiers (2001) consider that Luria's theory, and more specifically, his concept of reorganisation, offers a plausible account for individuals who successfully recover from brain trauma. In view of this, Luria's model is thought to provide a sound theoretical foundation for the conceptualisation of clinical neuropsychology as well as the treatment and rehabilitation of brain injured individuals.

It is apparent therefore, that although limitations exist, a strong argument can also be made as to the ongoing usefulness of Luria's conceptualisation of cognition and mental processing. In this light, Luria's work has also formed the departure point of more recently formulated theories of cognitive processing, such as that proposed by Das et al (1994), which is of particular relevance to this study and shall now be elaborated upon further.

3.3. The Nature of Intelligence and the PASS model:

There is generally little dispute that people's general cognitive abilities tend to *differ along some general continuum*, which is usually labelled intelligence, and that these differences have implications for a variety of behaviours. It is more difficult however, to arrive at a widely acceptable definition of intelligence that is both precise and useful and much debate exists in this regard (Murphy & Davidshofer, 2005).

In this light, *arguments* against a more *general understanding of intelligence* arise both from logical considerations and from clinical observations. Clinically, in cases of brain damage, specific cognitive functions are often spared while others remain impaired. In addition, individuals who have significantly damaged frontal lobe functions may have normal IQs, despite the fact that the frontal lobes are essential for higher cognitive processes. Similarly, some dyslexic children have high IQs despite their significant difficulties in reading. Examples such as these challenge the usefulness of a one-dimensional notion of general intelligence, be it conceptualized as mental energy or speed. Furthermore, a general ability view leads to different questions and measures of ability than a view that intelligence is made up of multiple and interdependent cognitive processes (Das, 2002).

Cattell (1963, in Murphy & Davidshofer, 2005) for example, has suggested two related but conceptually distinct aspects of general intelligence, namely *fluid and crystallised intelligence*. Fluid intelligence is defined as the ability to see relationships as in analogies and letter and number series and primarily deals with reasoning ability. Crystallised intelligence on the other hand, refers to an individual's acquired knowledge and skill, referring to the size of one's store of factual knowledge. Other *multidimensional views of intelligence* are suggested by the seven modules of intelligence posited by Gardner (1983, in Murphy & Davidshofer, 2005), the triarchic theory of Sternberg (1985, in Murphy & Davidshofer, 2005), and the Planning, Attention, Simultaneous, and Successive (PASS) theory proposed by Das et al (1994).

In essence, Das and his colleagues (Das, 2002; Das et al, 1994; Das, Kar, & Parrila, 1996) have offered the *PASS theory* as an alternative to the conceptualization of intelligence as a general mental ability which is based on the view that *intelligence is composed of multiple interdependent cognitive processes*. Furthermore, the PASS theory was developed with the

intention of predicting and explaining normal as well as atypical cognitive functions. In this light, Naglieri (1999, p. 250) states that "the PASS processes are dynamic in nature, respond to the cultural experiences of the individual, are subject to developmental changes, and form an interrelated (correlated) interdependent system".

As its name suggests, the PASS theory refers to *four kinds of competence* and links these processes with particular areas of the brain, following the work of Luria (1966) and his postulation of the existence of the three functional units as described above. Firstly, in keeping with Luria's (1966) theory, *planning* entails the formulation, selection, and regulation of plans of action. Secondly, *attention* involves the distribution of cognitive resources and effort and thirdly, *simultaneous and successive processing* comprises the cognitive processes used in the acquisition, storage, and retrieval of information (Das et al, 1994). However, although the PASS processes are seen to be related, they are nonetheless conceptualized as being "physiologically and functionally distinct" (Naglieri, Das, & Jarman, 1990, p. 429, in Keith, Kranzler & Flanagan, 2001).

At the base of the issue of the validity of Das et al's PASS model is the neuropsychological work of Luria (1966, 1973, 1980, in Naglieri, 1989), linking the cognitive components to physiological areas of the brain. Complementing Luria's work is the simultaneous and successive processing research initially reported by Das (1972, in Naglieri, 1989) and Das, Kirby & Jarman (1975, 1979, in Naglieri, 1989) which indicated that the information coding components of the model has construct validity.

However, Carroll (1995, in Kranzler & Keith, 1999) failed to replicate these results in a reanalysis of the same dataset. He stated that, "Evidently, the authors' model is not a very good fit, contrary to what they imply" (p. 404). The best-fitting model in his reanalyses was a hierarchical one with four first-order factors (viz., Planning/Attention, Simultaneous, Successive, and Reasoning) and two second-order "general" (g) factors. In addition to his empirical findings, Carroll's review of findings reported by Naglieri, Braden, and Warrick (1991, in Kranzler & Keith, 1999) also suggested that the PASS model provides a poor fit to the data. Based upon the factor analytic evidence available at the time, Carroll (1995, in Kranzler & Keith, 1999) concluded that they "have not yet arrived at a persuasive, interpretable model of intellectual abilities that is supported adequately by empirical data" (p. 408).

Kranzler and Weng (1995) also reanalyzed the data presented in Naglieri et al (1991, in Kranzler & Weng, 1995) to compare the fit provided by the PASS model with two alternative models. Because hierarchical theories of the structure of intelligence are prominent in the literature, the first alternative model was an extension of the PASS model to include a second-order *g* factor (PASS + *g*). The second model was a revised PASS model, suggested by the results of Naglieri et al. (1991, in Kranzler & Weng, 1995), with one combined Planning/Attention factor and separate factors for the Simultaneous and Successive processes ([PA]SS). Results of Kranzler and Weng's (1995) reanalysis indicated that the PASS model provided an improper fit to the data. Of the three models examined, it is noted that the [PA]SS model provided the best fit to the data. Moreover, a substantial second-order psychometric *g* factor was extracted from this battery of PASS tests. Kranzler and Weng (1995) therefore also concluded that, because "these results do not support the superiority of the PASS model over other conceptualizations of intelligence in describing this data; further refinement of the PASS theory or tests, or perhaps both, appears to be necessary" (p. 155).

In response however, Naglieri and Das (1995) argued that Kranzler and Weng (1995) reanalyzed "an experimental version of tasks that we were using some 5 years ago that is composed of tests that we have since eliminated from the current version of the standardization test battery (i.e. the CAS)" (pp.159-160). According to them, results indicate that the PASS model provided a significantly better fit to the data than did several alternative models, including a [PA]SS model (as suggested by Kranzler & Weng, 1995) and a hierarchical model (as considered by Carrol, 1995, in Kranzler & Keith, 1999).

3.4. The measurement of Intelligence and Successive and Simultaneous Processing Abilities:

Just as debate exists around the conceptualization of what intelligence is, so too does controversy exist regarding *how intelligence is operationalised and measured*. Standardized tests of intelligence have long been criticised on the grounds that they are not based on sound theory. Naglieri (1989) notes that perhaps the foremost example of a widely-used IQ test that is not based on a formal theory of intelligence is the Wechsler Intelligence Scale for Children (3rd ed.) (WISC-III; Wechsler, 1991). As Jensen (1987, in Das & Naglieri, 1987) stated, "Wechsler's conceptualization [of intelligence] was probably too all-inclusive to attract serious theoretical or scientific interest" (p. 72). However, recent advances in theory and research methods have spurred the development of a number of theoretically based tests of

intelligence including, amongst others, the Kaufman Assessment Battery for Children (K-ABC, Kaufman & Kaufman, 1983a) and the Cognitive Assessment System (CAS, Das & Naglieri, 1993), which conceptualise *multiple interdependent cognitive processes as fundamental to intelligence*. These are the two psychometric measures which were used to assess the simultaneous and successive processing abilities of the participants in this research project.

Das and Naglieri (1993; Naglieri & Das, 1997) assert that the CAS is broader in scope than traditional IQ tests, including the WISC-III, because it was developed to measure *all four PASS processes* discussed above. Consequently, they contended that the CAS may prove to be more useful than other tests of intelligence for the identification of difficulties in cognitive processing that are associated with academic failure. They also asserted that the CAS may offer a means of separating different populations of children on the basis of their relative performance across the four areas of cognitive processing (Kranzler & Keith, 1999). Results of a study by Kranzler & Keith (1999) however do not support these assertions by Das and Naglieri (1993; Naglieri & Das, 1997), with results of their analyses suggesting that the full scale score on the CAS may not be the best estimate of psychometric *g* and that the CAS subtests are better understood as measures of processing speed (rather than planning and attention processes), short-term memory span (rather than successive coding), and a mixture of fluid intelligence and broad visualization (rather than simultaneous coding). Keith & Kranzler (1999) also argue that given the absence of structural fidelity, the scaled scores derived from the CAS do not reflect the underlying theory upon which the test is based.

Debate regarding the efficacy of the *K-ABC* also exists. Donders (1992, in Murphy & Davidshofer, 2005) considers the K-ABC to be “an attractive measure of *g*” and satisfactory measure of achievement and cognitive processing. Moreover, a close relationship between the WISC-R and K-ABC was clearly established by Naglieri & Das (1990, in Das et al, 1994), who summarised the results of three studies that involved joint factor analytic examinations of the two tests (Kaufman & McLean, 1986; Keith & Novak, 1987; Naglieri & Jensen, 1987, in Das et al, 1994). Sternberg (1998, in Murphy & Davidshofer, 2005) however, cautioned that all three sequential processing subtests of the K-ABC contain an “overemphasis on rote learning”, which he feels is inappropriate in an intelligence test and which most other intelligence tests avoid.

The relationship between the *PASS model and the K-ABC* also warrants further consideration due to the association the authors of the test have made with the work of Das, Kirby & Jarman (1979, in Das et al, 1994). Although there is no doubt that the K-ABC is not consistent with the PASS model since it does not consider the role of planning and attention in its conceptualisation of intelligence, earlier work on simultaneous and successive processing did influence the K-ABC. This is apparent in a statement by Kaufman & Kaufman (1983c) when describing the sequential-simultaneous dichotomy model they choose based on the idea that a variety of research trends within cognitive psychology, neuropsychology and related disciplines support two basic types of information processing: sequential versus parallel or serial versus multiple, successive versus simultaneous, and other dichotomies associated with Freud, Pavlov, Maslow and James.

Kaufman & Kaufman (1983c) also cite a correlational study between K-ABC scores and factor scores on the successive and simultaneous battery developed at that time by Das, Kirby & Jarman (1979, in Das et al, 1994). The results suggest that the K-ABC Simultaneous and Sequential subtests correlated as would be expected with the simultaneous and successive tasks described by Das, Kirby & Jarman (1979, in Das et al, 1994). Therefore, according to Kaufman & Kaufman (1983c) the Simultaneous and Sequential scales of the K-ABC can be viewed as having similarity with the Simultaneous and Successive components of the PASS model. Das et al (1994) argue, however, that one of the major limitations of the K-ABC battery is that it does not have a verbal simultaneous task. A study by Das, Mensink & Jenzen (1990, in Das, 1994) showed that through the addition of a verbal simultaneous test, the K-ABC's ability to assess simultaneous processing, as defined by the PASS model, and predict reading achievement, can be improved.

3.5. Successive and Simultaneous Processing Abilities:

In view of this, the focus of this research project was specifically on the successive and simultaneous processing components of the PASS model. In this regard, Luria (1966, 1973), Das (1984) and Das et al (1979, in Das et al, 1994) distinguished between two types of processing, called successive and simultaneous processing. They note that the difference between these two types essentially concerns what occurs to the information once it has entered the processing system. In *successive processing*, the pieces of incoming information are coded into a temporal sequence with the connections among them providing ordinal links

of one piece of information to the next. Thus, the resultant code that is formed is one-dimensional in nature. This type of information is considered to be important when it is necessary to keep every piece of information and in its correct order. Luria's (1966, 1973) data demonstrated that successive processing is performed in the front-temporal areas of the brain. Successive processing is involved in rote memory, in the breaking down or analysing of information into an ordered sequence and in the operation of complex plans. In *simultaneous processing* however, the incoming information is coded into a form that is more "holistic" or multi-dimensional. In this case, the pieces of information are linked to each other in more complex ways, and order is usually lost although it allows the relationship (i.e. surveyability) among the pieces of input information to be seen. According to Luria, simultaneous processing takes place in the parietal-occipital areas of the brain. Simultaneous processing is involved whenever patterns are detected, be they spatial or verbal. Just as successive processing is required to keep information ordered, simultaneous processing is required to keep information related. In this regard, Giordani (1996) conducted research investigating the usefulness of the sequential-simultaneous distinction cross culturally by assessing 130 primary school children in Zaire with Kaufman Assessment Battery for Children. The results revealed the validity of the distinction between sequential and simultaneous processing within this intercultural context.

As noted by Das (1984) & Das et al (1994), simultaneous and successive processing is related to functioning of the *working memory*. Successive processing refers to the holding of chunks of information, with greater successive processing being required to hold more independent chunks of information. Simultaneous processing refers instead to the formation of chunks, with more simultaneous processing being required to form more complex chunks. Das et al (1994) note however that simultaneous and successive processing normally work in conjunction with each other. When a difficulty arises in using either type of processing however, Das (1984) and Das et al (1994) note that this could be either due to a lack of ability or to the inappropriate use of abilities. By contrast, normal cognitive activity requires a balanced and appropriate use of both simultaneous and successive processing.

Luria (1966, 1973) presented case studies of people who had suffered damage to either the parietal-occipital or fronto-temporal regions of their brains and had lost some of their ability to use simultaneous or successive processing. Das et al (1994) note that children suffering learning disabilities are likely to be less able than other children to use one or the other form

of processing. Das et al (1994) consider that if the problem is that such a child is less able to use a form of processing, then that ability may have to be trained within the processing system or an alternative method found for performing the task in question. On the other hand, a learning disordered child's difficulty may be that they are not inclined to use a particular type of processing. In this regard, when successive and simultaneous processing patterns are considered, research to date has tended to show that groups of learning disordered children tend to exhibit higher simultaneous processing scores than successive processing scores when assessed using the CAS or K-ABC, although group differences are not always consistent across studies (Das, 2002).

3.6. The Formation of Words in English:

Following on from this critical introductory discussion on the nature of cognitive processing and the measurement thereof, literature pertaining specifically to the cognitive processes involved in reading and writing, the development thereof and disorders of reading and written expression shall now be systematically explored.

3.6.1. Skilled reading:

To read, the reader must be able to transform the visual precepts of alphabetic script into linguistic precepts – that is, to recode *graphemes* or letters of the text into their corresponding *phonemes* or sounds. Integral to the process of reading therefore, is that the reader is required to reach conscious awareness of the internal *phonological* or sound structure of the spoken words, and reach an understanding that the *orthography* or the writing system used by the language, is representative of that phonology (Ehri, 1980; Ruddell & Unrau, 1994). Therefore, whilst to the skilled reader reading appears to be a simple and almost unconscious natural ability, it is however, a very difficult skill to learn and acquire, requiring the input and coordination of multiple cognitive and perceptual processes and abilities and an extended period of apprenticeship before fully mastered (Oakhill, 1996).

It may seem obvious that the end point of reading therefore ultimately comprises the reading and understanding of sentences which join logically to form passages of coherent, connected text, the purpose of which is to inform, instruct or perhaps just entertain the reader (Bryant & Bradley, 1985). However studies conducted and models proposed of skilled reading to date have tended to focus their attention on the readers ability to recognise individual words,

which is a requirement unique to the ability to read, as opposed to comprehension skills which are also required for successful verbal communication (Goswami, 1988; Harris & Coltheart, 1986).

3.6.2. Bottom up and top down processes:

Johnson & McClelland (1980, in Ellis, 1993) proposed a model that suggested a *bottom up approach* to the recognition of words. Bottom up theories focus firstly on the perception of physical or environmental stimulus, thereafter systematically proceeding upwards, typically in a hierarchically manner, to consider the involvement of higher order cognitive processes on perception and in the performance of the required task or skill (Eysenck & Keane, 2000; Sternberg, 1999). By contrast, top down theories focus initially on the influence of high-level cognitive processes, existing knowledge and prior expectation thereupon, following which the involvement of sensory data such as the perceptual stimulus is considered (Eysenck & Keane, 2000; Sternberg, 1999).

In this regard, Johnson & McClelland (1980, in Ellis, 1993) proposed an influential model of the visual word-recognition system, hypothesising that the perception of written language can be understood on a number of levels including at a letter-position pre-processing level, feature detection level, abstract letter detection level and abstract word detection level of processing. Johnson & McClelland (1980, in Ellis, 1993) argued that these levels operate in a sequential and hierarchical fashion with features being analysed prior to letter and letters before words. To read a single word therefore, it is hypothesised that the stimulus word must first be segregated into letters based on their ordinal position in the word, following which each position is then analysed for its constituent features. Various potential corresponding letters are then activated or inhibited on the basis of this feature analysis. At the level of the letter, the letter corresponding to the stimulus letter is then activated and the others inhibited. The output of the letter detectors then serves as input for the word detectors. An active letter detector is thought to excite word detectors that also have letters at that specific ordinal position and others inhibited. According to the Johnson & McClelland model (1980, in Ellis, 1993), the word is then ultimately recognised only at the word level through the combined operation of several letter detectors. The letter and word detectors are referred to as being *abstract* since they are argued to be useful in identifying letters and words regardless of their precise visual form. It is only then, once the word is recognised, that various properties of the

word such as its spelling, pronunciation and meaning, will become available to the reader (Carrol, 1986; Harris & Coltheart, 1988).

Independent evidence of the role of features in the visual detection of letters comes from the perspective of cognitive neuroscience involving an experimental task in which participants were required to search an array of letters for a pre-specified target letter (Neiser, 1963, in Carroll, 1986). Studies showed that detection times are faster when the array comprises letters with different features than when it consists of letters with features similar to the target letter. This evidence suggested that letters are identified from a variable number of features, depending on the other letters that are present, with the number of features needed for identification being much smaller when letters are dissimilar (Carrol, 1986).

However, as previously mentioned, reading is a highly complex process. In addition to the visual recognition of words, reading also involves the mastery of *lexical processes* or the ability to identify letters and words *and* to also activate relevant information in memory about these words, as well as *comprehension processes* or the ability to make sense of the text as a whole (Pearsons & Stephens, 1992).

In this regard, beginning readers are typically already fluent verbal language users, many of the comprehension skills required for which are also directly applicable to reading. These include the ability to construct sentences, interpret sentences in a given communicative context, draw inferences from individual statements, as well as monitor one's own comprehension, all of which are referred to as *general comprehension skills*. In addition however, learning to read also involves mastering of other skills specific to written language. Other than the extraction of visual features of letters and words, these also include the use of saccadic eye movements to scan sentences in text and in most languages to read from left to right on a page, as well as relating the written language to spoken language in some way (Snowling, Goulandris & Stackhouse, 1996).

In this regard, Rumelhart and McClelland (1981, 1982 in Ruddell & Unrau, 1994; 1986) proposed an influential *interactive activation model* of visual word recognition. The interactive model, as suggested by Rumelhart and McClelland (1981, 1982 in Ruddell & Unrau, 1994; 1986) hypothesised that activation of particular lexical elements occurred at multiple levels and that activities at each of the levels are interactive. Similar to the Johnson

and McClelland Model (1980, in Ellis, 1993), Rumelhart and McClelland (1981, 1982 in Ruddell & Unrau, 1994; 1986) distinguished between three levels of processing of text following visual input, namely at the feature level, the letter level and the word level. The model however assumed that information at each level is represented separately in memory and that information passes from one level to another *bi-directionally*, therefore involving *both* bottom-up and top-down processing, the latter commencing with high level cognition operating on prior knowledge and experiences related to a given context (Sternberg, 1999).

Implicit in the model therefore, is that known features about words also facilitates the identification of letters, thereby also taking into consideration the influence of the *word superiority effect* (Adams, 1990; Eysenck & Keane, 2000). Experiments conducted by Reicher and Wheeler (1969, 1970 in Harris & Coltheart, 1986) in this regard found that words comprising of four letter are more accurately reported than single letters under tachistoscopic conditions (presented in a rapid and automated manner), even when a forced choice technique was utilised to equate the chances of guessing, thereby providing strong evidence for the role of the word superiority effect in skilled reading.

Similarly, the Basic Behavioural Science Task Force of the National Advisory Mental Health Council (1996) reported that many theorists now view visual perception in terms of information processing based on interactive activation. It is therefore hypothesised that just as words are combined into sentences and sentences into paragraphs, a similar process and influence of context occurs, with information at higher levels, such as knowledge of what a paragraph comprises, facilitating the processing of information at lower levels, such as the meaning of a sentence. In this regard, Rumelhart and McClelland (1981, 1982 in Ruddell & Unrau, 1994; 1986) proposed that these computations take place very rapidly and unconsciously. The interactive model has been computer simulated, thereby making use of parallel means of processing of information as opposed to serial processing as well as permitting both the top-down and bottom-up flow of information. The performance of these computer simulations is noted to resemble the ability of readers and listeners in perceiving words and speech.

However, as with the Johnson & McClelland model (1980, in Ellis, 1993), according to the interactive activation model, letters are coded in terms of their precise locations in the visual field. To the contrary however, evidence has tended to suggest that coding of letters is instead

based on their relative positions rather than on their precise location in words. For example, McClelland and Mozer (1986, in Eysenck & Keane, 2000) noticed that pairs of words such as LINK and MINE are sometimes misread as LINE and MINK. In addition, according to the model, the word superiority effect for high-frequency words should be greater than for low-frequency words due to more top-down activation from the word level to the letter level, resulting in stronger connections and in a higher resting activation level thereof. However, experimentally it has been shown that the size of the word superiority effect is the same with both high and low frequency words (Gunther, Gfoerer & Weiss, 1984, in Eysenck & Keane, 2000). McClelland (1993, in Eysenck & Keane, 2000) thus further developed the model by including variable or stochastic processes into it, thereby enabling the model to simulate the distributions of responses of human participants on various word-recognition tasks.

Despite the recent changes however, the models proposed by Johnson & McClelland (1980, in Ellis, 1993), McClelland & Rumelhart (1981; 1982 in Ruddel & Unrau, 1994; 1986) and McClelland (1993, in Eysenck & Keane, 2000) are based upon the primary assumption that lexical access is determined by *visual information* and perception. Secondary emphasis has also been placed on the *semantic properties* thereof in the latter two interactive models as described above. However, much controversy exists in this regard. Frost (1998, in Eysenck & Keane, 2000) for example, argued instead that in reading, phonological coding is nearly always used prior to lexical access.

3.6.3. The dual (triple) route model to skilled reading:

From a cognitive neuropsychological standpoint therefore, the *dual (or triple-route) model* proposed by Ellis and Young (1988, in Ellis, Matthew, Lambon, Morris & Hunter, 2000) based upon components identified by them through their study of *acquired* dyslexia, or dyslexia in adult patients who were skilled readers prior to sustaining brain damage, proposed three routes between the printed word and speech. All three routes are also hypothesised to start with the visual analysis system, the purpose of which is to identify and group letters in printed words.

Ellis and Young (1988, in Ellis et al, 2000) hypothesised that route one makes use of grapheme-phoneme conversion. It is postulated that this process may involve working out the pronunciations for unfamiliar words and non-words through the translation of letters or letter groups into phonemes by the application of rules. In this regard, individuals who are

considered to most strongly adhere to route one in their reading, are labelled as suffering from *surface* dyslexia, referring to difficulty experienced in reading irregular words. However, since not all irregular words are mispronounced by sufferers of surface dyslexia, it is suggested that route one is not exclusively adhered to (Seymour, 1992).

Ellis & Young (1988, in Ellis et al, 2000; Adams, 1990) proposed, however, that route two is the route most typically utilised by adult readers who have stored a multitude of familiar words in a visual input lexicon, which becomes activated following visual representation of a word. Subsequently, the meaning of the word is obtained from the semantic system after which the word can be spoken. Sufferers of *phonological* dyslexia who struggle to read unfamiliar words and non-words, are thought to use route two but not route one. RG, the first case of phonological dyslexia systematically reported, was noted to be able to read 100% of real words presented under experimental conditions correctly while only being able to read 10% of non-words (Eysenck & Keane, 2000). Furthermore, sufferers of *deep* dyslexia who, while struggling to read unfamiliar words also make semantic reading errors, suggests that they too cannot use grapheme-phoneme conversion effectively, thereby making use mainly of route two, as proposed by the Ellis and Young model (1988, in Ellis et al, 2000; Seymour, 1992).

Route three is proposed to resemble route two in that the visual input lexicon and the speech output lexicon are involved in the reading process. However, the semantic system is bypassed in route three, so that printed words are pronounced but not understood. Unfamiliar and non-words are also difficult to pronounce (Eysenck & Keane, 2000).

The Young and Ellis dual (triple) model (1988, in Ellis et al, 2000) is considered to give a good account of both normal and brain-damaged reading, suggesting that normal readers make use of all routes when reading familiar words, although the direct route is generally regarded as being the quickest route in this regard. Although it was originally assumed that the main two routes to reading as described by the model, namely, lexical and non-lexical, are independent of each other, subsequent evidence has suggested that the two routes may be interrelated and that the lexical path can affect processing of the non-lexical path and visa versa (Eysenck & Keane, 2000; Snowling, Goulandris & Stackhouse, 1996).

3.6.4. The connectionist approach to skilled reading:

In this regard, by contrast, Plaut (1996, in Eysenck & Keane, 2000) has proposed a *connectionist approach* to the pronunciation of irregular and regular words, assuming them to be based instead on a *highly interactive system* rather than that of two (or three) non-interactive routes. Plaut (1996, in Eysenck & Keane, 2000) argued instead that words vary in consistency or the extent to which their pronunciation agrees with those of similarly spelled words and, as such, suggested that consistent words can generally be pronounced faster and more accurately than inconsistent words because more of the knowledge available to the reader supports the correct pronunciation of such words. This hypothesis is supported by evidence from a study conducted by Glushko (1979, in Eysenck & Keane, 2000), who found that word naming was generally predicted better by consistency rather than regularity of spelling.

However, although emphasising the importance of grapheme-phoneme coding in the reading of unfamiliar or non-words through route one, the dual (triple) route model of reading is still primarily visually based and as such considers the reading performance of normal individuals to generally be little affected by their phonological coding (Adams, 1990). However, Frost (1990, in Eysenck & Keane, 2000) in this regard, as noted previously, has argued *phonological coding of words* to be of much greater importance in skilled reading than is implied by the dual route model. Frost has postulated instead that, by contrast, phonological coding will occur even when it impairs performance and that some phonological coding will inevitably occur even when a word is presented to a reader for a very brief period of time (Eysenck & Keane, 2000).

3.6.5. Phonological coding in skilled reading:

Evidence does exist to support the importance of *phonological coding in skilled reading*. Strong experimental evidence in this regard comes from a study conducted by Tselgov et al (1996, in Eysenck & Keane, 2000). Participants who were English-Hebrew bilingual speakers, had to name the colour of words presented to them in one of the two languages. Although each non-word had an unfamiliar print form, its phonological translation was a colour name in the other language. Tzelgov et al (1996, in Eysenck & Keane, 2000) obtained a strong Stroop effect with these non-words, which refers to the slowing down of the readers' ability to read the names of the colours when the words themselves are printed in a colour different to their colour names. This evidence therefore suggested that participants were

engaging in phonological coding of the non-words, even though this was seriously hampering their ability to read the words efficiently and fluently (Sternberg, 1999).

While evidence therefore exists to support the phonological model of skilled reading, the influence and role of phonology in this regard is poorly understood. The phonological model is also considered limited in that it does not account for all the processes which ongoing research is showing to be involved in reading, as a highly complex activity. In addition, the phonological model does appear to provide a better account of reading in normal individuals and struggles to account for the symptomology of the various types of dyslexics in this regard (Carroll, 1986; Eysenck & Keane, 2000).

3.6.6. Comprehension abilities:

As evident from the above discussion, reading refers to the *ability to perceive and understand written language and, as such, is dependent upon a complex cognitive system* comprising both skills and knowledge ranging from visual discrimination of symbols and decoding of single words to comprehending and constructing the meaning of text (Rayner & Pollatsek, 1989). The skills that constitute reading therefore, do not occur in isolation from each other, but are highly interactive. Any separation or delineation which has been suggested in the discussion thereof is purely artificial to allow for increased clarification in this regard. Furthermore, as highlighted above, some of the knowledge required for reading may be shared with other cognitive systems such as language comprehension and visual perception (Broom, 2001).

However, the decoding and comprehension components of reading represent complete conceptually distinct systems of ability that can function independently, as evident by the double dissociation of functions between *autism and hyperlexia*, both characterised by excellent decoding but poor comprehension, and *dyslexia* in which poor decoding may be accompanied by excellent comprehension (Frith & Snowling, 1983, in Broom, 2001). However, each component is necessary for reading and neither is sufficient in itself and researchers to date have tended to focus on either one or the other of these two major components of reading (Broom, 2001; Stothard & Hulme, 1996).

In consideration of reading and writing comprehension abilities, Ruddell (1993, in Ruddell & Unrau, 1994) considered that children entering pre-primary school and the early grades have acquired many concepts and much world knowledge. Research has shown that children at this

age therefore have definite syntactical or sentence-structure knowledge and are able to understand story or text structure. Schema theorists in particular, have provided valuable insight into how children organise and use their own personal background experiences to construct meaning from text, suggesting that schemata develop from children's experiences to form specific knowledge modules defined by a related group of concepts. *Personal experiences* and *interactions* with others are therefore key to this development, leading to abstract representations of these encounters. In this regard, the *schema theory perspective* views the mind as a highly complex set of cognitive structures that serves to receive, sort, classify and hold information about events and objects (Hochman, 2000; Ruddell, 1993, in Ruddell & Unrau, 1994; Stothard & Hulme, 1996).

According to this view, *comprehension* processes therefore are thought to involve the organisation, building and reorganisation of information by forming *schemata* into which new information is subsequently incorporated. Comprehension processes therefore, are considered to be driven by the child's desire to make sense of experience and thus further influenced and shaped through their social interactions and events. As the child moves from being a beginner reader or writer to the increasingly advanced reading and writing stages, their knowledge of and familiarity with lexical, syntactical and text structure schemata directly influences their success in constructing meaning from text. Equally instrumental in children's construction of meaning is their growing knowledge about the word, text and immediate, remembered or anticipated social interactions (Hochman, 2000; Ruddell & Unrau, 1994; Stothard & Hulme, 1996).

Targeted revisualisation is underpinned by the assumption that words are important in their context, and that, as suggested by Ruddell & Unrau (1994), reading and writing do not purely involve the ability to work with individual words, but rather also sequentially in the *context* of sentence, sentences in the context of paragraphs and paragraphs in the context of stories, influenced by and relevant to the child's own personal life experience and interactions with significant other (Potter, 2003; Sfetsios, 2002). Thus, in the implementation of high imagery techniques, children are encouraged to utilise words in context and to revisualise sentences and paragraphs in the latter levels. Mind mapping and identification of key concepts in paragraphs in the latter levels are also aimed at facilitating the development of the child's comprehension abilities and expansion of schemata. Illustration of text and allowing the child to take control of their own learning process and to guide sessions, with the tutor assuming a

facilitating role only, emphasises the importance of allowing the child to take control of their own learning and to make the English language meaningful and relevant to their own lives and personal experience (Potter, 2001; 2003).

3.6.7. Spelling:

In comparison to the large body of research focusing primarily on reading as apparent from the discussion above, the study of spelling to date however, has been somewhat neglected (Trieman, 1997; 1998).

To spell, the speller is required to *translate spoken words* into their *corresponding printed symbols*, attributing to each speech sound in the spoken word a written letter or letters. In this manner therefore, the speller is able to represent spoken words with printed symbols. From this simple description of spelling however, it would thus appear that spelling and decoding are simply inverse operations which purely require knowledge of sound-symbol correspondences and are performed in a directly inverse fashion to each other. Following this logic therefore, it could be assumed that if a learner were able to read a word, they would then naturally be able to spell it too (Carreker, 2000; Frith, 1980). However, although both decoding and spelling require phonological and orthographic knowledge, Frith (1980) highlighted that they are not merely inverse operations to each other.

For young children, Trieman (1997; 1998) argued that spelling involves a *creative linguistic process* rather than habitual learning involving rote visual memorisation. Trieman (1997; 1998) considered that young children create spelling for words based on their knowledge of language and their knowledge of print, noting that many of children's common spelling mistakes make sense once the knowledge that they bring with them into the spelling task has been taken into account. Trieman (1997; 1998) highlighted that as children progress, their knowledge of the spelling system grows and deepens, thus enabling them to become progressively better spellers. Trieman (1997; 1998) highlighted four changes that tend to occur with increased spelling skills including, firstly, the internalisation of classification of sounds that are embodied in the conventional orthography, secondly, becoming increasingly reliant upon conventional spelling, thirdly, the rapid learning about letter patterns in printed words and, finally, reaching an understanding that morphemes are often spelled in a consistent fashion.

In this respect however, languages such as Afrikaans and African languages have a ‘shallow’ or ‘transparent’ orthography in which graphemes and phonemes have an invariant relationship. A ‘phonological’ reading and spelling strategy would therefore be a successful approach to employ when engaging with these languages (Besner & Smith, 1992, in Broom, 2001). By contrast however, *English* has a ‘deep’ or ‘opaque’ orthography. The pronunciation of a word in English therefore is not always predictable from its spelling since no one-to-one correspondence between phonemes and letters of the alphabet that represents those phonemes in print exists. The English alphabet for example, has only 26 letters in comparison to at least 36 phonemes in spoken English (Harris & Coltheart, 1986). Some letters in English therefore, represent more than one sound such as the *c* in *cat* and *city*. Furthermore, some sounds are represented by more than one letter with every correspondence being context sensitive. As a result therefore, a reader cannot be certain as to which phoneme a letter represents without knowledge of its surrounding letters, for example *ow* in *flown* and *clown*, the *eak* in *beak* and *steak* and the *ough* in *cough*, *rough*, *through* and *though* (Gough & Wrenn 1998; Venexky, 1995, 1970; Wijk, 1966, in Broom, 2000). Moreover, many exceptions or irregular words exist in the English language which do not conform to any of the rules of English phonology, such as *yacht* and *choir*. For these words, word specific knowledge must be available for their successful decoding. In the English language therefore, it is clearly evident that sound-to-spelling translations are less dependable and that many instances exist where spelling should require the complete and accurate recall of letter patterns and words (Frith & Frith, 1980, in Carreker, 2000; Frith, 1980; Trieman, 1997; 1998).

Furthermore, English decoding is also complicated by *homophonic words* that have dissimilar spellings and meanings yet are represented by the same phonology, such as *sale* and *sail*, which may be decoded using phonological rules, but still require word specific information linking the graphemic representations to their respective meanings. Skilled decoding of English orthography therefore is a very difficult activity necessitating both the ability to use phonological processing as well as orthographic processing (Broom, 2001; Frith, 1980; Hanna, Hanna, Hodges & Rudorf, 1966, in Carreker, 2000).

In the classroom however, spelling is typically treated as an *afterthought* to or as a by-product of *reading*. The assumption is that if students learn to read, they learn to spell and as a result, spelling instruction is given little importance and minimal attention during the instructional

day (Carreker, 2000). Furthermore, this view fails to recognise the integral role spelling instruction plays in learning to *read* since it has been shown that spelling instruction enhances reading proficiency through the reinforcement of letter patterns (Adams, 1990, in Carreker, 2000). Moreover, it has been argued that spelling is a more difficult skill to learn in comparison to reading. As noted by Carreker (2000) therefore, spelling instruction should be intimately integrated with the teaching of reading but, because spelling has its own distinctive characteristic and demands, it should also be distinct from reading and explicitly taught. Carreker (2000) argued that spellers must be taught in a manner that will increase awareness and memory of letter patterns and words, considering sequential multisensory structured spelling instruction to be particularly useful in this regard.

3.6.8. The development of reading, spelling and writing abilities:

Although limited evidence is therefore available to support the importance of the role that phonological coding plays in skilled reading as suggested by Frost (1990, in Eysenck & Keane, 2000), studies have supported the notion that phonological awareness is causally related to the *development* of reading and writing skills (Bradley & Bryant, 1985; Brady, 1997; Carrol, 1986). Research is tending to show however, that the role of phonological mediation in reading and writing is less successful in children suffering learning disorders and also tends to decline with age, with children later on being able to identify words by their orthographic patterns and to recognise common words as complete units through the influence of visual as opposed to phonological coding as proposed by numerous of the models of reading as discussed above, and through the influence of the word superiority effect (Brady, 1997; Bryant & Bradley, 1985; Goswami & Bryant, 1990).

As a result, particularly of the importance placed upon reading and writing ability within contemporary society, considerable research effort has been devoted to identifying predictors of the progress of children's learning to read and write (Unry, 1999). As a highly complex and unnatural task, when learning to read and write in an alphabetic script such as English, the child is required to gradually learn that printed words convey meaning, that the graphemes of printed words map on to the speech segments at the phonemic level and that there are irregularities in these mappings. In addition, when reading text, children also have to integrate the meaning of words within phrases and sentences using knowledge of syntax and semantics, thus developing the ability to not only comprehend words as units but rather the text as a whole, which is the ultimate purpose of reading (Carreker, 2000; Ruddell & Unrau, 1994). In

teaching reading, Walcutt et al (1974, p.4, in Unry, 1999) set up as their primary goal that they are committed to “*reading for meaning*”.

Of the wide variety of skills that have therefore been studied in this regard, tests of children’s *phonological awareness*, which assess the child’s ability to reflect upon and manipulate the sound structure of spoken words, have been found to be amongst the best predictors of progress made by a child in learning to read. Some of the strongest evidence for this claim comes from longitudinal and training studies which show that children who perform well on phonological processing tasks go on to become good readers and that training in phonological awareness promotes the development of literacy (Bryant & Bradley, 1985; Goswami & Bryant, 1990). The development of phonological awareness therefore is also noted to parallel the acquisition of reading skills, thus suggesting that the two processes are related (Haskins, 1996, in Shaywitz, 1996).

As described by Harris & Coltheart (1986), there are at least two different mental processes which a child could utilise to read aloud and to transform the orthographic representation of a word into its corresponding phonological representation. The first of these procedures considered key by Harris & Coltheart (1986) however, referred to as the *whole word or direct procedure*, is dependent upon the child having previously learned a direct correspondence between the letter string comprising the word they are attempting to read, and the spoken representation of that word. Alternatively, the child could utilise a *phonics procedure or indirect procedure* through which they will be able to link the text to its pronunciation via the implementation of spelling-to-sound rules, rather than through the utilisation of previously learned direct correspondences between individual printed words and their spoken forms (Harris & Coltheart, 1986).

However in this regard, the *relative importance of the direct and phonics procedures* in the early stages of learning to read has been heavily debated. In addition, although strong evidence exists to support the notion that readers do progress through several developmental phases or stages in acquiring word-analysis knowledge, regardless of the instructional methodology used, this too is under dispute. Numerous versions of stage theories of reading development, viewing the child as passing through a series of stages or phases before becoming fully literate, therefore exist (Pearsons & Stephens, 1992).

Frith's (1980) model of the development of spelling and reading abilities in children, upon which high mental imagery techniques have been formulated, was outlined in the second chapter of this dissertation. Whilst Frith's (1980) model clearly specified distinct stages through which the acquisition of reading and spelling proceed, Broom (2001) argued that it is vague in its clarification of the exact nature of the relationship between these stages and offers no explanation as to why the logographic strategy should be established before an alphabetic strategy. In addition, Broom (2001) noted that while Frith's (1980) model suggested that the orthographic stage developed by the merging of the logographic and alphabetic strategies, how this might happen is not elaborated upon. Furthermore, Broom (2001) considered that Frith (1980) did not specify each stage in accordance with a modular information processing system, and as a result, the relationship between the developing structures and those of the ultimate skilled model remain unclear.

Through extensive research and literature review in this regard, Ehri (1991; 1994) has identified four phases which appear to be most commonly hypothesised and strongly supported by research evidence.

According to Ehri (1991; 1994), in the initial stage or the *logographic phase* of reading acquisition, it is widely held that reading is visually based and proceeds via the use of partial cues relying on visual contextual or graphic features to read words. At this stage, the child has no strategies for deciphering unfamiliar printed words (other than the visual approximation to known words) and spelling is restricted to a few words learned by rote. The next two stages according to Ehri (1991; 1994), referred to as the *transition from logographic to beginning alphabetic phase* and the *alphabetic phase* respectively, reflect the child's starting ability to decode words using knowledge of the mapping between letters and sounds. The alphabetic stage is characterised by the ability of the child to use letter-sound relationships to read words or, as described by Harris and Coltheart (1986), the phonic procedure. Spelling using sound letter correspondence is also believed to become possible at this stage. In the final stage of literacy development as proposed by Ehri (1991, p.1051), referred to as the *orthographic stage*, the child learns to utilise alphabetic principles but also predictable letter patterns and groups in "orthographic neighbourhoods" that form patterns larger than sound-letter correspondence. It is during this last phase that reading and writing are automatic processes, the mapping between print and sound being at the phonemic level, with the child developing into a skilled reader. During this phase, patterns and groups are established in memory, thus

allowing the child to more readily utilise the whole word procedure, as described by Harris & Coltheart (1986; Ehri, 1991; 1994).

Thus according to Ehri (1991; 1994), for the skilled reader in the final stage, *orthographic, phonological and semantic processes are integrated, parallel processes* that occur simultaneously in coordinated networks, as suggested by the McClelland and Rumelhart model (1981, 1982 in Ruddell & Unrau, 1994; 1986). Ehri (1991; 1994) noted however, that since the interactive model has been extrapolated primarily from the use of word analysis knowledge by the expert reader rather than the beginning reader, caution must be used when interpreting it in this regard. Similar to Harris & Coltheart (1986), Ehri (1991; 1994) also considered that it is through sequential development and practice that skilled readers are able to make use of both whole word and phonic procedures to read successfully

3.7. Successive and Simultaneous Processing Abilities and Reading and Writing Skills:

As apparent from the above discussion, the exact nature of the *cognitive processes* involved in reading and writing are not yet fully understood and many contrasting views exist in this regard. Although few of the models discussed thus far in this literature review have directly considered the role of simultaneous and successive processing in performing these tasks, it is clear, however, that all of the models consider the ability to identify the relationship between visually presented letters, words, sentences, phonology and semantics as well as the ability to think logically as being vital to successful and independent reading and writing.

When considering the *information processing required to read*, Das et al (1994) propose that reading can be thought of, analysed, or studied at various levels, which together form a smooth progression from the visual detection of lines all the way up to the interpretation of complex themes and messages. By drawing upon numerous models of reading proposed to date as outlined above, Das et al (1994) delineate between eight levels which include, 1) features, 2) letters, 3) sounds, 4) words, 5) chunks, 6) ideas, 7) main ideas and 8) themes. Das et al (1994) consider that information processing can be occurring at all of these levels, although the reader is usually only consciously thinking or working at one or two of them. Successive processing is considered to be involved specifically in the reading sub-skills of word analysis, syntactical analysis and story sequence comprehension. Simultaneous processing, on the other hand, is involved in holistic word recognition that is not mediated by

phonic analysis, the extraction of ideas or relationships from sentences and the relation of information across the sentence and paragraph level or even further (Das, 2002). In order to work at a particular level smoothly, it is necessary for the lower levels to function automatically. For example, if the reader is having difficulty identifying words (level 4), chunking (level 5) or simple comprehension (level 6) becomes very difficult.

Das et al (1994) also consider that reading skill develops through *three progressive phases*, which they have identified as being the *global*, then *analytic* and finally *synthetic phases*. In the global phase, it is considered that the beginner reader treats text as a whole and does not have any means of identifying an unknown word, relying heavily upon simultaneous processing in their attempts to read. In the *analytic phase* however, the child begins to analyse words into their constituent parts, attaching sounds to the visual symbols. Das et al (1994) consider that this requires a *switch from simultaneous to successive processing*, to allow the breaking down of a holistic entity into a sequence of parts. However, a child could *persist* with simultaneous processing even though they realize that reading involves words which involve letters and sounds. Therefore, rather than developing the low-level letter-sound rules, they adopt the global approach of going directly to meaning without dealing with the details. Das et al (1994) consider that beginning readers who fail to switch to the analytic approach are very likely to develop reading problems and tend to read slowly and word-by-word, if not letter-by letter. The *synthetic phase* represents skilled reading in which the reader puts together an orientation towards meaning with the analytic ability to identify words quickly and precisely, drawing upon *both simultaneous and successive processing* to orchestrate a smoothly operated strategy or plan. If a child masters the analytic phase but fails to progress to the synthetic phase, despite effectively being able to pronounce text, they will not extract much meaning from it.

With regards to spelling, Das et al (1994) have also proposed an *information processing model*. Das et al (1994) argue that in *spelling*, *successive processing* is required for the initial break-down of the stimulus and for the holding of the resultant sound sequences in working memory while *simultaneous processing* is similarly involved in the visual skills of finding a written pattern for the sounds and for checking the written results. According to Das et al (1994) therefore, skilled spelling relies upon the *efficient integration* of simultaneous and successive processing, with an over-reliance on either resulting in spelling errors.

Research in this regard by Das & Kirby (1979, in Naglieri, 1989), reports that *simultaneous and successive tasks relate equally* to reading and that these tasks jointly account for approximately 40 % of the variance in reading comprehension, reading vocabulary, verbal IQ and non-verbal IQ scores. Moreover, *simultaneous processing* was related to *forward-looking comprehension* whereas *successive processing* was related to *backward-looking comprehension*. Subsequent research involving achievement has found that simultaneous and successive processing tasks have correlated significantly with measures of reading comprehension (Das & Cummins, 1982; Kirby, 1982; Kirby & Robinson, 1987; Leong, 1984; Strutzman, 1986, in Naglieri, 1989) and reading decoding (Cummins & Das, 1980; Das & Cummins, 1982; Das, Cummins et al, 1979, in Naglieri, 1989).

3.8. Learning disorders of reading and written express included in this study and successive and simultaneous mental processing:

Included in this study were participants suffering from developmental dyslexia, dysgraphia, attention deficit hyperactivity disorder and neurological damage as a result of a head injury. These specific disorders contributed to the participants' difficulties in mental processing, reading and written expression and this shall be explored further below.

3.8.1. Developmental dyslexia:

Developmental dyslexia, as defined by Critchley (1991, p.245), is “a disorder manifest by difficulty in learning to *read* despite conventional instruction, adequate intelligence and sociocultural opportunity”. Developmental dyslexia has been shown to be dependent upon fundamental cognitive disorders which are frequently of constitutional origin, affecting the development of literacy skills in approximately 4-10% of children (Fletcher, Morris, Lyon, Stuebing, Shaywitz, Shankweler, Katz & Shaywitz, 1997; Mash & Wolfe, 2005).

In particular, phonological and memory deficits have been shown to be the most common underlying cognitive features of this syndrome. The *phonological deficit model of dyslexia* hypothesises that the status of children's phonological representations determines the ease with which they learn to read, and that it is the poorly developed phonological representations of children with dyslexia that is fundamentally responsible of their literacy difficulties (Olson, Wise, Johnson & Ring, 1997; Singleton, 1997, in Brady, 1997; Snowling, 1996). Children suffering dyslexia have been shown to typically struggle with the reading of unfamiliar words,

a characteristic often assessed by asking the child to read nonwords that are phonetically regular. Research (DeFries et al, 1997, in Brady, 1997) funded by the National Institute of Child Health and Human Development (NICHD) in this regard, has shown non-word reading disability to be associated with a deficit in phonemic awareness.

Developmental dyslexia therefore, as can be seen above, is typically defined on the basis of reading difficulties. However, although the definition of dyslexia does focus on reading ability, dyslexics also invariably have severe impairments in *spelling*. Typically the dyslexic's spelling levels are below that of their reading levels and spelling problems frequently continue to persist even amongst dyslexics who have apparently "caught up" to the norm in their reading ability (Boder, 1973 & Critchley, 1975, in Trieman, 1997). However, despite the severity of the spelling problems in dyslexia, much less is known about the dyslexic's spelling ability in comparison to that of their reading ability (Seymour, 1984; Treiman, 1997).

Previously, spelling errors were thought to be markers of dyslexia and as a result individuals making large numbers of disordering errors such as "trial" for *trail*, reversal errors such as "dull" for *bull*, or nonphonetic errors such a "fegr" for *finger* might have been positively identified as being dyslexic. However, recent research has shown that in most cases, the dyslexic's spelling does not look very much different from the spelling of younger children. According to some studies conducted in this regard, dyslexics are indistinguishable from younger normal children in terms of disordering errors, reversal errors and the ability to spell words and non-words in a phonetic manner. However, other studies have found subtle difference between the spelling of dyslexics and younger normal children, tending to show that dyslexics, even more than younger children, may have difficulty in carrying out fine-grained analyses of spoken words. What may turn out to distinguish dyslexics from normal spellers therefore, is a profile of relatively high levels of knowledge about the orthographic structure of printed words. In accordance with this perspective, dyslexics therefore characteristically understand that print is a representation of spoken language. However, it is considered that their difficulty in analysing spoken syllables into small units makes the learning of conventional phoneme-grapheme correspondences very difficult (Ehri, 1994; Mash & Wolfe, 2005; Seymour, 1992; Temple, 1997; Trieman, 1997)

In examining the *information processing strategies of children*, Bannatyne (1971, in Kaufman & Mclean, 1986) arranged subtests of the WISC into spatial, conceptual and sequential

categories. Utilising this recategorisation of the subtests of the WISC, Bannatyne (1971, Kaufman & Mclean, 1986) found dyslexic children to score highest in the spatial category and lowest in the sequential category, thus implicating sequential processing as a major factor in reading difficulties. Das (2002) also reports research results indicating that individuals with true dyslexia have a specific deficit in successive processing. By contrast, individuals who are generally poor readers may have low successive scores, like dyslexics, but, unlike dyslexics, can have lower than average scores on the three other PASS measures. They also make phonological errors and are slow decoders but, unlike dyslexics, show difficulties in comprehension of syntax and meaning.

As previously discussed, successive processing is required in phonic word analysis in order to break the word into its sound parts so that each can be pronounced and then smoothly blended. Children suffering *successive processing difficulties* therefore, are likely to lack word analysis skills and struggle to “sound-out” unknown words, instead attempting to guess words from context and/or the first letter. They may also lack comprehension of syntactic structure and fail to realise the importance of word order or to form syntactical chunks. They may also struggle to grasp the story comprehension sequence. Simultaneous processing difficulties can result in a child experiencing difficulty recognising sight words or reading familiar words quickly when reading. They will also struggle to interpret the meaning of words, sentences and passages (Bain, 1993; Das, 2002; Das et al, 1994).

3.8.2. Dysgraphia:

A second key type of learning disorder relevant to the scope of this study, is *developmental dysgraphia*, or an impairment in a child’s ability to acquire the ability to spell and write fluently. In accordance with Frith’s (1980) model as outlined in the second chapter, if a child performs poorly on the processes required in the phonological phase, *spelling errors* which are *phonologically incorrect* will then characterise the child’s developmental dysgraphia. Such a child will manifest as being particularly poor in the spelling of non-words on dictation, where the use of sound-spelling rules is of particular importance. This type of dysgraphia could also be described as ‘*developmental phonological dysgraphia*’. When a child stops making phonological spelling errors however, and can generally produce correct spelling, the orthographic phase according to Frith’s (1980) model has then been reached. However, if a child presents poorly in the processes required for the orthographic phase, then phonological

spelling errors will persist well beyond the age at which they ought to have disappeared. This kind of dysgraphia may be referred to as '*developmental surface dysgraphia*' because of its correspondence to a form of acquired dysgraphia, namely surface dysgraphia in which, similarly to surface dyslexia, the previously normal speller now makes numerous phonological spelling errors (Goswami, 1988; Harris & Coltheart, 1986; Temple, 1997).

In accordance with the *information processing model of spelling proposed*, Das (2002) considers that *poor use of successive processing* can result in several problems. As in reading, poor pronunciation can result, which renders successful spelling unlikely. Similar problems also result from decoding the word incorrectly or incorrectly mentally tracking the word being spelled. In spelling, Das (2002) notes that *simultaneous processing difficulties* will lead to a child failing to make use of a visual code for the word or syllable being spelt. The speller would also fail to perform a visual check after spelling to ensure that the word does correspond to a familiar pattern (Bain, 1993). In this regard, Johnson (2002, in Joseph, McCachran & Naglieri, 2003) conducted a study to explore the PASS cognitive processing model in junior high students with and without written expression disabilities. The *Planning and Simultaneous composites* were found to be the most significant contributors when the composite scores were examined.

3.8.3. Attention deficit hyperactivity disorder:

The core symptoms of Attention Deficit Hyperactivity Disorder (ADHD) form two distinct factors comprising, firstly, of *inattention* and *disorganisation*, and secondly, of *hyperactivity* and *impulsivity*. There are also a number of associated features of ADHD which vary in accordance with the age of the individual and these may include problems with delayed gratification, mood lability, frustration tolerance, self esteem, oppositional behaviour, stubbornness, bossiness, bullying, obstinacy, temper outbursts and a lack of response to discipline. Furthermore, other areas in which dysfunction may be apparent includes, for example, eye-hand coordination, spatial orientation and visual memory, which may be evidence of the presence of '*soft*' *neurological signs* (Temple, 1997; Woods & Ploof, 1997).

At a level of categorical diagnosis, the *criteria* for ADHD in the fourth edition revised text of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000) requires developmentally extreme symptoms in either or both of these areas, which are of early onset (before the age of seven), longstanding (at least six months' duration),

pervasive (displayed in multiple situations), and impairing. That is, a child with ADHD is distinguished from his or her peers on the basis of the extremity of attentional and behavioural problems, the persistent nature of such difficulties, their display in multiple settings and the problems that they produce in key domains of daily functioning (Hinshaw & Zalecki, 2001).

The subtypes of ADHD noted in the DSM IV TR (American Psychiatric Association, 2000) pertain to the predominant types of symptoms that are displayed. Children with extreme levels of inattention (but not hyperactivity/impulsivity) are categorised in the *predominantly Inattentive type*; those with high degrees of hyperactivity/ impulsivity (but not inattention) are placed in the *predominantly Hyperactive/Impulsive type*; and those with impairing symptoms in both domains comprise the *Combined type*. Amongst others, ADHD is strongly related to school problems and academic underachievement, as evident in lowered test scores and other social indications such as increased detention, expulsion, special education placement and high school dropout rates. Similarly, and with reference to this study, this is likely to result in their *underperformance in reading, writing and spelling* in comparison with age related norms (Hinshaw & Zalecki, 2001). *Stimulants* however, have been shown through extensive research to have a therapeutic effect on these children through improving their ability to sustain their attention and to control their impulsivity, with Ritalin and Dexedrine having been shown to be the most effective types of medication available to date in this regard (Woods & Ploof, 1997).

Researchers have examined the *CAS as an assessment tool* for ADHD and related conditions (Das & Naglieri, 1993). Paolitto (1999, in Naglieri, Goldstein, Delauder & Schwebach, 2004) found that matched samples of ADHD and normal children earned significantly lower scores on the Planning scale of the CAS. Attention subtest scores may also be low, especially for those with the Inattentive type of ADHD because of their difficulty with sustaining attention and resisting distraction. These results illustrate that ADHD involves problems with *behavioural inhibition and self-control*, which is associated with *poor executive control*.

3.8.4. Head injuries and learning disorders:

Traumatic brain injury (TBI) is a major cause of death and disability among children, adolescents and young adults and one of the most common causes of chronic brain syndromes in children. Neurological damage associated with head trauma can be produced in several ways. Closed head injuries typically involve acceleration and deceleration of the brain within the hard skull that leads to contusions of the brain and may result in subarachnoid

haemorrhage. Open head injuries typically involve penetrating TBI that causes specific and direct loss of neural tissue. A common complication of TBI is cerebral oedema, but other complications include infection and haematoma formation both inside and outside the brain. Each of these complications result in neurological deficits and the effects may be widespread. Furthermore, compensatory mechanisms that are involved in recovery from head trauma may themselves alter brain function. A child who has suffered TBI is therefore likely to have both neurological and psychiatric difficulties depending on the brain region involved (Mash & Wolfe, 2005). Cope et al (1991, in Harris, 1998) note that cognitive deficits are the major disability in TBI. These may include impairment in concentration, attention, memory, executive functions and academic and social functioning (Savage & Wolcott, 1994, in Harris, 1998). The most common long term sequelae of TBI are considered to be cognitive and behavioural (Mash & Wolfe, 2005; Temple, 1997).

Gutentag, Naglieri & Yeates, (1998) found that when assessed using the CAS, children with closed TBI earned significantly lower scores in the domains of *Planning and Attention* than the matched control group of neurologically normal children. Within-group comparisons showed that the TBI groups Planning and Attention scores were significantly lower than their *Simultaneous and Successive scores*. The results are consistent with previous literature demonstrating poor performance on measures of attention and executive functions among children who have experienced TBI.

The third and final focus of this literature review will now consider the remediation of cognitive processing and the relationship between visual imagery, simultaneous and successive processing. How children utilise recall imagery when learning or failing to learn to read, write and spell will also be discussed.

3.9. The Remediation of Successive and Simultaneous Processing Abilities:

The extent to which *Luria's cognitive processing approach* can be used to develop *interventions* is discussed by Das (1983, in Das et al, 1994) and evidence that such an approach may be effectively applied is presented by Krywaniuk and Das (1976, in Das et al, 1994) and Brailsford et al (1984, in Das et al, 1994). The first study illustrated that students trained to use various successive strategies improved on successive tasks and that transfer to an academic skill which utilises successive processing (word recognition) resulted. Brailsford

et al (1984, in Das et al, 1994) reported that severely reading disabled children trained to effectively use simultaneous and successive strategies improved in these coding processes as well as reading. These research studies illustrate that coding processes and achievement have been improved in reading disabled children by increasing the efficiency with which the children employed simultaneous and successive processes. This illustrated the possible beneficial effects of training the child to better develop and use plans of action.

In view of this, Das et al (1994) proposed an *alternative to direct training of strategies* for the remediation of reading skills and suggested that a strategy will only be used by individuals with learning disabilities or mental retardation when it is internalised. Das et al (1994) consider that the *process of internalisation* will emerge through induction when the individuals are taken through structured experience provided by training tasks. Das et al (1994) indicate that direct training through rule learning and explanation of complex principles is less successful when used with children with learning disorders.

The *PASS remediation programme (PREP)* has therefore been constructed by Das et al (1994; Naglieri, 1999) to *induce successive or simultaneous processing* while involving the training of *planning and promoting selective attention*. PREP leads the child to apply appropriately successive processing skills and, to a lesser extent, simultaneous processing skills in word reading. In this regard, PREP provides a) alternatives for children who cannot use the processes effectively, b) experiences and practice in one or both processes, and c) specific training to help the child recognise the most efficient approach to use when reading.

PREP employs two types of training materials: those that are described as “*global*” (which foster the use of successive or simultaneous processes) and “*bridging*” (which help the student extend a particular strategy to an academic task such as word identification). The *global process training tasks* teach students to use and *internalise reading strategies*. The bridging processes provide training in strategies that relate specifically to reading and spelling. PREP has been tested in a number of studies reported in Das and Kendrick (1997, in Naglieri, 1999) and Carlson & Das (1997, in Naglieri, 1999). The students who received remediation gained significantly in word identification and word attack skills.

With reference specifically to *simultaneous processing and PREP*, Das, Rama & Poole (1995) and Naglieri (1999) notes that these can be improved by teaching children to recognise that

concepts in reading and spelling can be organised into groups. Working with patterns of shapes and knowledge of conceptual organisation (e.g. of people, places and things) may also be important. With regards to successive processing on the other hand, Naglieri (1999) considers that children's performance on tasks that involve successive processing may be augmented by attending to three components, namely, the child's knowledge base, span of memory and application of strategies that assist in sequencing objects, ideas and events.

3.10. The Remediation of Reading, Writing and Spelling:

Although a small percentage of children do learn to read in the absence of formal instruction, for most children, learning to read involves some degree of *formal instruction*. Before children can learn to read however, prerequisite skills such as knowledge of letters of the alphabet and mastery over the orientation skills associated with reading in the direction of print, are required (Frith, 1980). In this regard, Rayner & Pollatsker (1989) highlighted that while knowledge of letter names in nursery school was the best predictor of reading in the beginning year of instruction, by the second and third year of reading, what emerged most clearly from research evidence is that phonological awareness is intimately related to progress made in learning to read, showing that children who perform well on phonological awareness tests prior to the onset of reading do well in mastering reading and that this difference persists throughout the early school grades.

The research findings concerning reading instruction also indicate that knowledge of the relationship between the printed symbol and the sound pattern of the language is very important in learning to read. Two primary methods of teaching children to read include the whole word (or-look-say) method of instruction and the phonics method of instruction (Rayner & Pollatsker, 1989; Torgensen, Wagner & Rashotte, 1997).

The general rationale behind the *whole word methods* of reading instruction, is that the child is unable to recognise that the letters represent sound units, so the entire pattern of letters is therefore taught holistically as representing a particular word. Typically, the child is shown a flash card with a word on it which the teacher then pronounces followed by the child. Generally, the teacher starts with a small set of words and gradually expands the set as the child's ability in this regard increases. Another major rationale behind using the whole word approach is that, as discussed above, many words in English are irregular in spelling. Such

words therefore, it is argued according to this approach to tuition, must be learned partly or wholly in terms of their visual appearance. Another key argument in favour of the whole word method is that it promotes reading for meaning at a very early stage of reading development. When a child has developed a small sight vocabulary, the vocabulary can be deployed in various combinations to construct meaningful sentences. Gradually new words are introduced in such a manner that the context clarifies their meaning. After an initial sight vocabulary is established, many teachers then begin to emphasise that the letter symbols represent sounds. Each phoneme is dealt with in turn until the child is able to make fairly automatic letter-to-sound conversions (Rayner & Pollatsker, 1989; Torgensen et al, 1997).

The *phonics approach* on the other hand, in its purest form, starts with a limited set of letters which can be built into many different kinds of words. Gradually, more letters are added following which the child is given consonant blends. As some words keep reoccurring, the child also then begins to develop a sight vocabulary during these early stages. The individual letters are taught by the sounds they make and the child is then encouraged to blend the sounds of novel letter combinations. An important aspect of the phonics approach is that it teaches an analytic approach to words designed to exploit the alphabetic principle. Major criticisms of the approach however, include that the phonics approach is boring for the child and that it obscures the main purpose of reading, which is to extricate the underlying meaning from the printed text. These problems have resulted in a general shift to include phonic based instruction with meaning emphasis programs (Rayner & Pollatsker, 1989).

Another method of instruction that is sometimes thought of as being halfway between the phonics and whole word methods, is the so-called *linguistic method* (Bloomfield & Barnhart, 1961, in Rayner & Pollatsker, 1989). This method involves the child encountering a limited set of words similar in spelling construction that are combined to form sentences. The method is similar to the whole word approach except that a phonics type of decoding is also encouraged by the teacher. In general, meaning emphasis programs stress language experiences of the child. Thus, the child dictates short stories to a teacher and is taught to read the words that he or she has dictated. Instruction in learning individual words usually emphasises whole words, though some phonics drill may be incorporated into the program at later stages (Rayner & Pollatsker, 1989; Torgensen et al, 1997).

Just about all of the authors on learning disorders as reflected in the available literature noted that children who suffer from learning disorders are not able to learn as do other children despite the fact that they may have the capacity to do so as their intelligence levels are typically equivalent to that of normal children. Therefore, it seems that these children need *specialised teaching techniques* which are characteristically of a multi-sensory nature to suit their particular learning styles and which take into consideration these children's' underlying cognitive deficits (Birsh, 1999; Bryant & Bradley, 1985).

In this regard, research has shown *PREP (the PASS Remedial Program)* as previously outline in this literature review, to be *effective in improving reading and spelling* despite not remediating these directly, but rather through "global process" training (Das, Mishra & Pool, 1995). Carlson and Das (1997), for example, used PREP to improve reading in underachieving children. Not only was there improvement in pre- to post-performance following 4 months of training in the treated group, but the treated children who received remediation gained almost 1 year in word decoding, which was significantly more than the other children with reading disabilities, who were receiving resource room teaching (Das, Mishra & Pool, 1995).

Within the *South African context*, Churches, Skuy & Das (2002) utilized the Woodcock Tests of Reading Mastery-Revised and tests modelled on the CAS to define a group of children with deficits in successive processing associated with dyslexia and a group of children with general reading delay. The first group was taught according to PREP and the second participated in a remedial program based on whole language principles. The treatment groups received 24 one hour long sessions. Gains in successive processing were shown for the first group, as measured by the tests modelled on CAS, but not for the second group. Both groups showed gains in phonics and word identification relative to their respective control groups, suggesting the respective intervention program was effective for each group.

Fernald (1943) however, favoured the *kinaesthetic method* to teach children suffering visual and auditory defects to read. The techniques consists of, firstly, discovering the means by which the child can learn to write words correctly, secondly, the motivating of such writing, thirdly, the reading by the child of the printed copy of what has been written, and finally, the reading of extensive materials other than that of their own composition. These techniques, as

outlined by Fernald (1943), are reflectant of those employed by the high mental imagery approach being investigated in this study.

Fernald's (1943) method comprised of a child *learning a word through tracing over it* with his/her finger while concurrently verbalising each part of the word being traced. Once the child was able to write the word without looking at the original copy, it was then utilised in a story by the child, which was then typed up and reread in print by the child. Fernald (1943) noted that after a period of tracing, the child developed the ability to learn new words by looking at the word in the script, saying it as it was being looked at, and then writing the word without copying it from the original text, verbalising each part of the word as it was being written. Once the child had learned from the printed word, the ability to generalise to and decipher new words as a result of their resemblance to words already familiar to them was encouraged. As noted by Kirk (1972, in Sfetsios, 2002), the *Fernald kinaesthetic method* (1943) of teaching disordered readers has been and continues to be widely utilised by many teachers in various forms. The most commonly used method in particular, might be the tracing method, which is a method used extensively by the Montessori approach. Words may be traced using a pen/pencil or by direct finger contact and even through the utilisation of other kinaesthetic methods such as the use of a typewriter or, more recently, the computer, as in the Targeted Revisualisation Programme (Carreker, 2000).

3.11. Visual Imagery:

Research into the nature of mental imagery has presented a challenge for mainstream cognitive psychology. Since mental imagery is essentially a *'private' or 'subjective'* experience in the sense that people's mental images cannot be directly observed, mental imagery cannot be investigated on the basis of observation of the non-verbal behaviour of the imaginer. Instead, scientific research into mental imagery has focused on collecting systematic verbal accounts of people's phenomenal experience (Richardson, 1999).

Although research into imagery therefore does not constitute a single homogenous field, it is widely accepted that *people's ability to create, contemplate and manipulate mental images* depends upon the *integrity of their brain structures and underlying cognitive processes*. In view of this, it was previously widely thought that imagery is based upon a single mechanism that is localised within the right cerebral hemisphere. However, this is now a topic of debate

(Richardson, 1999). Kosslyn (1980, in Richardson, 1999), for example, has put forward the idea that imagery depends upon a complex system which consists of a large number of different components or subsystems.

In his attempts to increase understanding of mental imagery, Paivio (1971) completed a review of human symbolic processing that attempted to accommodate diverse findings from perception, memory and language within a common conceptual framework (Richardson, 1999). Paivio (1971, p. 53) proposed the “*dual coding model*” in which he hypothesised around the relationship between verbal and perceptual codes. Within this model, Paivio (1971) identified three levels at which information might be processed. The first is at the *representational* level, where the sensory trace that is produced by an item when it is perceived, arouses the appropriate symbolic representation in long-term memory. Thus words activate verbal representations (which Paivio, 1971, called “logogens”) whereas perceptual experiences activate imaginal representations (which he called “imagens”). The second is at the *referential* level, where symbolic representations in one system arouse corresponding representations in the other system; these interconnections are assumed to be involved in naming or describing objects, on the one hand, and in creating the image of an object, on the other hand. Finally, the *associative* level involves associative connections among images, among verbal representations, or among both.

Paivio (1971) considered that whether the processes at any of these three levels were involved in a given psychological task, depended upon particular characteristics of the task. In learning and remembering however, he considered that all three levels are assumed potentially to be implicated. Consequently, according to this model, performance could be based upon the image system, the verbal system, or both. Paivio (1971, p. 181) then also linked this to another assumption, namely the “*coding redundancy hypothesis*”. This stated that memory performance increased directly with the number of alternative memory codes available for an item (Paivio, 1971). Given these assumptions, the concept that retention increases with the imageability of the material can be explained because, according to Paivio (1971, pp. 207-208), “the items are increasingly likely to be stored in *both* the verbal and nonverbal code...the increased availability of both codes increases the probability of item recall because the response can be retrieved from either code – one code could be forgotten during the retention interval, but verbal recall would still be possible provided that the other is retained”.

In view of this, Hodes & Bloomsburg (1994) argues that educational/instructional materials should therefore be designed to reflect the extensive interaction of the distinct verbal and visual codes in learning. According to Hodes & Bloomsburg (1994), well-planned visual illustrations can facilitate selective encoding and elaborative processing.

Richardson (1999) notes that in Paivio's (1971) dual coding theory, the *verbal system* was supposed to be for *specialised serial or sequential processing*, whereas the *image system* was supposed to be *specialised for simultaneous or parallel processing*. It follows from this that the image system should not be important in tasks that involve the retention of a familiar set of verbal items in a particular sequence, such as immediate memory span. Instead performance on these tasks should depend solely upon the efficacy of the verbal system. According to the redundancy hypothesis, observed effects of imageability reflects the involvement of the image system. Conversely, therefore, if the image system is not involved in certain tasks, performance should not vary with the imageability of the materials. Paivio (1971) noted that there was support for this, insofar as memory span for high-imagery nouns did not seem to differ for memory span for low-imagery nouns.

Bruner et al (1966, in Potter, 2003) on the other hand, understood *excessive visualisation* to instead *hamper efficient development of thought* since, in their view, imagery has a more direct relationship to thought and form, forming a fundamental level of the hierarchical continuum of conceptualisation. Findings of research conducted by Bruner et al (1966, in Potter, 2003) has suggested that over reliance on vivid perceptual cues makes concept formation more difficult and that in comparison, language may be a more efficient and effective symbolic system of thought.

Despite these contrasting views however, the implication is that *images have properties of symbolisation* as well as meaningfulness, in this respect being similar to language symbols (Moerk, 1977, in Sfetsios, 2002) in the development of cognition in the child. In this light, Piaget (1960; Piaget & Inhelder, 1971) understood *perception, imagery and language* to develop over the *lifespan* as *separate systems*, with each being used in the service of thought, where language ultimately becomes the principal medium for symbolism.

Although Piaget (1960; Piaget & Inhelder, 1971) did not specifically theorise about learning disorders as such, on the basis of his theories, it can be extrapolated that one should *use*

imagery with a child for as long as it is required, which is also in keeping with Luria's (1973) notion of the use of external devices to facilitate memory for as long as should be necessary. Once this is no longer needed, the child is considered to have *developed to a stage of learning* in which imagery is no longer necessary and language becomes the principle medium for symbolism. This implies that images are similar to language symbols in that they both have properties of symbolism as well as meaningfulness. Piaget & Inhelder (1971) concluded in this regard that *images* do have *symbolic* and significant properties and are thus similar to *language* as they have a semantic context and are figurative instruments to the developing child. Both images and linguistic symbols therefore, in accordance with this theory, are thus usable towards the common goal of intelligent operations, but are not included as systems within the cognitive dimension. Rather, they are systems that can be utilised in the service of thought (Piaget & Inhelder, 1971).

In this regard, *Piagetian theory* closely informs the procedures used for invoking memory when utilising the high imagery remedial techniques being investigated in this study. Piaget and Inhelder (1971) suggested that the processes of copying and drawing are central to the development of perception and imagery and proposed that, similarly to Luria (1973), cognition is based upon the integration of the systems of perception, imagery, language and thought. These processes are considered to each play a vital role in a child's learning to read, write and spell (Piaget & Inhelder, 1971).

As highlighted by Potter (2003), *different types of imagery* have been differentiated including auditory imagery, visual imagery, kinaesthetic/haptic imagery, synaesthesia referring to the integration of modalities, and eidetic imagery, which means "clear visual image" and pertains to images that are noted for their unusual vividness and persistence" (Forrest, 1981, p.40). Haber (1970, in Sfetsios, 2002) defines an eidetic image as one that lasts longer than 30 seconds. Any image that lasts less than 30 seconds according to Haber (1970, in Sfetsios, 2002) is considered to rather be an afterimage.

Not all people experience *eidetic imagery* however, and this imagery is less commonly experienced by adults than by children. In order to 'test' whether an individual experiences eidetic images according to Jaensch (1930), is to identify whether physiological afterimages are obtained after fixating on an object of intense colour for several seconds. Eidetic images according to Jaensch (1930), are strongest on a dark grey background. Therefore, it seems that

colour is particularly important in promoting the efficacy of eidetic imagery. It has also been suggested that closing ones eyes may improve the quality of eidetic imagery. Images of print however have been shown not to last as long when compared to images of pictures, although have not been reported to be of poorer quality in comparison to that of the latter (Forrest, 1981).

3.12. The Usefulness of High Mental Imagery Techniques in the Remediation of Reading, Writing and Spelling:

Since imagery has been found to be universal in nature, to date, there have been many *attempts to maximise visual imagery* and particularly in its relation to children and in their *acquisition of reading and spelling* (Wippich et al, 1989). As noted by Frith (1980), spelling ability is taken for granted by the good speller who simply and intuitively knows that a word is spelled in a particular way as opposed to another. Frith (1980, p.232) reported a good speller to have once commented that “when you speak a word I can see it in my head as a typed image ... the letters are black and lower case on a white background ... no effort is required, it just happens”, suggesting that some good spellers might have direct access to some sort of visual memory for words, possibly experienced as visual imagery, which might supplement or replace rule based spelling procedures. Poor spellers therefore, in keeping with this hypothesis, could then be considered to be those who do not have access to or who are unable to maximise their use of a comprehensive visual memory.

Furthermore, when researchers have tried to assess the *reliability of various imagery scales* that have been designed to date, it has been found that the scores obtained on the imagery scales improve as they are repeated, thus leading to the conclusion that the ability to utilise and apply visual imagery increases with practice and that it can therefore be *trained* to be effective in teaching spelling to children, both in mainstream schooling and those suffering learning disorders (Forrest, 1981; Wippich et al, 1989).

Additional research findings are also available to support the *usefulness of high imagery techniques in facilitating reading and writing*. A study by Nash (1984, in Knauff & Johnson-Laird, 2002) for example, investigated the use of visual images, such as instant photography, in creating synthesis between mental images and language. This was found to be effective in motivating students to learn, teaching visual/spatial awareness, increasing the relevance of

classroom learning, and teaching basic skills. Formal evaluation of its effect on creative writing demonstrated that subjects using instant cameras, film and a visual curriculum guide made significantly greater improvements in their writing ability than did control subjects. Additional benefits were also noted including, amongst other, enhanced communication, writing, reading and visualization skills.

More specifically, to test the hypothesis that *induced mental imagery* would facilitate the contemplation and reflection that have been suggested as being important to the writing process, Gambrell (1982) investigated the effects of instructions to induce mental imagery upon the written language of young children. Analysis of results revealed a statistically significant difference in favour of the imagery group for total number of words written, suggesting that mental imagery is a viable strategy for young writers.

To illustrate the usefulness of high mental imagery techniques, Potter (2004) described the case of 'K', an above average intelligence child suffering from learning disorders of reading and written expression. Potter (2004) considered that 'K's' difficulties in this regard were likely to be related to successive processing and sequencing difficulties with problematic visual-motor integration skills. 'K' received high imagery remedial techniques over the course of two and a half years, from ages 11 to 14 years old. At the time of commencement of the high mental imagery techniques, 'K' was reading at a level which fell between two to three years behind that expected for his chronological age. His reading fluency was reduced and his writing ability was significantly below that expected for his age. Analysis of his phonic skills revealed that he had not yet established knowledge of the rules relating to the sounds and letters associated with long vowel sounds. IQ testing revealed reduced scores on the coding subtest which are often associated with learning disorders of reading and written expression. Following the two and a half year period of high mental imagery remedial tuition, Potter (2004) noted that 'K' had shown considerable progress in acquiring the basic skills necessary to read and write. He could read complex material silently and showed improved comprehension skills. He had also shown improvements in his ability to express his thoughts in writing. Ongoing difficulties were apparent in that he still struggled to read fluently and he worked at a reduced rate. Some spelling difficulties continued. Despite these ongoing problems, 'K' improved in his writing and spelling skills in class, to the point that his grades markedly improved.

Research findings such as these therefore indicate that *high mental imagery techniques*, like those being investigated further in this study, *can be effective in improving reading, writing and spelling of children*.

3.13. The Usefulness of High mental imagery Techniques in the Remediation of Successive and Simultaneous Processing Abilities:

As highlighted above, numerous attempts have been made to maximise the use of mental imagery particularly with children and in their acquisition of reading, writing and spelling skills (Wippich et al, 1989). However, it logically follows that for gains to be apparent in the reading, writing and spelling of a child with whom high imagery techniques are being utilised, *underlying cognitive gains/maturation* must occur for these gains to be made. This is supported by the theories of Piaget (1960; Piaget & Inhelder, 1971) who considers that language and imagery are similar and both useful and important in the development of cognition. This may offer an explanation as to the improved nature of the learners in their reading ability when high imagery techniques are implemented.

In this light, studies previously conducted by Sfetsios (2002) and Potter (2004) have demonstrated on a case study basis that *associated cognitive gains*, as evident in intellectual/cognitive tests, are also apparent upon post-testing after the consistent usage of high imagery remedial techniques over a period of time with a participant suffering learning difficulties in their English language skills. Although only exploratory in nature, these case studies found that some cognitive gains occurred in addition to the gains made in the reading, spelling and writing abilities of the participants. Some gains particularly in the coding skills (a skill demanding the use primarily of *sequential processing abilities*) of the participants were suggested by the case study results.

As described above, 'K' was tutored over a 2 and a half year period utilising high mental imagery techniques (Potter, 2004). In addition to the gains made in reading, writing and spelling as previously detailed, 'K' showed improvement in his successive processing skills and ability to process visual information, as revealed by gains in his scores when his pre- and post cognitive and intellectual test scores were compared. Significant intertest scatter remained apparent on both pre- and post testing however. Although improvements were

apparent, ongoing sequencing and successive processing difficulties were still evident following the period of remediation (Potter, 2004).

Other studies within an international context have been conducted exploring the link between various aspects of cognition (*particularly memory and learning*) and *mental imagery*. In this regard, one of the first psychologists to relate *memory performance to people's learning strategies* was Bartlett (1932, in Richardson, 1999). He found that he could classify his subjects on the basis of their informal comments as either “*visualisers*”, who claimed to rely mainly upon visual imagery in remembering, or as “*vocalisers*” who claimed to rely mainly upon language cues rather than mental images. Bartlett (1932, in Richardson, 1999) found that although the “*vocalisers*” tended to be less confident in their recall, the two groups produced comparable levels of memory performance. Of importance however, is that Bartlett considered that *mental imagery has a role to play in the memory strategies* at least in some peoples whom he named “*visualisers*”.

In view of this, more recent research conducted by Richardson (1999) has shown that *imageability of material is normally (although not highly) correlated with its memorability*. He argues that one of the key achievements of Paivio's (1971) early research was to show that imageability was a far better predictor of memory performance in tasks which involve the learning of individual items than any of the other properties that psychologists had previously considered. In this regard, Paivio (1971, p. 389) notes that “any superiority observed under imagery mnemonic conditions may result from the addition of imagery to a verbal baseline laid down during the subjects initial representational or associative reactions to the to-be-learned items. i.e. two mediational systems are potentially available rather than one”. In support of this, Richardson (1999) drew upon evidence which is consistent with the notion that the image-evoking potential of material is directly implicated in the mechanisms responsible for learning and remembering. In addition, research by Gonzalez, Campos and Perez (1997) has indicated that imaging ability and image control are significantly correlated with various aspects of divergent and creative thinking (*which necessitates particularly simultaneous thought processes*). The correlations detected were generally weak however. Not all cognitive theorists are proponents of the usefulness of visual imagery in learning however. Knauff and Johnson-Laird (2002), for example, argue that instead visual imagery can impede reasoning and that an overreliance on visual imagery can hamper learning.

Although it is apparent therefore that some research data is available exploring the role of mental imagery particularly in learning and memory, limited literature is available exploring the specific link between mental imagery and simultaneous and successive processing abilities.

3.14. Computer Guided Practice and Colour Coding in Multi-Sensory Teaching Methodology:

3.14.1. Multisensory teaching:

Multi-sensory teaching is commonly endorsed and practiced by teachers of learners suffering a wide range of learning disorders. The term multi-sensory has been used to refer to any learning activity that includes the use of two or more sensory modalities simultaneously to assimilate and learn or to express information (Birsh, 1999; Moates & Farrell, 2000). Moates & Farrell (2000) argued that the conceptions of memory organisation, neural activation patterns in language processing and the importance of meta-cognition are consistent with the efficacy of multi-sensory techniques. Research has also shown that new neural networks are established through repeated activation (Walsh, 1994). In this regard, when attention to linguistic detail is enhanced through multi-sensory involvement, a more complete and explicit registration of linguistic information (phonological and other) is likely to occur in the learner's working memory. It is likely that those transient associative memories are more likely to be stored in connection with existing information in the language processor if other movement or sensory events occur with them (Moates & Farrell, 2000; Yulle, 1983). Moats & Farrell (2000) therefore proposed in this regard, that it is not simply the multimodal nature of such practice that explains its power, but rather also the mediating effect of various sensory and motor experiences on attention and recall (Yulle, 1983).

3.14.2. One-to-one tutoring:

Juel (1998) noted the powerful effects of *one-to-one tutoring* of first grade children who were struggling with reading when compared to the results of small group tutoring of comparable children. Yet the reasons behind the powerful effects of one-to-one tutoring are still not clear. Some researchers have suggested that the extensive training provided to some reading tutors may at least be partially responsible for its success (Wasik & Slavin, 1993, in Juel, 1998), yet other researchers have found that successful learning in one-to-one tutoring is not significantly related to the quantity of tutor training (Cohen et al, 1982, in Juel, 1998). It is thus argued by some that one-to-one tutorials may simply heighten the engagement of the

learner with both the materials and the learning process for longer periods of time than occurs in a typically bustling classroom (Cohen et al, 1982, in Juel, 1998).

Regardless of the reason however, the clearly powerful nature of one-to-one tutoring was primarily the reason for the inclusion of a contrast group in the design of this study, thereby allowing for the impact of purely one-to-one remedial tutoring on the participant's abilities in English reading, writing and spelling to be accounted for so that the impact of high mental imagery there upon could be more easily determined.

3.14.3. Colour coding:

Furthermore, *colour* is commonly known to be a powerful stimulus which aids children in learning through the captivation of their attention (Gattegno, 1963, in Sfetsios, 2002). The lack of one-to-one correspondence between phoneme to grapheme and the complications that result from this have been primarily responsible for the development of reading programmes that use colour to categorise the sounds and introduce new symbols to facilitate a more accurate correspondence between the phoneme and the spelling thereof (Walcutt et al, 1974, in Sfetsios, 2002). Research has shown that fewer trials are required for children to learn coloured letters when compared to those written in black and white, with coloured letters aiding the initial learning in word recognition which is primarily a skill of a visual nature (Goodman & Cumdick, 1976). Gattegno (1963, in Sfetsios, 2002) found for example, that when testing the effects of colour of symbols on the learning rates thereof of both slow and average readers, colour coding initially enhanced the learning of the shape of letters in both the average and slow readers.

3.14.4. Computer aided learning:

It has been proposed that the *computer* may play a vital role in helping children to acquire better basic reading skills and as such, is proving to be a particularly useful teaching aid for children suffering learning disorders. One of the areas of difficulty in which the learning disordered child struggles, includes the rapid and accurate decoding of individual words as discussed above, due to impaired phonological awareness and skills. In this regard, research conducted to date has shown computer aided training to be effective in improving the reading speed and accuracy of context free words and oral reading of text in children with learning disorders (Jones, Torgensen & Sexton, 1987). However, research conducted has shown the computer to be more effective in improving decoding skills than broad based comprehension

skills. Computers have also been shown to be useful in providing large amounts of individualised practice which is reported to emphasis speed of response (Holland, 1980, in Jones, Torgensen & Sexton, 1987).

3.15. The Theoretical Basis of High Mental Imagery Remedial Techniques:

As has been highlighted throughout the above discussion and in the introductory chapters of this dissertation, the high mental imagery approach to remediation investigated in this study recognises that poor readers and spellers typically struggle to learn to read and spell via phonological means due to their underlying *difficulties in phonological awareness*. The approach therefore emphasises *multi-sensory* teaching, particularly through the use of *visual imagery* involving the process of *revisualisation* to learn English words, as emphasised by Paivio's *dual coding model* (1971) and *Piaget* (1960; *Piaget & Inhelder, 1971*) who highlighted the close relationship that exists between imagery and language (Potter, 2003).

Decoding of words is utilised to facilitate the child's understanding of the construction of English language. Throughout the different hierarchical levels of the high imagery remedial approach, emphasis is also placed upon the utilisation of words being targeted in sentences and paragraphs, which are then also subsequently revisualised thus placing emphasis on the *context* in which words occur and thus up holding the main purpose of learning to read and write, which is to do so for meaning.

In addition, the *multi-sensory approach* to both reading and spelling, as highlighted by Luria, (1973) whose theory forms the basis upon which the high mental imagery approach to remediation has been developed, facilitates the integration of brain and neurological functions and of various mental skills and abilities which are all necessary to coordinate to allow for skilled reading and fluent spelling and writing to occur, all of which are highly complex tasks to learn and to master, particularly for a learning disordered child.

In this regard, by following a *hierarchical and sequential framework and utilising high mental imagery techniques* as central to the approach taken to the remediation of the development of oral and visual communication abilities, this approach purposes to link language and visuo-spatial modalities on receptive, integrative and expressive levels (Potter, 2003). The child is taught to use perception, mental imagery and language in combination

through a process referred to as '*targeted revisualisation*'. Single words are first visually imaged and spelled orally, then revisualised and written, demanding the use primarily of *simultaneous mental processing*. Simultaneous processing is essential for successful visual perception and imagery and vital to facilitating an understanding of the relationship that exists between perceived information, particularly of a visual nature, as well as any association that may exist between visual and verbal information. A serial component of one's successive processing abilities is also apparent in high mental imagery techniques. The development of sequential memory and verbal sequencing/processing skills, and particularly the *syntactical* component of *successive mental processing*, is emphasised through the decoding process and extension of the revisualisation process to sentences and paragraphs (Potter, 2000; 2001). Inherent to successive mental processing and the development thereof, are tasks demanding logical sequencing of material, particularly of a verbal nature.

Furthermore, the high imagery remedial approach recognises that *every child is unique* and thus emphasises the importance of ensuring that remediation is targeted specifically towards the child's own cognitive processing difficulties and weaknesses in their ability to utilise English orthography and allows for *flexibility* and adaptability to ensure that the child's needs in this regard are being met. Student-centred and led teaching is also key to the programme, thereby encouraging the child to take responsible for their own learning process. *Colour coding* and decoding, as highlighted in the above discussion, also facilitates mental imagery and is in keeping with the multi sensory and flexible yet structured approach fundamental to the principles of high mental imagery remedial techniques (Potter, 2003).

3.16. Summary of Chapter:

Given the particular neuropsychological and neurocognitive focus of this study, literature pertaining to the concept of intelligence and how this relates to simultaneous and successive cognitive processing was initially explored. Evidence examining the remediation of these dichotomous mental processes and the possible role that high mental imagery may play in this regard (the primary research aim) was then examined. Since the purpose of high imagery remedial techniques is to ultimately produce improvements in the English language abilities of a learner (subsidiary research aims), a number of theories related to skilled reading, spelling and writing as well as the development and remediation thereof in children were reviewed. Literature pertaining to the relationship between cognitive processing, reading,

spelling and learning disorders was also expounded upon. The theories of Luria and Piaget, which form the theoretical foundation upon which the process of target revisualisation has been conceptualised, were also reviewed. Finally, a hypothetical theoretical rationale underlying the principles of the high imagery remedial techniques, particularly as related to the involvement of simultaneous and successive cognitive processing, was explored.

As highlighted by Gardener (in Zillmer & Spiers, 2001, p. 478), “neuropsychologists should not be asking “‘How smart is this person?’ but rather ‘How is this person smart?’” In keeping with these sentiments, this study purposes to tap into areas of strength of the child to facilitate improvements in their cognition and English orthography, thereby compensating for apparent weaknesses in this regard.

Chapter Four: Methodology

4.1 Sample:

The intention of this study was to investigate the effectiveness of high mental imagery techniques in improving the cognitive and English orthographic abilities of children suffering specific learning disorders. This was done using a methodology based on prolonged engagement with a number of individual children.

The sample size in this study was thus small, and consisted of eight children receiving full time private education at a local remedial primary school. All participants suffered various forms of specific learning disorders affecting, in particular, their abilities in the areas of English spelling, reading and writing (Banister, Burman, Parker, Taylor & Tindall, 1995).

The researcher was granted permission by the school Headmaster to access the school premises, its facilities and learners for the purposes of this study prior to its commencement (see appendix i). The participants, aged between 10 and 11 years old, were drawn from the Grade V population attending the remedial school using purposive, non-probability sampling methodology (Banister et al, 1995). Children selected to participate in this study were those who, in view of their scholastic history, could have been considered to be ‘treatment resistant’ to date, implying that they had progressed poorly and had not responded well to other forms of traditional remedial education in improving their English orthographic abilities.

Specifically, the sample was selected from the Grade V population attending the school, based primarily upon their performance in the Schonell One Word Spelling test as reflected in results obtained during testing in class end-2003, as documented in their school records. Those Grade V’s achieving the lowest spelling ages according to the test norms in comparison to other learners in their grade, were identified by the researcher and research supervisor in collaboration with school staff, and their parents contacted initially by the school and informed about considering involving their child in this study (appendix iv). Those parents who expressed written interest in the possibility of their child’s involvement, were then approached by the researcher and informed further about the study with the explanation that each participant would randomly be assigned to one of two groups, each taking a different yet beneficial approach to the tutoring of spelling and reading (Barret, 1997).

Informed written consent was obtained from the parents of the children identified as being appropriate for inclusion and volunteering to participate in the study, to allow for their involvement in accordance with ethical research guidelines (see appendix ii and iii) (Barret, 1997). Finally, verbal assent was obtained from each child prior to commencement of their involvement in the study (appendix v) (Barret, 1997).

4.2 Procedure:

The resultant eight children, comprising of two sets of four children from the three Grade V classes at the school, constituting the sample, were then matched into pairs as closely as possible according to their age, learning disorder, gender and spelling ability as reflected in their results obtained on the Schonell One Word Spelling test end-2003. The members of each pair were then randomly assigned to one of two comparable groups, namely, to either an experimental group who received tutoring utilising high mental imagery techniques in accordance with the methodology of the Targeted Revisualisation Programme or, to a contrast group who received tutoring based upon more traditional forms of remediation in keeping with alphabetic/phonic methodology.

Each participant's successive and simultaneous processing abilities as well as their spelling, reading and writing skills were pre and post tested using a psychological assessment battery comprising of various appropriate educational and paediatric cognitive assessment tools as shall be elaborated upon later within this chapter. Their phonic skills were also analysed prior to and after their involvement in the tuition programme. The pretesting was conducted in May 2004 following which participants received 6 months of biweekly 1 hour individual remedial tutoring sessions after school under the guidance of appropriately trained tutors, in accordance with the remedial intervention strategy of the study group to which the participants were randomly assigned. Post testing followed the completion of the sessions in November 2004. As per the procedure of previous researches conducted at this school through the University of the Witwatersrand to investigate the efficacy of high mental imagery techniques, a minimal charge of R30/session was agreed from the outset of the tuition period to be payable by the parents of the participants to cover the transport costs and miscellaneous expenses incurred by the tutor and to reduce the influence of volunteer bias upon the results of this study.

Due to its exploratory, pre-experimental, multi-method and essentially qualitative nature, the analysis presented in this study is descriptive in nature, allowing for in-depth longitudinal within and between participant analysis of the children's' performance and progress as specified by aggregated case survey methodology. This method allows the researcher to examine each individual case in greater detail and then to combine the results of individual cases into combinations to allow for in-depth between participant analyses and contrast (Banister et al, 1995; Lucas, 1974a; 1974b; Wilson, 1995).

As per aggregated case survey research design, matching between individual participants assigned to the contrast and experimental groups allows for common trends evident within the pairs to be highlighted and further explored. Common trends and differences between the experimental and contrast group are also contrasted and finally conclusions drawn and compared to those of previous related studies and preliminary findings gathered to date.

4.3 Measurement Instruments:

Each participant was pre- and post-tested in a standardised manner utilising the following psychological assessment instruments:

- The Kaufmann Assessment Battery for Children (K-ABC) – Sequential and Simultaneous (mental) processing subscales
- The Cognitive Assessment System (CAS) – Successive and Simultaneous cognitive processing subscales
- The Holborn Reading Scale
- The Schonell One Word Spelling Test
- The Schonell Word Reading Scale
- The Schonell Graded Dictation Tests (Forms B, C & D)
- The Phonic Inventories (Levels One, Two & Three)

Each participant was also involved in a semi-structured response interview with questions standardised in the form of an imagery questionnaire. The experimental group, with whom high mental imagery techniques were utilised throughout the study in accordance with the principles of targeted revisualisation, were interviewed regarding their use of mental imagery both prior to and upon completion of the study to allow for any changes in their ability and

use thereof over the intervention period to be explored. The contrast group, who were not exposed to high mental imagery remedial techniques, were only interviewed in this regard during post testing to minimise the introduction of possible confounding effects within the study (Barret, 1997).

A full biographical history of each participant was obtained through examination of their school records and via a written parental and teacher questionnaire, supplemented by a verbal semi-structured interview as required, for clarification purposes. Records of each child's full and sub-scale IQ scores on the most recent intelligence test conducted, as measured by either the Weschler Intelligence Scale – Third Edition (WISC-III) or Senior South African Individual Scale-Revised (SSAIS-R), were obtained from their school files. Furthermore, to assess their ability in creative writing, written samples of each participant's work, as reflected in their current school exercise books, were also examined and analysed by the researcher both prior to the commencement of the intervention and again upon completion thereof.

4.3.1 The Kaufman Assessment Battery for Children:

The *Kaufman Assessment Battery for children (K-ABC)* (Kaufman & Kaufman, 1983a, 1983b; 1983c) is an individually administered measure of intelligence and achievement, standardised in America on a large representative nationwide sample of normal and exceptional children within the age range of 2 ½ through 12 ½ years. Although a relatively recent addition to the domain of individual tests of mental ability, the K-ABC is considered to be based on a well articulated theory of intelligence that is grounded strongly in research in neuropsychology and cognitive psychology. The test has also been designed to minimise the cultural bias that is thought to exist in many intelligence tests and research has found it to be successful in this regard (Bracken, 1985; Chattin & Bracken, 1989, in Cohen & Swerdlik, 2002). The test attempts to separate fluid and crystallised intelligence and to provide diagnostic information that helps determine why children perform well on some tasks and poorly on others (Klanderma, Perney & Kroechehell, 2001; Murphy & Davidshofer, 2005).

The K-ABC has been the focus of extensive research in America and was used with over 1 million American children in its first years of distribution. Partly, as a result of its strong theoretical base, there is evidence to indicate that the K-ABC has proven to be especially useful in special populations, such as the gifted or the neurologically impaired (Murphy & Davidshofer, 2005). The multi-subtest battery yields standard scores in global areas of

functioning including *sequential processing*, *simultaneous processing*, mental processing composite (sequential plus simultaneous) and achievement. Intelligence, as measured by the K-ABC, is defined in terms of an individual's style of solving problems and processing information. The mental processing composite is most closely identified with the child's level of fluid intelligence (Murphy & Davidshofer, 2005). The K-ABC comprises of 16 subtests, although a maximum of 13 is administered to any particular child. It consists mostly of non-verbal items (e.g. pictorial diagrams) that require the testee to perform a variety of information processing tasks (Hooper & Hynd, 1986; Kaufman & Kaufman, 1983a, 1983b, 1983c; Murphy & Davidshofer, 2005).

Average split half reliability coefficients for the four global scales range from .89 to .97 for school aged children. Most subtests were also found to be reliable, with internal consistency values ranging from .84 to .97. Studies have shown six month retest reliabilities to range from .72 to .95 (Matazow et al., 1991, in Spreen & Strauss, 1998). The mental processing composite is positively correlated with several measures of school achievement and shows an average correlation of .70 with the WISC-R full scale IQ. Finally, factor analyses of the K-ABC suggest that the fundamental organisation of the mental processing tests (sequential versus simultaneous) is empirically justified, offering some evidence of construct validity. (Kaufman & Kaufman, 1983c; Klanderma et al, 2001). Most factor analyses which have been independently performed in this regard indicate the presence of simultaneous and sequential processing factors although there is some disagreement over the factor that the K-ABC refers to as "achievement" (Keith, 1985; Keith & Dunbar, 1984; Keith et al, 1985; in Cohen & Swerdlik, 2002). In addition, while it is generally considered that the Kaufmans have made a convincing argument for the utility of the distinction between sequential and simultaneous learning, factor-analytic evidence suggests that these two types of learning may not be entirely independent as is suggested by the K-ABC (Bracken, 1985; in Cohen & Swerdlik, 2002).

The full K-ABC was not administered in this study however - only the simultaneous and successive mental processing subtests were administered in pre and post testing. This may have altered the psychometric properties of the test. Very limited research exists in this regard however. The impact of this on the psychometric properties can therefore not be quantified.

The K-ABC is widely used as an educational assessment tool in the South African context and some research into its usefulness in this regard has been conducted to date. Research conducted by Skuy, Taylor, O'Carroll, Fridjhon & Rosenthal (2000) found that, when administered with black and white children, the K-ABC appeared to be a relatively non-discriminatory alternative to the Wechsler Intelligence Scale for Children (Revised) for a South African sample. South African norms for the K-ABC are not available however and, as a result, scores obtained by participants on the K-ABC subtests in this study were interpreted with caution because the possibility of cultural bias cannot be ruled out.

4.3.2 The Cognitive Assessment System:

The *Cognitive Assessment System* (CAS; Naglieri & Das, 1997) was developed to integrate theoretical and applied areas of psychological knowledge using a theory of cognitive processing and tests designed to measure these processes. More specifically, the CAS was developed to evaluate the Planning, Attention, Simultaneous and Successive (*PASS*) cognitive processes of individuals between the ages of 5 and 17 years old. The *PASS* theory is the result of the merging of both theoretical and applied psychology most recently summarised by Das et al (1994) who initiated a link between Luria (1966, 1970, 1973, 1976, 1980, 1982, in Das et al, 1994) and the field of intelligence when they suggested that intelligence could now be reinterpreted from the cognitive perspective, which the CAS refers to as *PASS*. It is suggested that *PASS* processes are the essential elements of human cognitive functioning, namely *planning processes* that provide cognitive control, utilisation of processes and knowledge, intentionality and self-regulation to achieve a desired goal; *attentional processes* that provide focused, selective cognitive activity over time; and *simultaneous and successive information processing* that are the two forms of operating on information.

The CAS yields an overall measure of cognitive full scale score and four cognitive processing scales called planning, attention, simultaneous and successive processing. The *planning subtests* were developed to require the testee to create a plan of action, apply the plan, verify that action conforms to the original goal and modify the plan as needed. CAS subtests that measure planning contain tasks that are relatively easy to perform but require the individual to make a decision/s about how to solve novel tasks. The subtests included are matching numbers, planning codes and planning connections. The *attention subtests* require the focus of cognitive activity, detection of a particular stimulus and inhibition of responses to irrelevant completing stimuli, including subtests of expressive attention, number detection and reception

attention. The *simultaneous processing subtests* require the synthesis of separate elements into an interrelated group, using both verbal and nonverbal content. Subtests include non-verbal matrices, verbal-spatial relations and figure memory. The *successive processing subtests* were developed to demand the preservation or comprehension of a serial organisation of events. They require the individual to deal with information that is presented in a specific order and for which the order drives the meaning. Subtests include word series, sentence repetition and sentence completion (for ages 8 – 17) (Das et al, 1994; Naglieri & Das, 1997).

The CAS was standardised through a carefully designed stratified random sampling plan resulting in a sample that closely matches the US population. Data collection included the assessment of children from 5 – 17 years of age from both regular education and special education settings (N = 3072) (Naglieri & Das, 1997). Subtest reliabilities coefficients were calculated by the split half method for all simultaneous and successive subtests (except speech rate). The reliability coefficients were all shown to be consistent with what is typical for a test of cognitive abilities. The results indicate that the standard battery full scale and PASS subtests have high internal reliability. The full scale reliability coefficients range from a low of .95 to a high of .97. The PASS subscale reliabilities range from .83 to .93. Test- retest reliability of the CAS also demonstrates good stability across age groups over time. Validity with special populations including persons who are mentally retarded, learning disabled, gifted, have attention deficits or traumatic brain injuries are reported. Differences in PASS subscales performance were found for these groups, supporting the discriminant validity of the CAS (Fein & Day, 2004; Naglieri & Das, 1997).

Research on correlation between scores obtained on the CAS and on other specific psychological tests has shown that few significant correlations exist between the Conners Continuous Performance Test, the Wechsler Intelligence Scale for Children (Third Edition) and the CAS. These results suggest that practitioners should expect to find a lack of consistency between the scores provided by these measures and should be conservative of their use in clinical settings (Fein & Day, 2004; Naglieri et al, 2004). Pearson product-moment correlation between the CAS full scale and the Woodcock-Johnson Revised Test of Achievement Skills cluster however, was .71 for the standard CAS battery scores, providing evidence for the construct validity of the CAS. These research findings suggest that the CAS correlates with achievement as well as, if not better than, tests of general intelligence (Naglieri & Rojahn, 2004). In this regard however, the results of independent analyses done

by Kranzler and Keith (1999; Keith, Kranzler & Flanagan, 2001) revealed that the CAS lacks structural fidelity, indicating that the relations among the scaled scores of the CAS (i.e. subtests, PASS Scales, and Full Scale) are not consistent with the theory upon which the test is based (i.e. the PASS theory). Kranzler and Keith (1999; Keith et al, 2001) argue that without structural fidelity, the construct validity of the CAS simply cannot be established and they therefore, do not support the use of the CAS in practical settings for differential diagnosis or for planning educational interventions based on the PASS Scales.

For the purposes of this study however, only the *simultaneous* and *successive processing scales* were administered to address the research questions. This may have altered the psychometric properties of the test. Very limited research exists in this regard however. The impact of this on the psychometric properties of the data in this study can therefore not be quantified.

Although some exploratory research into the usefulness of the CAS in the South African context appears to be currently underway, South African norms for the CAS were not available. In view of the lack of availability of South African data, the results obtained by participants on the CAS subscales were interpreted with caution within this study, due to the , potential cultural bias that may exist in this regard. This limits the applicability and diagnostic usefulness of this test in this country at present, and should be noted as a limitation of this study.

4.3.4 The Holborn Reading Scale:

The Holborn Reading Scale (appendix vi) was used to assess the participants' reading ability. The scale was designed with the intention of providing a rough assessment of a child's reading age in a short period of time and without calculations and is considered as useful for implementation with children aged between five and eleven years old.

Formulated in 1948 by Watts (in Pumfrey, 1985), this test comprises of 33 sentences arranged in increasing order of difficulty with respect to mechanical elements and comprehensibility. The sentences have been specifically selected so that in the initial standardising group consisting of more than 2000 pupils aged five and a half to ten and a half years old, the progress shown in mastery of the difficulties of reading aloud by the children was at a rate represented by an increase of one sentence every three months. Each of the sentences in the

scale therefore represents a reading age of three months higher than that of the preceding sentence (Buros, 1959; 1968; 1969). A child's mechanical reading ability can rapidly be assessed, but there are no norms for comprehension; hence the comparison between a child's mechanical reading and comprehension cannot be made as meaningfully as is suggested in the manual (Pumfrey, 1985).

This test has achieved popularity however, perhaps because of its ease of administration and the apparently simple interpretation of scores (Pumfrey, 1985). The child is asked to read the sentences aloud from the beginning of the page and the test is stopped after the fourth consecutive error is made. The reading age is then determined from the corresponding figure in the margin opposite the sentence in which the fourth mistake occurred. Although the instrument has been standardised for use with a British population, it is widely used in clinical, scholastic and remedial work with children in South Africa, including by teachers at the remedial school where this study was executed. It is evident that the test bears signs of expert construction however no published information regarding the reliability and validity of this test appears to be available. The norms available are clearly dated. (Buros, 1959; 1968; 1969).

4.3.5 The Schonell spelling and reading tests:

The *Schonell One Word-Spelling test*, *One Word-Reading test* and *Graded Dictation test* (Schonell, 1932; 1952a; 1952b) (see appendix vii, viii & ix) were utilised to respectively assess the participants' spelling, reading and writing/spelling abilities.

The *Schonell One Word-Spelling test* comprises of 100 words containing ten words per year from the ages of five to thirteen and ten words for the two years fourteen and fifteen. The 100 words were selected from 300 words administered individually to approximately 60 children, with the easiest word being read correctly by 55% of children aged five and the most difficult being read correctly by 45% of children aged fourteen and fifteen. The words have no special connection with any methods of reading teaching. The child is asked to write the test word down after it has been verbally read out by the examiner and repeated within the context of a sentence. Upon completion of the test, the number of correct answers is calculated. The spelling age for this test begins at five years of age with every five correct answers obtained thereafter adding a year thereto (Buros, 1959; 1968).

The *Schonell One Word-Reading test*, suitable for children between the ages of five and fifteen, requires the child to read aloud single words increasing sequentially in difficulty, reading across the page from left to right. The test is stopped once the child has read ten successive words incorrectly. The correct number of words read correctly provides the raw score, which is compared to the table provided to gain the child's reading age. It is considered a useful tool to provide a rapid assessment of reading ability and typically serves as a preliminary screening measure indicative of the need for more detailed testing (Buros, 1959; 1968; 1969)

The *Schonell Graded Dictation tests (Forms B, C & D)* requires the child to write down the sentences that are verbally read to them by the examiner in dictation format in order to provide an estimate of the participants ability to write continuous material, punctuate and to spell words within the context of sentences. The number of errors made in each dictation provides the raw score, which is converted into the child's spelling age utilising the tables provided (Schonell, 1932; 1952).

The Schonell tests, originally formulated, revised and standardised by Schonell and Schonell in 1939 and 1942 respectively for use with the British population, are widely used in both South Africa and the United Kingdom to assess the spelling and reading abilities of mainstream and remedial school going children, including by teachers at the remedial school where this research was conducted. The words in the tests were drawn from essential spelling lists compiled by Schonell (1932) graded into six major groups of increasing number, the grading of which has been checked by teachers and with reference to written material produced by children between the ages of seven to twelve to ensure its content validity. While the groups themselves are of increasing difficulty, the words within each group also become, for the most part, successively harder. The words included in the tests were intended by Schonell (1932) to comprise of those common words which elementary school children utilise in writing and which children of average intelligence at the age of thirteen should be familiar with and able to spell.

Although limited psychometric information is available for the Schonell test battery, dated norm related data is available based on British samples with correlations between the tests provided in the case of 210 pupils from eight to eleven years with coefficients for the correct score ranging from .67 to .86 however, the number of cases of children in the sample at any

age remained small, never exceeded 63. The reliability for the Schonell Dictation Test B has been determined to be .92 (Schonell, 1932; 1952). The British norms for the graded word reading test were revised in 1972 but the diagnostic tests do not include a number of aspects of reading now considered important eg. auditory discrimination between words, matching written and heard forms of words (Pumfrey, 1985). Shearer (in Pumfrey, 1985) recently administered the test to a nationally representative sample of 6 000 children aged from below five to eleven years attending British schools. He was able to revise the order of difficulty of the words and to restandardise the norms for the test. Shearer (in Pumfrey, 1985) claims that the new norms are remarkably similar to those initially produced by Schonell (1932, 1952) but are very different from those given in 1972. Controversy thus exists as to which set of norms has more general validity (Pumfrey, 1985). Very limited research regarding the usefulness of the Schonell test battery within the South African context appears to have been conducted to date.

4.3.6 The Phonic Inventories:

The Phonic Inventories (see appendix x) were developed by Potter (2000; 2001) to allow for the identification of the phonic rules established by the child and to facilitate the correct diagnosis of the patterns of errors made in their written construction of English words. The inventories comprise of three levels designed to reflect different areas and levels of complexities in the process of learning to spell and read in English. Level one focuses on short vowels and consonant blends, level two on long vowel and vowel digraphs and level three on root words, the doubling rule, morphological endings, polysyllabic words and compound words. Owing to the link between reading and spelling as cognitive processes, reading experience is likely to mediate the child's performance on the Phonic Inventories (Grasko, 2005).

In administration of the inventories, beginning with Level One, the examiner reads each word aloud, then places the word in the context of a short sentence and, finally reads the word in isolation again, following which the child is required to write the word down with each subsequent word being written consecutively, in two columns, on a lined A 4 size page. Upon completion thereof, utilising the error analysis table provided, the spelt words are then analysed by the examiner for errors as related to initial consonants, initial blends/clusters, medial vowels, medial vowel digraphs, ending consonants, ending blends/clusters, long and

short vowel confusion, reversal/transposals, errors with prefixes, errors with suffixes and syllabification errors. Errors are then tallied according to type to determine their frequency.

Within this research project, the identified errors then formed the unique targets for remedial instruction with each participant within the sample, thereby serving to aid the contrast and experimental group tutors to focus the content of the remedial sessions on each child's individual needs and in planning an appropriate remedial intervention strategy (Potter, 2000, 2001).

This instrument was developed in cooperation with and based upon the sequence of instruction followed by primary school classroom teachers and as such, can be regarded as being content valid. Furthermore, the Phonic Inventories are criterion-referenced tests (i.e. they are target specific and relate to particular developmental stages in the teaching of spelling, as opposed to being norm or group-referenced). Error analysis is incidental, as opposed to involving a system designed to yield specific information about the patterns of error made by individual children. Because of the specialised scoring of the Phonic Inventories, it is possible to know a child's spelling level as well as specific areas of difficulty that require attention or intervention. In this way, the Phonic Inventories move beyond traditional spelling assessment by directly accessing the level of phonological awareness and alphabetic knowledge attained by the child as well as the specific areas of difficulty (Grasko, 2005).

Within the South African context, a study by Grasko (2005) explored the usefulness of the Phonic Inventories by comparing the error patterns made by mainstream and remedial primary school learners on all three levels of the instrument using a repeated measures ANOVA. It was found that both mainstream and remedial children made similar patterns of errors. A high prevalence particularly of errors in ending blends was apparent, and errors made in medial vowels, medial vowel digraphs, suffixes and syllabification also common. What was also evident however was that remedial learners made consistently *more errors* on each category in levels One and Two of the Phonic Inventories. This would suggest that the Phonic Inventory Levels could be used for screening purposes in mainstream classes, with frequency of errors of the key error types for each level of the Phonic Inventories being used to identify at risk children. For Level Three, it is noteworthy that the actual patterns of errors made by remedial children looked very similar to that found for children in mainstream

schools. Furthermore, the mainstream children's performance improved notably as they moved up in grade, although this was not such for the remedial children, suggesting the Phonic Inventories may be tapping a persistent predictor of learning difficulties. A stepwise regression analysis was used to establish whether the relevant levels of the Phonic Inventories predict performance on contrast spelling tests. It was found that there was a good degree of fit between the tests, with the Phonic Inventories explaining between 69 and 77 percent of the variance of scores on these contrast tests. A discrimination analysis also showed that the Phonic Inventories predicts school affiliation to a fair degree. These findings therefore suggest that the Phonic Inventories is a valid spelling test for South African learners and has good potential to be used as a screening instrument to identify children with dyslexia.

4.3.7 Creative writing ability:

The children's *creative writing ability* and progress made in this regard was monitored throughout the sessions by the tutors and their observations recorded in session feedback forms [appendix xiv a) and xiv b)] throughout the intervention period. This was assessed in relation to the child's ability to identify main ideas from sequenced pictures, main ideas from sequenced paragraphs and main ideas from stories, as well as in paragraph building and sequentialisation, creative writing, writing structure and comprehension.

Creative writing ability was also assessed through the subjective analysis of written samples drawn from the participant's current school exercise books by the researcher and child's teacher. This was done twice, once at the beginning and once at the end of the intervention period, thus allowing for both between and within subject comparisons to be made with regards to the child's writing ability at various stages of the study.

4.3.8 The Mental Imagery Questionnaire and Mental Imagery Checklist:

The Mental Imagery Questionnaire (see appendix xi) is a semi-structured self-report interview schedule developed by Potter (2000; 2001), based on the procedures described by Fernald (1943). The instrument focuses on the child's ability to use mental imagery in visualising and revisualising the form and structure of words. It has been used on a pilot study basis in a number of researches conducted to date through the Psychology Department of the University of the Witwatersrand investigating the usefulness of high mental imagery techniques in the remediation of English language abilities (Abelheim, 2002; Els, 2003;

George, 2001; MacReadie, 2001; Picton, 2002; Ravenscroft, 2002; Sampson, 2002; Wilson, 2001).

The Mental Imagery Questionnaire focuses in particular on visual imagery for words, and is useful in establishing whether children are able to use eidetic imagery (Jaensch, 1930; Fernald, 1943) in the process of learning and remembering written words. As words are based on a particular sequence of letters, the questionnaire also provides the researcher with insight into the nature and sequence of the imagery processes utilised by each child in remembering words, and whether the child is able to read, write and spell the words concerned (Potter, 2000; 2001). Evidence from additional sources [e.g. neurological correlates of the child's spoken and written output as shown on Positron Emission Tomography (PET imagery/scan) results] can then be used to substantiate the child's self-report on the imagery process.

It should be noted that the psychometric properties of the Imagery Questionnaire have not yet been researched using neurological correlates. However, studies conducted to date have established the potential of the instrument to yield substantive information on mental imagery in the process of learning the form and structure of words (Abelheim, 2002; Els, 2003, George, 2001; MacReadie, 2001; Picton, 2002; Potter, 2003; 2004; 2005; Ravenscroft, 2002; Sampson, 2002; Sfetsios, 2002; Wilson, 2001), as well as to identify children who are able to use visual imagery in learning words and those who cannot (Ravenscroft, forthcoming).

In the current study, each child in the experimental group was pre and post tested using the Mental Imagery Questionnaire. The participants in the contrast group were only post tested with this tool to minimise the impact of any possible confounding effects such as instrumentation, compensatory rivalry or demoralisation. The oral and written output of each child during remedial sessions, as documented by the tutors in session feedback reports, was also analysed throughout the six month intervention period. As the Mental Imagery Questionnaire provides self-report information on how imagery is used in the learning process, these multiple sources of data were cross-analysed to determine whether and how mental imagery was used by each child in the study as an aid in the learning of English words and the effectiveness of this, as well as the impact of utilising high mental imagery remedial techniques in this regard (Banister et al, 1995; Breakwell, 1997).

A Mental Imagery Checklist (see appendix xi for a full version of the checklist), which has been recently conceptualised by Potter (2006), was utilised as a means to understand the participants' ability to engage in the various elements of the reading, imaging, revisualisation and written output process. This checklist describes these various elements in outcome based, operational terms. If the participant demonstrated an ability to perform a particular element, this was then checked on the checklist. An abbreviated version of this checklist has been utilised in the description of case studies within this dissertation to provide a summary of the participants' ability to engage in the various elements of the imagery process. For the participants from the experimental group, this was assessed at pre and post testing. This was only assessed at post testing for the contrast group participants. The checklist focuses on the participants' ability to image sequences of letters in words and transform these into oral and written output as well as manipulate a series of mental images into sentences and paragraphs.

4.3.9 Parental and Teacher Questionnaires:

Both the *parent and teacher questionnaires* were compiled by the researcher, adapted for the purposes of this study, from standard psychological paediatric parental and scholastic history taking questionnaires, to allow for the gathering of comprehensive data pertaining to the background histories of each participant in the sample.

The *parental questionnaire* (see appendix xii) is a written biographical inventory completed by each participant's parent/s or legal guardian/s to allow for the gathering of additional information regarding each participant's developmental, medical, psychological and academic history to ensure that comprehensive background information is obtained to allow for in-depth and accurate case analyses.

The *teacher questionnaire* (see appendix xiii) is a written questionnaire completed by the child's remedial school class teacher towards the end of the six month intervention period to allow for the gathering of additional information regarding the participants' academic history and performance, particularly in the areas of English reading, writing and spelling in their current class situation at school.

4.3.10 Session Feedback forms:

A diary reflecting the progress of each participant in remedial sessions was kept throughout the intervention period. *Session feedback forms* [see appendix xiv a) and xiv b)] complied by

the researcher for the purposes of this study, were completed by the participants' tutors following every remedial session held, outlining the content and focus of the remedial session and reflecting each participants' performance and progress in remediation. These session feedback reports were analysed qualitatively post the intervention period by the researcher to inform the test scores obtained by the participants and to provide contextual information from which conclusions were drawn pertaining to the children's performance in spelling, reading and writing throughout the study.

4.3.11 Intelligence tests:

The results of each participant's *most recent intelligence test* were obtained from their school records, as measured either by the *Wechsler Intelligence Scale - Third Edition (WISC-III)* or the *Senior South African Individual Scale-Revised (SSAIS-R)* administered by clinical/ educational psychologists during scholastic/psychological assessment conducted independently of this study and prior to its commencement.

The purpose of intelligence tests, in addition to measuring overall intellectual capacity, is to obtain specific information relating to the cognitive abilities and intellectual functioning of the test-taker. In the case of learning disabled children, this provides valuable and useful information upon which decisions regarding cognitive strengths and weaknesses, as well as appropriateness of placements and schools for a child may be reached (i.e. should a child attend a mainstream or remedial school) and academic achievement predicted (Prifitera & Saklofske, 1998; Spache, 1976; Van Eeden & De Beer, 2001).

The children within this study were required to undergo full scholastic/psychological assessment prior to their admission to the remedial primary school to confirm the appropriateness of their placement at this particular school in accordance with their current intellectual profile as well as their scholastic, perceptual and behavioural strengths and weaknesses.

4.3.11.1 The Senior South African Individual Scale-Revised:

The *Senior South African Individual Scale (SSAIS)* was initially released in 1964 and revised in 1991. The resultant Senior South African Individual Scale-Revised (SSAIS-R) is considered to be the South African equivalent of the Wechsler Intelligence Scale for Children-Revised (WISC-R). This scale is an intelligence test intending to, firstly, obtain the level of

general intelligence of a test taker, which is often useful in predicting a learner's scholastic achievement and secondly, to obtain a profile of the learner's relative strengths and weaknesses in certain facets of intelligence, useful as diagnostic and prognostic information (Van Eeden, 1991).

The SSAIS-R has been standardised for use with English and Afrikaans speaking South African learners between the ages of seven years and zero months and sixteen years and eleven months old (Van Eeden & De Beer, 2001). Norms were established at the time of revision of the SSAIS-R and the test standardised utilising a systematic sample of 4767 learners considered to be proportionally representative of Afrikaans and English speaking learners from the age of seven to sixteen attending mainstream public schools in South Africa, including learners from White, Coloured and Indian South African population racial groupings. Norms for learners who could be considered to be non-environmentally disadvantaged and those considered to be environmentally disadvantaged (proportional norms) in view of their degree of exposure to "western technological culture", have also been established (Van Eeden, 1991, p.15).

This intelligence test is used mainly with primary school learners and comprises of 11 subtests, organised into 6 verbal and 5 non-verbal components. Verbal subtests include tests of similarities, vocabulary, numerical ability, story memory, memory for digits and comprehension while non-verbal subtests include pattern completion, block design, completion of missing parts, form perception and coding. A verbal and non-verbal standard score is obtained through conversion of the respective composite raw scores utilising the norm tables provided. The full scale (or global) scaled score is calculated through addition of the verbal and non-verbal scale scores, which are then converted into Intelligent Quotient (IQ) scores (Van Eeden, 1991).

At the time of its revision, the SSAIS-R was found to have a full scale reliability co-efficient of 0,95 for 10 and 11 year old non-environmentally disadvantaged English speaking learners. The reliability coefficients for the various subtests, age groups and norm groups have also been determined. The concurrent, construct, predictive and criterion validity of the SSAIS-R has also been determined for the various age and South African norm groups. The correlation coefficients between the various subtests comprising the SSAIS-R were also found to be highly significant for most age bands and within the two norm groups. The correlation

between the composite scales of the SSAIS-R and those of existing group intelligence tests were also found to be highly significant, suggesting that the SSAIS-R measures the same constructs as the existing intelligence tests (Van Eeden, 1991; Van Eeden & De Beer, 2001).

4.3.11.2 The Wechsler Intelligence Scale for Children – Third Edition:

The *Wechsler Intelligence Scale for Children – Third Edition (WISC-III)* was published in 1991 and is the revised version of the Wechsler Intelligence Scale for Children – Revised (WISC-R) (Prifitera & Saklofske, 1998). It is currently the most popular and widely used individual assessment tool of intellectual functioning of children worldwide, purposing to assess the global aspect of intellectual functioning and to provide a profile of a learners composite cognitive abilities (Van Eeden & de Beer, 2001). Whilst retaining the basic structure and content of the WISC-R, the WISC-III in comparison, has updated and more representative norms, improved clarity of factor structure, and is considered to contain more culture and gender sensitive items (Close Conoley & Impara, 1995; Spreen & Strauss, 1998).

The WISC-III is intended for use with children from the age of six to sixteen years and eleven months and comprises thirteen distinct subtests divided into two scales – a verbal scale, using language based items, and a performance scale, consisting of visual motor items less dependent on language. The test consists of ten compulsory and three supplementary subtests. The five compulsory verbal subtests include Information, Similarities, Arithmetic, Vocabulary and Comprehension, with Digit Span being supplementary. The five non-verbal scales include Picture Completion, Picture Arrangement, Block Design, Object Assembly and Coding, with the Mazes and Symbol Search non-verbal subtests being supplementary. The five compulsory subtests in each of the two composite scale produce scale specific IQs (i.e. verbal and non-verbal IQs) and the total sum of the 10 subtest scores produces a full scale IQ. Although scores obtained on the supplementary subtests are intended to provide a richer picture of the child's abilities, they do not contribute to the IQ scores. The scores of the verbal and performance IQ's therefore are combined to calculate the full scale IQ (Prifitera & Saklofske, 1998; Spreen & Strauss, 1998).

The WISC-III was normed on a sample of 200 children from each age group between six and sixteen years, representative of the United States population (N= 2 200) (Prifitera & Saklofske, 1998). It has a high reliability for all its subtests ranging from .61 to .92. The average internal consistency coefficient for the full scale IQ is .96, the verbal IQ .95, and the

performance IQ .91. Split half reliability and test-retest reliability is high for the verbal, performance and full scale IQ's (above .88). Content validity is noted to be high and correlations between the WISC-III and other intelligence tests also calculated to be strong, with its predictive validity, particularly with regards to academic achievement, considered to be highly significant (Close Conoley & Impara, 1995; Kamphaus, 1993, in Prifitera & Saklofske, 1998; Spreen & Strauss, 1998).

Evidence to date has however suggested that the WISC-III is not particularly sensitive to the detection of the presence of abnormal clinical conditions such as attention deficit hyperactivity disorder or dyslexia in children since it does not always necessarily yield abnormal profiles in this regard (Close Conoley & Impara, 1995). The latest revision of the WISC, namely the WISC IV, was released in 2003 and although highly similar to previous versions of the WISC, no longer distinguishes between verbal and performance factors. Given the recency of its release however, the WISC IV has only been utilised to a limited extent internationally and nationally and few studies of the psychometric characteristics of this test exist (Murphy & Davidshofer, 2005). South African norms for the WISC-III are not available, and US norms need to be applied with caution when the WISC-III is utilised to assess the intelligence of South Africa learners.

4.4 Data Analysis:

Following post testing, all data collected during the course of this study as described within this chapter, were then compiled, described and analysed as stipulated by aggregated case survey methodology, in the subdivisions of successive and simultaneous cognitive processing abilities, spelling ability, writing ability and reading ability so that the research questions could be addressed. Pre and post test raw scores obtained were tabulated and also compared to available norm and age related data. Qualitative data were analysed by the researcher and utilised to inform the test scores obtained and to describe the nature of any progress made by each participant in their cognitive, reading, writing, spelling and mental imagery abilities over the intervention period (Barret, 1997).

Thereafter, the background histories and qualitative and quantitative data gathered for the participants were compiled and the results obtained by each case discussed in detail. The data obtained for each participant within the matched pairs were then compared and trends,

commonalities and differences explored. The results obtained for all participants within each group i.e. the experimental and contrast groups, were also then compared and evident trends further described and discussed (see chapters 5 and 6).

Finally, the findings of this study were compared to preliminary data gathered regarding improvements apparent in cognition and English orthography in previous related research studies (Abelheim, 2002; Els, 2003, George, 2001; MacReadie, 2001; Picton, 2002; Potter, 2003; 2004; 2005; Ravencroft, 2002; Sampson, 2002; Sfetsios, 2002; Wilson, 2001). General trends common to the studies were highlighted and discussed and appropriate correlational conclusions describing the resultant trends apparent following the utilisation of high mental imagery remedial tuition techniques and the gains made in the simultaneous and successive processing, spelling, reading and writing abilities of the Grade V participants with specific learning disorders affecting these areas formulated (see chapter 6) (Banister et al, 1995; Prifitera & Saklofske, 1998).

4.5 Ethical Considerations:

The ethical research guidelines established by the committee for Research on Human Participants (Humanities) of the University of Witwatersrand were strictly adhered in this study. Furthermore, prior to its commencement, this study obtained ethical approval from the University of the Witwatersrand Higher Degrees committee as well as the University Of Witwatersrand Department Of Psychology Internal Ethics Board. Furthermore, this study also forms part of a larger group of studies investigating the efficacy of high mental imagery techniques for which consent from the Research on Human Participants Ethical Committee of the University of the Witwatersrand has been previously obtained. In addition, the parents/legal guardians of the participants were required to provide written informed consent to allow their child to participate in the study and to permit the researcher access to the academic, medical and psychological information contained in the child's school records (see appendixes ii and iii). Informed, written consent was also obtained from the school headmaster to utilise the school facilities and access it's learners for research purposes (appendix i). The participants themselves were also required to provide verbal assent before participating (appendix v) (Barret, 1997).

Confidentiality of the participants was strictly maintained and their anonymity assured in all documentation and reporting of study findings. Information directly related to the participants' involvement in the study was destroyed upon completion of the research, thereby ensuring that strict confidentiality and anonymity continues to be maintained (Barret, 1997). Participation in the research was also emphasised as being purely voluntary and their ability to withdraw from the study at any time without explanation or negative consequence highlighted to the participants and their parents in the information sheet provided prior to the commencement of the study (appendix ii and iii) (Barret, 1997).

It was also ensured throughout the execution of this study that the participants were not harmed nor their school program or academic progress negatively interfered with as a result of their involvement in this research, which ran independently from the remedial primary school curriculum. Upon request, parents of the participants were allowed access to their child's pre and post test results, reflecting the progress made by the child, and the general trends found in the study upon completion thereof.

4.6 Summary of Chapter:

In this chapter, the methodology utilised to implement this research has been outlined. The rationale for the aggregated case study design of this study was initially detailed after which the purposive, non-probability sampling strategy and research procedures employed to gather the required data elaborated upon. The qualitative and quantitative data gathering instruments including the psychological assessment battery utilised in pre and post testing, were then specified and discussed, showing how the resultant data collected through these measures and questionnaires would then be analysed and the research questions addressed. The research questions in this study focus specifically on the participants' successive and simultaneous cognitive processing abilities as well as their skills in reading, spelling and writing and the nature and extent to which improvements were made in these areas following the intervention period, pending on the remedial technique utilised (high mental imagery versus phonological). Finally, ethical considerations taken into account in this study to ensure confidentiality, anonymity and the well being of the participants at all times, were specified.

Chapter Five: Results

The case studies including the background histories and a discussion of the pre- and post test results of the study participants, as well as their progress made throughout the study intervention period, is presented in this chapter. The results of the participants comprising the experimental group are initially outlined, following which the results of those comprising the contrast group are expounded upon. Each participant has been allocated a *unique two letter code* to allow for their identification within the study whilst maintaining confidentiality. The first letter of the code denotes into which group the participant falls being either *E* (experimental group) or *C* (contrast group). The second letter of the code is either an *A*, *B*, *C* or *D*, denoting into which matched pair the participant belongs. For example, the participant EA of the experimental group (indicated by the *E*), was matched with participant CA of the contrast group (represented by the *C*), as denoted by the *A* which is present in both in their codes respectively. Likewise, participant EB was matched with participant CB, participant EC with participant CC and participant ED with participant CD.

5.1 Participant EA (See appendix xv):

5.1.1 Background information:

EA is a first language English speaking female who was 11 years 6 months old at the time of commencement of the remediation. EA resides with her parents and sister who is 3 years older than her and attends mainstream schooling. EA is of South African decent and her home language is English. She is also conversant in basic Afrikaans (oral and written).

EA was born at full term via forceps delivery. Her mother's pregnancy with her was uneventful. EA weighed 3,0 kg at birth. Her physical developmental milestones fell within the normal range although her verbal milestones were slightly delayed. She has no medical history of note. EA attended weekly Occupational Therapy from the ages of 7 – 9 years to remediate visual-perceptual-motor difficulties which were assessed as being apparent. According to various Occupational Therapy progress reports available, this improved over the course of therapy received. She also received Speech Therapy concurrent to this to improve auditory processing and speech difficulties she suffered from.

EA started Grade 0 in a mainstream primary school where she also subsequently completed Grades I – III. During Grade III at school, it became particularly apparent that EA was struggling to cope academically. She was lagging behind in her work and her reading and writing ability was poor compared to that of her peers. Her attentional and planning skills are also noted to have been poor. EA was diagnosed as suffering from Attention Deficit Disorder (in view of her poor attentional abilities although hyperactivity was not particularly apparent). She was prescribed Ritalin which she took for several months. This was discontinued when her parents decided to pursue homeopathic and dietary alternatives to attempt to enhance EA's cognitive and academic performance. EA was not taking any medication during the period of time that she was involved in this study. EA was noted to be a cooperative and conscientious child however she struggled to grasp concepts and work at an adequate pace in class. The quality of her performance fluctuated, particularly as her reduced attentional capacities were exceeded. As a result, she lagged behind in mainstream schooling. Her self confidence and self esteem were also noted to be low in view of her awareness that she was struggling to cope in class and EA began to isolate herself socially, despite having adequate social skills. Following a psychoeducational assessment, EA commenced Grade IV at the remedial school where she continues to receive schooling in Grade V.

EA reports to enjoy attending the remedial primary school although notes that she dislikes homework and maths. Her current teacher reports her to be participative and cooperative in class, although she at times needs encouragement to pay attention, persevere and to complete tasks. She is noted to sometimes also experiences difficulty in listening and with following instructions, although this is improving. She is considered to be friendly and helpful and eager to learn and appears to be well liked by her classmates with whom she seems to get on well with socially. Her verbal, artistic and creative abilities are reported to be very good although assistance is still required in numeracy, comprehension, reading and spelling, which are reported to be her greatest scholastic weaknesses although improvement, particularly in her spelling and reading abilities have been evident to both the teacher and her mother throughout Grade V.

EA was internally motivated to attend the tuition sessions and her attendance record was excellent, allowing EA to accumulate 30 sessions over the intervention period. EA was tutored in accordance with the high imagery remedial technique methodology and as such received 2 sessions of Level One of the programme, 5 sessions on Level Two of the

programme, 14 sessions of Level Three of the programme and 9 sessions on Level Four of the programme with laddering and flexibility between the levels apparent throughout the sessions to stimulate interest and to maintain EA’s motivation and encourage increased participation, with the tutor assuming an increasingly facilitative and ‘back seat’ role as the sessions progressed (See summary of daily diary of sessions in appendix xxiii).

5.1.2 Mental imagery:

Summary of EA’s ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (*Key: ✓ = ability to engage in an element*)

<u>Specific element in the targeted revisualisation process</u>	<u>Pre-testing</u>	<u>Post-testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓	✓
3. Is able to transform the revisualised image of the word into written output.	✓	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.		✓
5. Is able to transform the mental image of a word into written output after a delayed period of time.		✓
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	✓	✓
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.	✓	✓
8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.		✓
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.		✓
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.	✓	✓
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.		
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.		✓

As indicated above, during pretesting, EA reported that she was able to visualise and revisualise a word in her mind, reporting that she was able to read the letters of the word from the image of it in her mind. The visual image was reported as resembling a mental picture of the form and structure of the word. It was more colourful than the original and moved around

at a slow pace within her mind. She demonstrated some capacity to manipulate and transform these mental images into oral and written output.

Initially, EA reported that this image faded quickly and that, should she want to recall the word at a later stage, she would be able to do so but would experience difficulty reading the word and spelling it from the visual image due to temporal decay thereof, with the word becoming more 'fuzzy' or 'blurry' and thus harder to focus upon in her mind. Upon post testing however, EA described that her ability to visualise and revisualise images had improved over the course of the intervention period. She seemed to be able to utilise her visual imagery skills further to facilitate her learning of words. EA reported that she was now able to visualise and revisualise words and sentences learnt more clearly and that she was able to read the letters of the words at a later stage even after the tuition session and thus could spell the word more correctly as a result thereof. Even later on in the day and during the following day and during tests or at a time when EA was required to recall words that had been targeted, she reported to be able to sometimes revisualise the words in her mind and thus spell them correctly from the image. EA appeared to have greater awareness of her ability to manipulate and transform mental images into oral and written output in post-testing and seemed to be able to more successfully harness this skill to her advantage when learning words.

5.1.3 Intelligence and cognitive processing test scores (see table 20.4 in appendix xv for raw scores):

EA underwent psycho-educational assessment in September 2003 and her intellectual abilities were assessed utilising the WISC- III. Her Full-Scale IQ was measured to falling within the below average range. Her Verbal IQ falls within the average range and her Non-Verbal/Performance IQ falls within the borderline range. There is a significant difference between EA's Verbal and Non-Verbal IQ scores, which indicates that she suffers from a non-verbal learning disability. Her verbal abilities are her significant strength.

There is also evidence of intra- and inter-test scatter indicative of relative areas of strength and weakness. With regards to the verbal scales, her relative strengths appear to be her understanding of social and moral norms. Her comprehension skills, auditory/verbal processing and sequencing skills are adequate. Her relative weaknesses within the verbal realm are her short term auditory memory (for contextualised and non-contextualised

information) and her numerical reasoning skills. Her vocabulary is adequate although her expressive language skills are reduced for her age. Her reduced attentional skills appear to have affected her performance on the verbal (and non-verbal) memory related tasks. Her level of distractibility is noted to be of concern in view of her reduced concentration span. There is also evidence of underlying anxiety, which is likely to have further negatively impacted on her attentional skills.

There is marked intertest scatter apparent within the Non-Verbal subtests, indicating that EA has areas of significant non-verbal learning difficulty. Relative non-verbal strengths are her visual discrimination skills and concrete spatial reasoning abilities. Her abstract spatial reasoning skills and ability to mentally manipulate visual images are relative non-verbal weaknesses for her. As evident from her delayed score on the Coding subtest, her non verbal sequencing and visual processing skills are significantly weak greatly reducing her rate of work, particularly in reading and writing.

Table 1: Pre and post testing CAS and K-ABC results of participant EA:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	1	Nonverbal Matrices	1
Sentence Repetition	0	Verbal Spatial Relations	1
Sentence Questions	4	Figure Memory	2
Sum of gains made	5	Sum of gains made	4

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	2	Gestalt Closure	1
Number Recall	3	Triangles	0
Word Order	1	Matrix Analogies	0
Sum of gains made	6	Spatial Memory	0
		Photo Series	1
		Sum of gains made	2

As apparent from the above description of EA's intellectual capabilities and intertest scatter as measured on the IQ battery, EA experiences cognitive difficulties particularly of a

simultaneous processing nature. Her sequential processing abilities appear to be a significant strength. Her performance on those subtests within the IQ battery requiring sequencing and logical mental processing generally fall within the average range, both verbally and non-verbally, indicate that she prefers to process information successively. Her adequate comprehension skills, auditory processing abilities and verbal sequential processing skills support the hypothesis that her sequential processing skills are a relative strength. Some difficulties in this regard are still apparent however, as evident from her reduced numerical skills and poor coding ability, the latter which is also evident of problems with her sequential processing ability particularly at speed and in tasks which require motor output. Simultaneous processing, on the other hand, appears to be difficult for her. EA performed within the overall borderline range on the IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information. Her significantly higher Verbal IQ is characteristic of learners who much prefer to process information successively as opposed to simultaneously.

Over the course of the remedial period utilising high imagery remedial techniques, EA made improvements in both her successive and simultaneous processing abilities as apparent upon perusal of her pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. Overall, the gains she made on the K-ABC and CAS correspond.

Although her relative strength, gains in her successive/sequential processing abilities are apparent. EA made a raw score gain of 5 as measured on the CAS and 6 as measured on the K-ABC. Her raw score gain of 4 on the Sentence Question subtest of the CAS is indicative of an increased ability to process information logically and express verbal information more coherently. This is also suggested by her raw score gain of 1 on the Word Series subtest. The gains made on the Number Recall subtest (raw score gain of 3) and Word Order subtest (raw score gain of 1) indicate that gains in her ability to process and organise verbal information sequentially is apparent. The raw score gain of 2 that EA obtained on the Hand Movements subscale of the K-ABC is indicative of an improvement in her ability to process visual information sequentially as related to tasks requiring motor output.

Gains in her simultaneous processing abilities are also evident, although these are less marked than the gains she made in her sequential processing skills. EA obtained a raw score gain of 4 and 2 on the simultaneous processing subtests of the CAS and K-ABC respectively. Raw

score gains of 2 and 1 on the Figure Memory and Nonverbal Matrices subtests of the CAS respectively and 1 and 1 on both the Gestalt Closure and Photo Series of the K-ABC subtests respectively are indicative of her improved ability to process and recall spatial/visual information holistically and to discern the spatial relationships that are apparent therein. Her raw score gain of 1 on the Verbal Spatial Relations subtest is indicative of slight improvement in her ability to link corresponding verbal and visual information more effectively. EA's attentional abilities are also of concern however and these are likely to negatively impact on her cognitive processing skills.

5.1.4 Phonic inventories (See table 20.1 and 20.2 in appendix xv for results):

EA shows notable improvements in her spelling abilities as evident from an analysis of her errors made on the Phonic Inventories in pretesting and post testing. On Level One, EA made improvements in her ability to use medial vowels (10 errors to 6). Four fewer errors were made in her utilisation of ending consonants blends (10 to 6). On Level Two, EA's greatest improvements were made in her ability to utilise medial vowels and medial vowel digraphs. She also made fewer errors in long-short vowel and consonant-sound confusions on post testing. On Level Three, EA showed some improvement in her usage of suffixes (10 errors to 6) and prefixes (4 errors to 2). Fewer medial vowel errors are also apparent on Level Three.

5.1.5 Reading and spelling scores (see table 20.3 in appendix xv for raw scores):

Table 2: Pre and post testing reading and spelling score results of participant EA:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	5 months	2
Schonell One Word Spelling Test	10 months	9
Schonell One Word Reading Scale	5 months	4
Schonell Graded Dictation B	4 (positive score gain)	4 Reduction of errors
Schonell Graded Dictation C	2 (positive score gain)	2 Reduction of errors
Schonell Graded Dictation D	Not done – too advanced	Not done – too advanced

It is apparent from the above table that EA made improvements in both her reading and spelling ability as evident from the comparison of her results obtained on the pre and post testing battery. In reading, EA attained a raw score gain of 2 on the Holborn Reading Scale and 4 on the Schonell One Word Reading Scale. The tutor had noted that EA's reading pace and fluency had also increased over the intervention period. In addition her comprehension abilities have also been reported to have improved. EA improved in her ability to read silently

and to read with understanding of the meaning of the text, as indicated by her improved ability to summarise by picking out key points and main ideas.

As apparent from the above results, EA has also made a marked improvement in her spelling ability with a raw score gain of 9 on the Schonell One Word Spelling Test. Increased performance on the Schonell Graded Dictation tests is also evident. Continued errors made on these tests include the incorrect usage of medial vowel digraphs, long and short vowels and particularly the use of *e* at the end of a word, as well as ending consonant blends.

Improvement in her usage of medial vowels and her ability to correctly use some ending consonant blends and vowel digraphs are apparent.

5.1.6 Writing ability:

It is apparent from the analysis of EA's writing samples taken at the beginning and end of the remediation period, that she has increased in confidence as well as in her understanding of the usage of English grammar, sentence structure and punctuation. Although still reluctant to engage in creative writing independently and facilitation from the tutor is required to identify key ideas from comics utilised in the tuition sessions in accordance with high imagery remedial techniques, EA became increasingly able to do so independently and to write sentences pertaining to a single idea which then follow on to form a paragraph and subsequently a story. These also became increasingly descriptive in nature. However, since creative writing is a challenging task requiring initiative and risk taking, EA was still not internally motivated to do so, although did enjoy writing stories from comics and illustrating her stories, thus making them her own. Towards the end of the intervention period however, EA seemed to find this to be less difficult.

5.2 Participant EB (see appendix xvi):

5.2.1 Background information:

EB is a second language English speaking female who was 11 years 8 months old at the time of commencement of the remediation. EB resides with her mother, step father and 2 siblings (a 17 year old brother and 7 year old sister). Both her siblings attend mainstream schools although her sister has been diagnosed as suffering from ADHD. Her parents divorced when EB was 5 years old. She visits her father on alternative weekends. EB is of South African decent and her home language is northern Sotho. She has always been schooled in English

however and has been exposed to English since an early age, being able to express herself in English prior to attending school. She is fluent in Northern Sotho (oral and basic written) and is also conversant in basic Afrikaans (oral and written).

EB was born via normal vaginal delivery at full term. Her mother was healthy during her pregnancy with EB although she notes that she was exposed to psychosocial stressors at the time. EB was small at birth, weighing 2,5 kgs. She suffered jaundice at birth, requiring ultraviolet light therapy for several days as a result. Her physical and verbal developmental milestones are noted to have fallen within the normal range. EB suffers from myopia, which is corrected with glasses. There is no other medical history of note. EB has received both Occupational Therapy and Speech Therapy to date. Her visual perceptual motor skills were found to be reduced and formed the focus of Occupational Therapy treatment, which was received on a weekly basis for 3 years 6 months, commencing in Grade 1. Speech Therapy was also received for a total of 3 years, although not successively, the aim of which was to facilitate her language development. These therapies had been terminated at the time that EB commenced her participation in this study.

EB started Grade 0 in a mainstream primary school where she also completed Grades 1 and 2. She had to repeat Grade 1 once at this school. During Grade II, it became particularly apparent that EB was struggling academically and performing below average in comparison to her peers. She was found to struggle to listen to and process instructions, have difficulty completing her work and keeping up with the pace of work required. In particular, she was noted to have difficulty with oral and written expression of her thoughts and ideas in English, and to have poor spelling, reading and numeracy skills. Her memory capacity and ability to process information logically and in a meaningful manner is noted to be problematic. In class, EB was noted to be a quiet and apprehensive learner who experienced difficulty asking for help or asking questions when she is struggling in class. She is noted to be very eager to please and to experience performance anxiety when expected to complete tests or assessments. EB is however reported to be a very friendly and cooperative learner who relates well socially with her peers and authority figures. She is reported to experience intense feelings of frustration and inadequacy in view of her academic difficulties. EB entered remedial school in Grade III where she is currently completing Grade V.

EB's teacher reports that she has observed some improvements in EB's spelling, writing and oral reading abilities over the time of the intervention period. She is reported to have made improvements in her ability to process information more logically and to structure her thoughts more effectively when expressing herself verbally and in writing. She is also reported to have made gains in terms of her own self confidence in English writing and reading. Her ability to use pronouns and tenses and to structure sentences in a grammatically correct manner is also noted to have improved. EB subjectively reports that her spelling and reading skills have improved and that she feels more able to converse in English effectively as compared to prior to the remedial programme. EB was internally motivated to attend the tuition sessions and her attendance record was good, allowing EB to accumulate 25 sessions over the intervention period. EB was tutored in accordance with the high imagery remedial technique methodology and as such received 3 sessions of Level One of the programme, 4 sessions on Level Two of the programme, 11 sessions of Level Three of the programme and 7 sessions on Level Four of the programme with laddering and flexibility between the levels apparent throughout the sessions to stimulate interest and to maintain EB's motivation and encourage increased participation, with the tutor assuming an increasingly facilitative and 'back seat' role as the sessions progressed (See summary of daily diary of sessions in appendix xxiii).

5.2.2 Mental imagery:

Summary of EB's ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (Key: ✓ = ability to engage in an element)

<u>Specific element in the targeted revisualisation process</u>	<u>Pre-testing</u>	<u>Post-testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓	✓
3. Is able to transform the revisualised image of the word into written output.	✓	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.		✓
5. Is able to transform the mental image of a word into written output after a delayed period of time.		✓
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	✓	✓
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.	✓	✓

8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.		✓
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.		✓
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.	✓	✓
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.		
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.		✓

As indicated above, initially, EB reported seeing the mental image of a visual stimulus vaguely in her mind when asked to visualise its form and structure. She reported that words were imaged as they were written on the page in her workbook that she was asked to look at and then required to revisualise. If the original words were printed in colour, her mental images appeared in the same colours. If no colour was included in the stimuli however, her mental image would appear as black and white. Her mental images of words were reported as stationary and not very clear, fading quickly after a few seconds. EB was not able to recall the images once they had faded. She showed some ability to manipulate her mental images.

During post testing, EB reported that she felt that her ability to visualise, revisualise and manipulate images had developed over the intervention period as a result of the implementation of imagery remedial techniques. She reported the same congruence between the form and structure of the word on the page and the form and structure of the mental image of the word, but also reported that the mental images had improved in clarity. She was now able to read the word from the page in her mind to recall it. She noted however, that once she had said the word, it disappeared from her mind. She was then able to recall, revisualise and manipulate the image with it being less clear upon recall. EB reported that she was finding the high imagery approach to remediation to be a useful method to facilitate her learning of English orthography and felt that she was able to do more successfully at post testing.

5.2.3 Intelligence and cognitive processing test scores (see table 21.4 in appendix xvi for raw scores):

EB underwent psycho-educational assessment in March 2003. EB's Full Scale IQ on the SSAIS-R places her in the upper limits of the below average range of intellectual functioning. There is no significant difference between her Verbal and Non-Verbal IQ. Her Verbal IQ falls

within the upper limits of the below average range. Her Non-Verbal IQ falls within the lower limits of the average range. Her non-verbal abilities are therefore her relative strength.

There is however significant intra- and inter-test scatter indicating areas of learning difficulty. With regards to the verbal scales, her relative strengths appear to be her understanding of social and moral norms. Numerous relative weaknesses exist however, including her auditory/verbal processing and sequencing skills, numerical abilities, English vocabulary and expressive English language skills. Her short term auditory memory for contextualised and non-contextualised verbal information is a significant weakness. EB appears to lack confidence in particularly her verbal abilities and displayed a tendency to give up easily rather than attempt to persevere on more challenging verbal subtests.

Although her relative strength, the inter-test scatter within the non-verbal subtests indicates that difficulties are apparent. Relative non-verbal strengths are EB's understanding of part whole relationships and visual discrimination abilities. Relative non-verbal weakness exist including a reduced visual memory capacity, reduced concrete and abstract non-verbal reasoning skills and a decreased ability to mentally manipulate spatial designs. Her motor/visual processing speed is slow as apparent from her borderline coding score, which will affect her ability to engage in reading and writing at an age appropriate level. There is evidence from the assessment that EB is hypervigilant with underlying anxiety being present. Some evidence of reduced complex attentional skills and cognitive flexibility with a limited problem-solving (verbal and non-verbal) capacity is apparent. This is likely to have further reduced her scores on the verbal and non-verbal subtests.

Table 3: Pre and post testing CAS and K-ABC results of participant EB:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	1	Nonverbal Matrices	2
Sentence Repetition	0	Verbal Spatial Relations	1
Sentence Questions	2	Figure Memory	2
Sum of gains made	3	Sum of gains made	5

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	1	Gestalt Closure	1
Number Recall	0	Triangles	1
Word Order	5	Matrix Analogies	1
Sum of gains made	6	Spatial Memory	4
		Photo Series	2
		Sum of gains made	9

As apparent from the above description of EB's intellectual capabilities and intertest scatter as measured on the IQ battery, EB experiences cognitive difficulties of both a simultaneous and successive nature. Her simultaneous processing abilities appear to be her relative strength however. Her performance on those subtests within the IQ battery requiring sequencing and logical mental processing are reduced, both within the verbal and non-verbal spheres, indicative of difficulties that she experiences in successive processing. Her processing speed is also reduced, as apparent from her reduced auditory processing skills, poor coding score and numerical abilities, for which adequate successive processing abilities are essential. Her English vocabulary is reduced and her comprehension skills and ability to use words within the context of sentences and paragraphs limited, which is indicative of her reduced successive processing skills. Simultaneous processing appears to be her relative strength in comparison. EB performed more competently on those IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information. These are tasks which demand intact simultaneous processing skills. Her higher Non-Verbal IQ is characteristic of learners who prefer to process information simultaneously as opposed to successively.

Over the course of the remedial period utilising high imagery techniques, EB made improvements in both her successive and simultaneous processing abilities as apparent upon perusal of her pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. These gains made appear to be marked.

With regards to her successive/sequential processing abilities, EB made a raw score gain of 3 as measured on the CAS and 6 as measured on the K-ABC. Her raw score gains of 2 and 1 on the Sentence Question and Word Series subtests of the CAS are indicative of an increased

ability to process information logically and express verbal information more coherently. This is also suggested by her raw score gain of 5 on the Word Order subtest of the K-ABC. The slight raw score gain of 1 that EB made on the Hand Movements subscale of the K-ABC is indicative of a slightly improved ability to process visual information sequentially and of her increased psychomotor processing and is likely to impact positively on her writing skills.

Although her relative strength, gains in her simultaneous processing abilities are also apparent and significant. EB made a raw score gain of 5 and 9 on the simultaneous processing subtests of the CAS and K-ABC respectively. Raw score gains of 2 on both the Nonverbal Matrices and Figure Memory subtest of the CAS are indicative of her improved ability to process and recall spatial/visual information holistically and to discern the spatial relationships that are apparent therein. Gains are apparent on the Gestalt Closure, Triangles, Matrix Analogies, Spatial Memory and Photo Series subtests of the K-ABC, which are also indicative of these improvements. Her raw score gain of 1 on the Verbal Spatial Relations subtest is indicative of a subtle improvement in her ability to relate verbal information to into corresponding visual/non-verbal material.

5.2.4 Phonic inventories (See table 20.1 and 20.2 in appendix xvi for results):

EB shows improvements in her spelling abilities as evident from an analysis of her errors made on the Phonic Inventories in pretesting and post testing. On Level One, EB made improvements in her ability to use initial (1 error reduction) and ending consonants blends (6 to 2). No gains are apparent on Level Two, with EB obtaining equivalent scores on the various Level Two categories. On Level Three, EB showed some improvement in her usage of syllabification (5 to 3). Slight gains (1 error reduction) are also apparent in medial vowel/digraphs and ending consonant blends.

5.2.5 Reading and spelling scores (see table 21.3 in appendix xvi for raw scores):

Table 4: Pre and post testing reading and spelling scores results of participant EB:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	14 months	5
Schonell One Word Spelling Test	14 months	12
Schonell One Word Reading Scale	15 months	12
Schonell Graded Dictation B	3 (positive score gain)	2 Reduction of errors
Schonell Graded Dictation C	7 (positive score gain)	7 Reduction of errors
Schonell Graded Dictation D	1 (positive score gain)	1 Reduction of errors

It is apparent from the above table that EB made noticeable improvements in both her reading and spelling ability as evident from the comparison of her results obtained on the pre and post testing battery. In reading, EB attained a raw score gain of 5 on the Holborn Reading Scale and 12 on the Schonell One Word Reading Scale. With regards to her reading, EB's tutor reports that she is able to read with greater fluency and understanding. With practice, her comprehension skills and ability to pick out key points from a text and answer questions relating to the text have improved. Although some improvement has been reported in terms of EB's oral reading as well, her pronunciation of English words remains problematic at times.

As apparent from the above results, EB has also made marked improvement in her spelling ability with a raw score gain of 12 on the Schonell One Word Spelling Test. Increased performance on the Schonell Graded Dictation tests is also evident. Perusal of her performance on these tests indicates that EB has made improvements in her ability to use medial vowel digraphs and ending consonant blends. She also appears to be using suffixes and prefixes more appropriately. EB continues to make careless spelling errors however and appears to continue to struggle at times to generalise her spelling skills to words which have not yet been targeted within the sessions. An over reliance on phonological rules to spell words continues to be evident.

5.2.6 Writing ability:

Analysis of initial creative writing done by EB in work books available during the time of pre testing showed that EB did not plan what she intended to write or the idea/story she was attempting to convey. As the remedial programme progressed, EB was increasingly able to plan and structure what she wanted to write and what idea she wanted to convey, initially in the construction of a single sentence and then in a paragraph. She was encouraged to just think about one idea she wanted to write about rather than too many, thus making the task of writing more accessible to her. Analysis of writing by EB done during the latter part of the remedial programme showed increased structure and planning in this regard. Punctuation and tense usage had also improved. EB was also introduced to the concept of mind-mapping to assist in the planning of stories, which she found useful. Furthermore, writing from comics also assisted EB to plan her thoughts and ideas with reference to her writing so that this was of a more logical nature.

5.3 Participant EC (see appendix xvii):

5.3.1 Background information:

EC is a first language English speaking male who was 11 years 11 months old at the time of commencement of the remediation. EC resides with his parents and sister who is 6 years older than him and attends mainstream schooling. EC is of South African decent and his home language is English. He is however also conversant in basic Hebrew. EC's ability in this regard is only verbal in nature and he does not have the ability to write in Hebrew. He is also conversant in basic Afrikaans (oral and written).

EC was born three weeks premature. His mother's pregnancy with him is otherwise noted to have been uneventful. EC was small at birth, weighting 2,1 kgs. He was required to spend three days in an incubator post birth, following which he was discharged from hospital. No other significant medical history was reported. EC progressed normally through his developmental milestones, sitting at 6 months, walking at 11 months, saying his first word at 9 and a half months and constructing sentences at 18 months. No impairment in his motor coordination skills were reported by his parents when EC was a child other than that EC had always been very physically small for his age. EC attends weekly Occupational Therapy sessions which commenced at the beginning of 2003, where the focus of remediation has been upon improving his fine coordination abilities, facilitating improved postural control and reducing his hypotonia. His pencil pressure as well as the size and spacing of his written work have improved as a result thereof.

EC started Grade 0 in a mainstream primary school where he also completed Grade I and Grade II. During Grade III at the school, it became particularly apparent that EC was struggling to cope academically. His difficulties were particularly evident in his inability to read and spell in accordance with age related norms. Reversals and omissions commonly characterised his spelling. Comprehension abilities however were noted to be good. EC's behaviour too was reported to be unproblematic with him being described as a compliant, quiet, friendly and somewhat shy child who always tried his hardest to perform his best and to work neatly. EC's inability to cope scholastically resulted in reduced self esteem and in feelings of frustration and insecurity. Following an educational assessment in June 2002, EC was moved to the remedial school where he is currently completing Grade V. In the

educational assessment conducted, EC was diagnosed as suffering from dyslexia which is in keeping with the profile of his performance on the testing battery.

EC was described as being a cooperative, friendly and mature individual by his current teacher and as being well liked by his peers and well integrated into his class. It was reported that EC does not shy away from a challenge and does persevere to complete tasks, desiring to do so properly. His attention to detail and over concern with neatness however, was noted to result in a reduced rate of work on occasion. Some difficulty in EC's ability to follow instructions was also apparent at times. His concentration and ability to think and reason however, was considered to be good. EC was reported to experience some frustration as a result of his own inability to spell correctly and with the persistent errors he makes in this regard. EC's teacher reported that she has seen improvements in EC's spelling and reading ability over the course of the remediation. She noted that EC's increased awareness in particular of his spelling errors has been significant. EC's mother also noted that improvement in EC's spelling has been good following remediation reporting that he was more aware of his spelling and that frequently, after writing a word incorrectly, he was able to correct it independently and without facilitation and thus able to spell it correctly on a second attempt.

EC was internally motivated to attend the tuition sessions and his attendance record was good, allowing EC to accumulate 25 sessions over the intervention period. EC was tutored in accordance with the high imagery remedial technique methodology and as such received 4 sessions of Level One of the programme, 4 sessions on Level Two of the programme, 10 sessions of Level Three of the programme and 7 sessions on Level Four of the programme with laddering and flexibility between the levels apparent throughout the sessions to stimulate interest and to maintain EC's motivation and encourage increased participation, with the tutor assuming an increasingly facilitative and 'back seat' role as the sessions progressed (See summary of daily diary of sessions in appendix xxiii).

5.3.2 Mental imagery:

Summary of EC's ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (Key: ✓ = ability to engage in an element)

<u>Specific element in the targeted revisualisation process</u>	<u>Pre-testing</u>	<u>Post-testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓	✓
3. Is able to transform the revisualised image of the word into written output.	✓	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.		✓
5. Is able to transform the mental image of a word into written output after a delayed period of time.		✓
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	✓	✓
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.		✓
8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.		✓
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.		
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.		✓
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.		
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.		

EC was both pre and post tested on the mental imagery questionnaire. As indicated above, during pretesting, EC reported that he experienced difficulty in being able to mentally visualise stimuli, with him requiring an extended periods of time to focus on and look at the word prior to being able to visualise it. In addition, it was apparent that the image faded very quickly from EC's mind, decaying rapidly as if fading into the background, thus making it illegible to EC. EC reported that in the image he was able to see the word as if it were printed in black on a page. Sometimes the background was white, and other times the background was black which made the word harder to see. He never saw any colour in his images, even if colour was present in the word that he was visualising on the page. EC noted that once the word had faded, it was very difficult for him to be able to recall the image into his mind.

At time of post-testing, EC reported that over the intervention period, his ability to utilise and manipulate imagery as a tool in the learning of spelling had improved. He reported that although he still saw no colour in his images, his initial images were clearer and lasted longer and he was able to recall the image if he wanted to. However, if an extended period of time had elapsed since the initial visualisation had taken place, he was not able to recall the image

of the word, thereby suggesting that EC still found temporal decay of the images to be problematic. EC also reported that he experienced what can only be described as ‘overload’ of his visual memory in that he frequently reached a point where he could not visualise any more and had to take a break to ‘clear’ his visual memory as a result of ‘full’ storage. When reaching the overload point, EC’s ability to visualise and revisualise decreased as evident in the spelling mistakes made upon pronunciation of the words and the rapid decay of the words from his visual memory due to interference. EC reported that he found the imagery techniques he had used in therapy useful in facilitating the learning of words. He also reported that he had observed an improvement in his own spelling ability as a result thereof.

5.3.3 Intelligence and cognitive processing test scores (see table 22.4 in appendix xvii for raw scores):

As measured on the WISC-III in the psychoeducational assessment conducted in June 2002, EC’s Full-Scale IQ falls within the lower limits of the average range. His Verbal IQ score falls within the lower limits of the average range and his Non-Verbal IQ score within the average range. Although no significant discrepancies were apparent between his verbal and performance intelligence quotients, it is evident that his non-verbal abilities are slightly better than his verbal abilities are revealed by the intellectual assessment scores.

There is intra and inter-test scatter indicative of some areas of learning strength and difficulties. With regards to the verbal scales, his relative strengths are his understanding of social and moral norms and verbal abstract reasoning skills. His English vocabulary skills are a significant strength. His relative weaknesses within the verbal realm are his numerical reasoning skills and short term auditory memory for non-contextualised and contextualised information. He has a slow processing speed as indicated by his borderline performance on the coding subtest, which will impact on his ability to perform timed tasks. This will also affect his ability to read and write at an age appropriate level.

Marked scatter is apparent within the non-verbal subtest scores, indicating that whilst EC’s non-verbal abilities are his relative strength, he still experiences difficulties within the area. With regards to reading and writing, his difficulties in this area are apparent in view of the reversals and omissions evident in his writing. Significant non verbal strengths are his concrete and abstract spatial reasoning skills and understanding of part-whole relationships. EC’s visual discrimination abilities and visualisation abilities, non verbal sequencing and

visual processing skills are significant non verbal weaknesses for him. There are some signs of inattention and distractibility, particularly on tasks requiring mental manipulation. Evidence of hypervigilance and underlying anxiety with possible perfectionist tendencies were noted to apparent, thus further contributing to his reduced rate of work. This is noted to have affected his performance on the standardised intellectual battery, particularly in relation to his performance on timed sub-tests.

Table 5: Pre and post testing CAS and K-ABC results of participant EC:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	0	Nonverbal Matrices	3
Sentence Repetition	0	Verbal Spatial Relations	0
Sentence Questions	3	Figure Memory	3
Sum of gains made	3	Sum of gains made	6

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	5	Gestalt Closure	1
Number Recall	2	Triangles	0
Word Order	1	Matrix Analogies	0
Sum of gains made	8	Spatial Memory	1
		Photo Series	1
		Sum of gains made	3

As apparent from the above description of EC's intellectual capabilities and intertest scatter as measured on the IQ battery, EC experiences cognitive difficulties of both a simultaneous and successive nature. His simultaneous processing abilities appear to be his relative strength however. His performance on those subtests within the IQ battery requiring sequencing and logical mental processing are reduced, both within the verbal and non-verbal spheres, indicative of difficulties that he experiences in successive processing. EC also suffers from dyslexia and experiences difficulty with the logical and successive processing of letters and words, as characteristic of this disorder, which is also indicative of the difficulties that EC experiences within the successive realm. His processing speed is also reduced, as apparent

from his poor coding score and numerical abilities, for which adequate successive processing abilities are essential. His English vocabulary is good although his comprehension skills and ability to use words within the context of sentences and paragraphs are limited, which is indicative of his reduced successive processing skills. Simultaneous processing appears to be his relative strength in comparison. EC performed more competently on those IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information. These are tasks which demand intact simultaneous processing skills. His higher Non-Verbal IQ is characteristic of learners who prefer to process information simultaneously as opposed to successively.

Over the course of the remedial period utilising high imagery techniques, EC made improvements in both his successive and simultaneous processing abilities as apparent upon perusal of his pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. These gains made appear to be marked.

With regards to his successive/sequential processing abilities, EC made a raw score gain of 3 as measured on the CAS and 8 as measured on the K-ABC. His raw score gain of 3 on the Sentence Question subtest of the CAS is indicative of an increased ability to process information logically and express verbal information more coherently. This is also suggested by his raw score gains of 1 and 2 respectively on the Word Order and Number Recall subtests of the K-ABC. The significant raw score gains that EC made on the Hand Movements subscale of the K-ABC is indicative of an improved ability to process visual information sequentially and of his increased psychomotor processing, as also assessed by the Coding subtest of the IQ battery, and is likely to impact positively on his writing skills.

Although his relative strength, gains in his simultaneous processing abilities are also apparent. EC made a raw score gain of 6 and 3 on the simultaneous processing subtests of the CAS and K-ABC respectively. Raw score gains of 3 on the Nonverbal Matrices and Figure Memory subtest of the CAS are indicative of his improved ability to process and recall spatial/visual information holistically and to discern the spatial relationships that are apparent therein. Slight gains are apparent on the Gestalt Closure, Spatial Memory and Photo Series subtests of the K-ABC, which are also indicative of these improvements.

5.3.4 Phonic inventories (See table 22.1 and 22.2 in appendix xvii for results):

EC has shown improvements in his spelling abilities as evident from an analysis of his errors made on the Phonic Inventories. On Level One, EC's most noticeable improvements were made in his ability to use ending blends/clusters with errors being reduced from 8 to 1 in this category. On Level Two, EC's greatest improvements were made in his ability to utilise medial vowel digraphs (from 6 to 3) and ending blends/clusters (from 8 to 6) with errors in both these categories being reduced in post testing. Furthermore, in post testing EC only made 2 medial vowel errors in comparison to 8 errors in pre testing, thus showing marked improvement. In addition, long and short vowel confusions were reduced from 5 to 3 errors upon post testing. On Level Three, ending consonant errors were reduced from 5 to 3. Suffix errors are reduced to 5 and syllabification errors to 4 from 10 and 5 errors respectively in post testing.

5.3.5 Reading and spelling scores (see table 22.3 in appendix xvii for raw scores):

Table 6: Pre and post testing reading and spelling scores results of participant EC:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	6 months	2
Schonell One Word Spelling Test	7 months	6
Schonell One Word Reading Scale	6 months	5
Schonell Graded Dictation B	3 (positive score gain)	2 Reduction of errors
Schonell Graded Dictation C	5 (positive score gain)	5 Reduction of errors
Schonell Graded Dictation D	Not done – too advanced	Not done – too advanced

It is evident from the above table that EC made improvements in both his reading and spelling ability as evident from comparison of his results on the pre and post testing battery. In reading, EC attained a raw score gain of 2 on the Holborn Reading Scale and 5 on the Schonell One Word Reading Scale. The tutor had noted that EC's reading pace and fluency had also increased over the intervention period. In addition his comprehension abilities have also reported to have improved. EC experienced little difficulty in engaging in silent reading and was able to describe what he has read in summary and concisely, giving an indication that he was able to understand what he was reading and pick out key points and main ideas.

As apparent from the above results, EC has also made improvement in his spelling ability with a raw score gain of 6 on the Schonell One Word Spelling Test. Continued errors made on this test include errors on the usage of medial vowel digraphs as well as a reversal in the spelling of *flower* which EC spelt as *floewr* although he spelt this word correctly on the post

test phonic inventory Level Two thereby showing inconsistency in his spelling in this regard. The incorrect usage of the y as a vowel is also apparent in this test in EC's spelling of *noise* as *noys*. Increased performance on the Schonell Graded Dictation tests is also evident. Errors still apparent in his performance of these tests include medial vowel and medial vowel digraph errors as on the Phonic Inventory Levels Two and Three as indicated by errors made in the spelling of *church* /*cherch* and *turn*/*tern* as well as syllabification errors as evident in EC's spelling of *pretty* as *prety* in post testing.

5.3.6 Writing ability:

EC was able to convey his ideas quite logically as revealed in an analysis of his writing ability at the time of pretesting. EC appeared to understand what the purpose of a sentence was and was able to utilise basic punctuation correctly. Furthermore, EC was able to construct a paragraph utilising sentences which flowed logically on from each other. However initial writing was poorly descriptive and severely hampered by EC's reluctance to utilise words which he was unable to spell, thus also reducing the creativity of his writing. Whilst the basic grammatical structure of EC's sentences was good, EC confused his use of tenses in the sentences and in paragraphs. Furthermore, because of over attention to detail and concern about neatness, EC's writing speed was slow. Over the course of the intervention period it became evident that EC's writing ability had improved. He enjoyed constructing stories from comics which assisted in improving the creativity and descriptiveness of his creative writing. Furthermore, EC became more aware of the grammatical structure of his sentences and was encouraged to read over his sentence upon the completion thereof to check that his sentence made sense upon reading as well as to check for spelling errors. EC's writing rate however remained reduced.

5.4 Participant ED (see appendix xviii):

5.4.1 Background information:

ED is a first language English speaking male who was 11 years 7 months old at the time of commencement the remediation. ED resides with his mother and 3 year older brother who is currently attending mainstream schooling. ED's parents divorced three years ago and ED has struggled to come to terms with his parents divorce. He received psychological counselling for a year thereafter to assist him to adjust to this. He visits his father on alternative weekends

and during his school holidays. ED is of South African decent and his home language is English. He is also conversant in basic Afrikaans (oral and written).

ED was born 2 weeks post mature via normal vaginal delivery. His mother's pregnancy with him is otherwise noted to have been uneventful. ED weighed 3,8 kgs at birth. He was slightly jaundiced, requiring several days of ultra-violet light therapy to treat this. ED's physical and verbal milestones are reported to have fallen within the normal range. ED suffered from recurrent ear infections as an infant requiring grommets to be inserted at the age of 9 months. There is no other medical history of noted. ED attended Occupational Therapy for 3 years from the age of 7 to 10 years old. He has also attended remedial therapy for several years. ED was not attending any kind of therapy concurrent to the remediation sessions offered as part of this study. Occupational Therapy focused particularly on normalising his reduced tone and postural control and improving the quality of his pencil grip and control. Gains in these areas were made as apparent from Occupational Therapy progress reports available.

ED commenced mainstream schooling in Grade 0 after which he progressed into Grade 1. It was apparent during Grade 1 however, that he was impulsive and struggled to attend in class and concentrate on his school work. His performance in his school work was reduced compared to that of his peers. He was diagnosed as suffering from Attention Deficit Hyperactivity Disorder at this time and Ritalin was prescribed. Both the attentional and hyperactive aspects of this condition were noted to be apparent. ED was prescribed Ritalin, which he subsequently took for 3 years. His mother discontinued his Ritalin thereafter since she wished to instead pursue alternative dietary options to improve his attention and reduce his impulsivity. ED repeated Grade I in a special aid class at the mainstream school, progressing thereafter into Grade II in the special aid class. Attempts were made to reintegrate ED into mainstream schooling in Grade III however, he could not cope academically. He was found to be poor in reading, spelling, writing and mathematics with a tendency to be careless and distractible in class and act out when frustrated or upset. He often became tearful or worried because of his awareness of these difficulties and the sense of stigmatisation he appears to feel from his peers as a result thereof. In Grade III following a psychoeducational assessment, ED continued his schooling in a remedial school where he currently completes Grade V.

ED is reported to be an intelligent child who thrives on external reward and accolade. He is externally motivated and therefore struggles to engage in school related tasks if he does not perceive there to be an external source of motivation for him to do so. He struggles to assume responsibility and tends to isolate himself socially. Emotional difficulties are described and ED presents with separation and performance anxieties, which appear to have worsened since his parents divorce. He can become tearful if reprimanded or if he does not get his own way. His self esteem is very low and he feels very inadequate, often portraying a sense of bravado to boost his sense of self. In class, ED becomes easily frustrated and loses focus quickly when engaging in tasks. He struggles to persevere and problem solve particularly when faced with more difficult tasks. Reversals are apparent and his comprehension and reading skills are below that expected for his age. ED's teacher described that improvements particularly in his reading ability was apparent as a result of his engagement in the remedial program. He was also making increased efforts to be less impulsive in spelling and writing tasks and engage in these tasks more readily. Increased confidence in his ability to read, spell and write was reported by ED, his teacher and mother.

ED's motivation to attend the tuition sessions fluctuated as time progressed. He was externally motivated to attend and did so primarily because his mother wished him to do so. As a result, ED did not always engage whole-heartedly in the lessons. In view of his ADHD, for which he is not taking medication, he was distractible and struggled to focus at times. ED accumulated 25 sessions over the intervention period. ED was tutored in accordance with the high imagery remedial technique methodology and as such received 5 sessions of Level One of the programme, 5 sessions on Level Two of the programme, 10 sessions of Level Three of the programme and 5 sessions on Level Four of the programme with laddering and flexibility between the levels apparent throughout the sessions to stimulate interest and to maintain ED's motivation and encourage increased participation (See summary of daily diary of sessions in appendix xxiii).

5.4.2 Mental imagery:

Summary of ED's ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (*Key: ✓ = ability to engage in an element*)

<u>Specific element in the targeted revisualisation process</u>	<u>Pre-testing</u>	<u>Post-testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓	✓
3. Is able to transform the revisualised image of the word into written output.	✓	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.		✓
5. Is able to transform the mental image of a word into written output after a delayed period of time.		✓
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	✓	✓
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.	✓	✓
8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.	✓	✓
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.		✓
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.	✓	✓
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.		
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.		✓

As indicated above, ED reports that initially he was able to visualise and revisualise stimuli on a page, seeing these in his mind, as they appeared on the page on which the word was written. He was able to visualise the word in colour and black/white, as it was written on the page. The images however, were blurry and unclear and ED reports having to concentrate hard to focus on the mental image and to see the individual letters comprising a word that he had visualised and to manipulate these. The image is reported to have faded fairly quickly from his mind and he struggled to recall the image at a later stage without relooking at the original stimulus. His imagery ability improved over the course of the intervention received however. He reported to be able to see the mental image with greater clarity as he became more practiced in high imagery remedial techniques. He reported being able to focus on individual parts of the mental image more clearly, thus allowing him to “see” more clearly individual letters and words in revisualised words and sentences respectively and manipulate more easily. The image remained stationary, although at the end of the remediation period, ED reported that he felt that he had greater cognitive control over the mental image, with it appearing less faded and lasting for a longer period of time prior to dissipating. He also felt

that his ability to recall an image when required to spell a word at a later stage improved, thus allowing him to use mental imagery more effectively as a learning aid.

5.4.3 Intelligence and cognitive processing test scores (see table 23.4 in appendix xviii for raw scores):

ED's Full Scale IQ score on the SSAIS-R places him in the above average range of intellectual functioning. There is a small difference between his verbal and non-verbal IQ and this is not significant. His non-verbal/performance skills are slightly stronger than his verbal skills however although both fall with the above average range. Despite his high overall subscale scores, there is however significant inter-test scatter indicating some areas of relative learning difficulty. His reduced attentional and emotional abilities are also likely to contribute to his reduced academic performance and reading, writing and spelling impairments as evident in the classroom. There is however some evidence of intra- and intertest scatter which is suggestive of areas of learning difficulty.

With regards to the verbal scales, his relative strengths are his understanding of social and moral norms, verbal abstract reasoning skills and short term auditory memory for contextualised information. His vocabulary and comprehension abilities are also measured as being relative strengths. His relative weaknesses within the verbal realm are his auditory memory for non-contextualised verbal information and numerical reasoning. His poor complex attentional skills are likely to have negatively affected his performance here. ED also has a slow processing speed which will impact on his ability to perform timed tasks.

Significant non-verbal strengths are his concrete and abstract spatial reasoning skills and discrimination abilities. His understanding of part-whole relationships and non-verbal sequencing and processing skills are significant non-verbal weaknesses for him. His coding score falls within the below average range indicative of his reduced non-verbal/visual processing skills. ED's attentional capacities are reduced and his distractibility level is of concern. There is also evidence of performance related anxiety and hypervigilance, emotional immaturity and acting out/attention seeking tendencies which are likely to have negatively impacted upon his scores. His reduced planning abilities and impulsive problem solving style are also likely to have influenced his performance and to reduce his academic skills.

Table 7: Pre and post testing CAS and K-ABC results of participant ED:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	1	Nonverbal Matrices	3
Sentence Repetition	3	Verbal Spatial Relations	3
Sentence Questions	3	Figure Memory	1
Sum of gains made	7	Sum of gains made	7

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	0	Gestalt Closure	1
Number Recall	1	Triangles	1
Word Order	1	Matrix Analogies	0
Sum of gains made	2	Spatial Memory	0
		Photo Series	0
		Sum of gains made	2

As apparent from this description of ED's intellectual capabilities and intertest scatter as measured on the IQ battery, ED experiences relative cognitive difficulties particularly of a successive processing nature. His simultaneous processing abilities appear to be his relative strength. His performance on those subtests within the IQ battery requiring sequencing and logical mental processing are reduced, both within the verbal and non-verbal spheres, indicative of difficulties that he experiences in successive processing. His processing speed is also reduced, as apparent from his reduced coding score and relatively weaker numerical abilities, for which adequate successive processing abilities are essential. ED suffers from complex attentional difficulties, poor planning skills and a high level of distractibility. This is likely to affect his cognitive processing abilities. Attentional difficulties and limited planning skills have been found to correlate particularly with sequential processing difficulties. Simultaneous processing appears to be his relative strength in comparison. ED performed well on those IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information. These are tasks which demand intact simultaneous processing skills. Although both his Verbal and Non-Verbal IQ scores fall within the above

average range, his higher Non-Verbal IQ is characteristic of learners who prefer to process information simultaneously as opposed to successively.

Over the course of the remedial period utilising high imagery techniques, ED made improvements in both his successive and simultaneous processing abilities as apparent upon perusal of his pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. Of interest however, is that the apparent gains made in this regard on the CAS are marked. Although improvements are also apparent on the K-ABC, these are deflated in comparison. With regards to his successive/sequential processing abilities, ED obtained a raw score gain of 7 as measured on the CAS and 2 as measured on the K-ABC. His raw score gains of 3 on the Sentence Question and Sentence Repetition subtests of the CAS respectively are indicative of an increased understanding of the grammar and composition of the English language, improvement in his ability to process information logically and to express verbal information more coherently. This is also suggested by his raw score gains of 1 on the Word Order and Number Recall subtests of the K-ABC and Word Series subtest of the CAS. ED made no gains in his performance on the Hand Movements subscale of the K-ABC. This suggests that there is little improvement in his ability to process visual information sequentially in tasks which yield a motor output as measured on this subtest.

Although his relative strength, gains in his simultaneous processing abilities are also apparent. ED obtained a raw score gain of 7 and 2 on the simultaneous processing subtests of the CAS and K-ABC respectively. Raw score gains of 3 and 1 on the Nonverbal Matrices and Figure Memory subtest of the CAS respectively are indicative of his improved ability to process and recall spatial/visual information holistically and to discern the spatial relationships that are apparent therein. Slight gains are apparent on the Gestalt Closure and Triangles subtests of the K-ABC, which are also indicative of these improvements. ED made a raw score gain of 3 on the Verbal Spatial Relations test of the CAS, which suggests that he showed greater appreciation for the relationship between verbal material and its visual representation/meaning at the end of the remediation period. As previously noted, ED suffers from marked attentional and emotional difficulties and these are likely to affect his academic performance and cognitive processing despite his intellectual abilities falling within the above average range.

5.4.4 Phonic inventories (See table 23.1 and 23.2 in appendix xviii for results):

ED shows improvements in his spelling abilities as evident from an analysis of his errors made on the Phonic Inventories in pretesting and post testing. On Level One, ED's most noticeable improvements were made in his ability to use initial and ending blends/clusters and medial vowels. He also made fewer long-short vowel and consonant-sound confusions on post testing. On Level Two, ED's greatest improvements were made in his ability to utilise medial vowel digraphs (from 16 to 9) and ending blends/clusters (from 10 to 6) with errors in both these categories being reduced in post testing. Furthermore, in post testing ED only made 6 medial vowel errors in comparison to 9 errors in pre testing, thus showing some improvement here. Although reversals were still apparent, these were reduced in number. On Level Three, errors in ending consonant blends were reduced from 11 to 3. Suffix errors were reduced from 16 to 11 and the quantity of syllabification errors made were slightly reduced in post testing.

5.4.5 Reading and spelling scores (see table 23.3 in appendix xviii for raw scores):

Table 8: Pre and post testing reading and spelling scores results of participant ED:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	9 months	3
Schonell One Word Spelling Test	4 months	3
Schonell One Word Reading Scale	13 months	11
Schonell Graded Dictation B	1 (positive score gain)	1 Reduction of errors
Schonell Graded Dictation C	Not done – too advance	Not done – too advance
Schonell Graded Dictation D	Not done – too advance	Not done – too advance

It is apparent from the above table that ED made improvements in both his reading and spelling ability as evident from the comparison of his results obtained on the pre and post testing battery. In reading, ED attained a raw score gain of 3 on the Holborn Reading Scale and 11 on the Schonell One Word Reading Scale. ED's ability to read with understanding and for meaning is reported to have increased. When reading a passage silently, he is now more easily able to recall and summarise the key concepts which he has just read. His confidence in his ability to read, orally and silently, is also reported to have increased.

As apparent from the above results, ED has also made improvement in his spelling ability with a raw score gain of 3 on the Schonell One Word Spelling Test. A slight increased performance on the Schonell Graded Dictation tests is also evident. Although ED still continues to make careless errors and his spelling ability appears to fluctuate depending on his

level of motivation to engage in the writing task, perusal of his pre and post test errors indicate that improvements are particularly apparent in his ability to use ending consonants blends more correctly. Some gains are also evident in his usage of medial vowel digraphs. His usage of prefixes and suffixes appears to remain problematic however, indicating that this requires ongoing targeting.

5.4.6 Writing ability:

Analysis of ED's writing ability at the commencement of the programme revealed that it was likely that with motivation and structure, ED may be able to write a coherent story or piece of writing with logical sentences. Punctuation and grammatical structuring of the sentences and paragraphs however were poor and tenses including the use of past and present tense words were used in conjunction in one piece of writing. It was apparent that although ED was aware of the idea which he wanted to convey in his writing, he had not broken the idea down further into smaller ideas or decided how he should use sentences to convey the whole general idea in a paragraph. Analysis of ED's writing at the time of post testing showed that he was beginning to understand, with facilitation of the tutor, that a paragraph comprises of sentences, each which conveys a single idea. Although affected by his motivational abilities, ED started to use punctuation independently and capital letters at the start of new sentences. His grammatical structuring of the words and utilisation of tenses as appropriate to the sentence also improved. ED also appeared to be gaining confidence in his writing ability.

5.5 Participant CA (see appendix xix):

5.5.1 Background information:

CA is a first language English speaking female who was 11 years 3 months old at the time of commencement of the remediation. CA is an only child who resides with her parents. She is of South African decent and her home language is English. She is also conversant in basic Afrikaans (oral and written) and able to speak basic Italian and Greek, which are languages that she is exposed to within her home environment.

CA was born at full term via forceps delivery. Her mother's pregnancy with her was uncomplicated although she notes that she experienced work-related stress during this time. CA weighed 2,5 kg at birth. She suffered slight jaundice and received short term ultraviolet light therapy for this. Her developmental milestones are noted to have fallen within the

normal range until the age of 5 years, when she sustained a closed head injury after falling from a jungle gym. Some reduction in her level of consciousness was apparent as a result thereof, although this only lasted several minutes. She also suffered an injury to her left eye at this time. She is noted to currently frequently suffer from headaches and nose bleeds and to complain of body pains. She has been diagnosed as suffering from myopia, corrected with glasses. Her milestones are reported to have progressed slowly after the head injury was sustained. In particular her language abilities are noted to have been poor with a tendency to slur her words and to express herself unclearly. She is reported to be an anxious child and secondary enuresis is occasionally apparent at nights. CA has received both Speech Therapy and Occupational Therapy, which commenced post the head injury, continuing intermittently until the age of approximately 9 years old. Occupational Therapy focussed on improving visual-motor-perceptual deficits and her poor postural control. Speech Therapy purposed to assist her with auditory processing and language difficulties. Some gains were apparent although her pace of work remained slow and decreased cognitive flexibility was reported. She fatigued easily and struggles to concentrate independently on tasks. She did not participate in any other therapies or take medication at the time of receiving this remedial intervention.

CA commenced primary school in a mainstream school. She was very co-operative and tried hard in class however she progressed slowly and performed below average academically compared to her peers. Her numerical and literacy skills were reported to be reduced. She is timid and apprehensive in class and struggles to ask for help when this is required. She is reserved with a tendency to isolate herself from her peers.

CA completed Grades 1 to 4 at a mainstream primary school. Although she passed all grades, she consistently performed below average in all areas compared to her peers. In Grade 4 it was noted that her level of cognitive flexibility and problem-solving was not at a sophisticated level and she struggled to perform more challenging tasks, as required in Grade 4. She also fatigued very easily and struggled to concentrate on class work. A psycho-educational assessment was done, following which she commenced remedial schooling in Grade V. It was considered that the increased structure and individual attention a full time remedial school environment could provide her would be beneficial to her to facilitate her learning. CA's teacher reports that some improvement in her reading ability, ability to express herself creatively and her level of confidence in reading and writing has improvement over the time

period that she has been involved in remediation. CA and her mother also consider that her reading ability and comprehension has improved over the intervention period.

CA was tutored biweekly in accordance with traditional phonological remedial techniques. Her attendance of sessions was good and she appeared to be internally motivated to participate. In totality, 25 tutorial sessions were given (See summary of daily diary of sessions in appendix xxiii).

5.5.2 Mental imagery:

Summary of CA's ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (Key: ✓ = *ability to engage in an element*)

<u>Specific element in the targeted revisualisation process</u>	<u>Post testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓
3. Is able to transform the revisualised image of the word into written output.	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.	
5. Is able to transform the mental image of a word into written output after a delayed period of time.	✓
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.	
8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.	
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.	
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.	✓
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.	
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.	

Since CA was a participant in the contrast group of this study, she was only post tested on the imagery questionnaire. As indicated above, she reported that she is able to visualise stimuli that she sees on a page although these words do not appear very clearly in her mind and are somewhat hazy and faded and thus it is difficult to spell from the visual picture. She reported

seeing the words in black in print as if written on a page. CA noted that the word that she was visualising was stationary and did not move and she struggled to manipulate the image. She noted that the image faded slowly in her mind. She reported to be able to recall the image if she so desired although the image is not very clear upon recall. CA reported that the images disappeared more quickly once she has said the word or if she had written it down. CA noted that when she spells a word incorrectly, there is 'something' about the word that tells her that the word was incorrect. She reported that the word and the shape of the word looked different to her. CA reported that after writing a word, although she would know that it is wrong, she often would not know how to spell it correctly even if she tried to re-spell it.

5.5.3 Intelligence and cognitive processing test scores (see table 24.4 in appendix xix for raw scores):

CA's Full Scale IQ on the SSAIS-R, as measured in April 2003, places her within the borderline range of intellectual functioning. There is a large, although not quite significant, difference between her verbal and non-verbal IQ. Her Verbal IQ falls within the borderline range and her non-verbal IQ falls within the below average range. Her reduced scores indicate the presence of a significant learning disability. Although reduced, her non-verbal abilities are her relative strength however. It is considered that her globally reduced scores may be due to neurological fall-out sustained as a result of the head injury at a young age.

There is significant inter-test scatter indicating particular areas of concern. It is important to note that although CA does suffer from non-verbal and verbal learning difficulties as evident from her scores on the IQ scale, her attentional and emotional difficulties have impacted on her results. Her complex attentional skills, cognitive flexibility and problem solving abilities are noted to be reduced, which impact significantly on her academic performance.

CA's most significant weaknesses within the verbal realm are her English vocabulary, short term auditory memory for non-contextualised verbal information, auditory processing skills and verbal abstract reasoning abilities. Her receptive and expressive English language abilities, numerical reasoning skills and her ability to sequence and process verbal information in time limited tasks are also reduced. A relative verbal strength is her auditory memory for contextualised information, with her score for the Digit Span subscale of the IQ battery falling within the average range. Her scores on the other verbal IQ test subscales fall within the delayed and borderline ranges.

A relative non-verbal strength is her visual discrimination skills, with her score on the Missing Parts subtest of the IQ battery falling within the lower limits of the average range. Her non-verbal concrete and abstract reasoning skills, understanding of part-whole relationships, non-verbal/visual sequencing and processing skills and ability to manipulate visual images are significant non-verbal weaknesses for her. Her coding score falls within the borderline range in view of her reduced processing speed and slow psychomotor rate. This is likely to contribute significantly to her reduced reading, writing and spelling capacities.

Table 9: Pre and post testing CAS and K-ABC results of participant CA:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	-1	Nonverbal Matrices	0
Sentence Repetition	0	Verbal Spatial Relations	1
Sentence Questions	4	Figure Memory	0
Sum of gains made	3	Sum of gains made	1

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	1	Gestalt Closure	-1
Number Recall	2	Triangles	0
Word Order	-2	Matrix Analogies	0
Sum of gains made	1	Spatial Memory	5
		Photo Series	0
		Sum of gains made	4

As apparent from this description of CA's intellectual capabilities and intertest scatter as measured on the IQ battery, CA experiences cognitive difficulties of both a successive and simultaneous processing nature. Her performance on those subtests within the IQ battery requiring sequencing and logical mental processing are reduced, both within the verbal and non-verbal spheres, indicative of difficulties that she experiences in successive processing. Her processing speed is also reduced, as apparent from her reduced Coding score and relatively weaker numerical abilities, for which inadequate successive processing abilities are essential. CA suffers from complex attentional difficulties, reduced cognitive flexibility and

poor planning skills. This is likely to affect her cognitive processing. CA's simultaneous processing abilities are also reduced. CA performed below average on most of those IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information. These are tasks which demand intact simultaneous processing skills. CA's cognitive processing abilities appear to be globally reduced.

Over the course of the remedial period utilising traditional phonological techniques, CA made slight improvements in both her successive and simultaneous processing abilities as apparent upon perusal of her pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. The apparent gains made in this regard on the CAS and K-ABC corresponds.

With regards to her successive/sequential processing abilities, CA obtained a raw score gain of 3 as measured on the CAS and 1 as measured on the K-ABC. Her raw score gains of 4 on the Sentence Question subtest of the CAS is indicative of an increased understanding of the grammar and composition of the English language and improvement in her ability to process information logically. This is also suggested by her raw score gain of 2 on the Number Recall subtest of the K-ABC. She made limited improvement in her ability to process non-contextual verbal information sequentially which is evident from the -1 and -2 gains she made on the Word Series and Word Order subtests, suggesting that her abilities in this regard, although still a relative strength, had actually regressed. CA made limited gains in her performance on the Hand Movements subscale of the K-ABC with a raw score gain of 1. This suggests that there is little improvement in her ability to process visual information sequentially in those tasks which require a motor output.

Slight gains in her simultaneous processing abilities are also apparent. CA obtained a raw score gain of 1 and 4 on the simultaneous processing subtests of the CAS and K-ABC respectively. No gains are apparent in her performance on the Nonverbal Matrices and Figure Memory subtest of the CAS or Triangles, Matrix Analogies and Photo Series of the K-ABC indicating that her ability to process and recall spatial/visual information holistically and to discern the spatial relationships has remained unchanged. Her most significant gain is on her performance on the Spatial Memory subtest of the K-ABC. This suggests that her visual memory has improved over the intervention period. A slight improvement is apparent in her performance on the Verbal Spatial Relations subtest of the CAS, which suggests that her

ability to perceive the relationship between verbal material and their corresponding visual association has improved subtly.

5.5.4 Phonic inventories (See table 24.1 and 24.2 in appendix xix for results):

CA shows some improvements in her spelling abilities as evident from an analysis of her errors made on the Phonic Inventories in pretesting and post testing. On Level One, CA’s most noticeable improvements were made in her ability to use initial consonant blends/clusters (3 errors to 1) and medial vowels (5 errors to 2). She also made fewer long-short vowel and consonant-sound confusions on post testing. On Level Two, CA’s greatest improvements were made in her ability to utilise ending consonant blends/clusters (from 12 to 10) with errors in this category being reduced in post testing. Slight improvements (by 1 error respectively) were apparent in her usage of medial vowels and medial vowel digraphs. On Level Three, ending blend/cluster errors were reduced from 4 to 0. Suffix errors were reduced from 10 to 9 and the quantity of syllabification errors made were slightly reduced in post testing. An increase in the number of medial vowel errors was apparent in her post test performance on Level Three however.

5.5.5 Reading and spelling scores (see table 24.3 in appendix xix for raw scores):

Table 10: Pre and post testing reading and spelling scores results of participant CA:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	3 months	1
Schonell One Word Spelling Test	4 months	3
Schonell One Word Reading Scale	4 months	3
Schonell Graded Dictation B	1 (positive score gain)	1 Reduction of errors
Schonell Graded Dictation C	0 (positive score gain)	0 Reduction of errors
Schonell Graded Dictation D	Not done – too advanced	Not done – too advanced

It is apparent from the above table that CA made some improvements in both her reading and spelling ability as evident from the comparison of her results obtained on the pre and post testing battery. In reading, CA attained a raw score gain of 1 on the Holborn Reading Scale and 3 on the Schonell One Word Reading Scale. Improvements in her ability to read more fluently and to pronounce words accurately when reading orally has been noted. Some gains in her comprehension skills are also apparent and CA appears to be gaining confidence in this regard.

As apparent from the above results, CA has also made improvement in her spelling ability with a raw score gain of 3 on the Schonell One Word Spelling Test. A very slight increase in her performance on the Schonell Graded Dictation tests is also evident. CA appears to be more confident in her usage of suffixes, prefixes and different tenses when writing. She also appears to be more able to express herself creatively in writing although careless spelling mistakes are still apparent and CA appears to have difficulty generalising concepts learnt to words which have not yet been remediated. An over reliance on phonological rules is apparent and thus CA has difficulty spelling words which are irregular.

5.5.6 Writing ability:

Analysis of CA's writing ability at time of pre testing showed her sentences to be very short comprising of about 4 or 5 words on average. Her writing was not very descriptive and she was only able to write in the first person, struggling to write in the third person as a result of her difficulty with abstract thought. Furthermore, it was apparent that CA found it difficult to structure her thoughts logically with regard to what she wanted to write and as a result her writing was difficult to follow when reading it. The grammatical composition of her sentences was also poor. Analysis of CA's writing at the end of the intervention period showed some improvement in this regard. With tutor facilitation, she showed increased insight into structuring her ideas into logical sentences and some improvement in CA's grammatical ability was also evident. CA appeared to show more confidence in her writing ability and her sentences tended to be slightly more descriptive and creative in nature.

5.6 Participant CB (see appendix xx):

5.6.1 Background information:

CB is a first language English speaking female who was 11 years 2 months old at the time of commencement of the remediation. CB resides with her parents and 3 year older sister who is attending mainstream schooling. Although her sister does well academically, she is reported to experience attentional difficulties. CB is of South African decent and her home language is English. She is also conversant in basic Afrikaans (oral and written).

CB was born at full term via caesarean section. Her mother's pregnancy with her is noted to have been unproblematic. She weighed 3,2 kgs at birth. She was slightly jaundiced at birth, requiring several days of phototherapy to treat this. Although CB is noted to have been a

healthy infant and child, she required the insertion of bilateral grommets in an attempt to alleviate the recurrent ear infections she experienced. There is no other medical history of note. According to her mother, her physical and verbal developmental milestones fell within the normal range. However, some delay may have been present since CB required Occupational Therapy and Physiotherapy as a developing child. Occupational Therapy focused on remediating visual-perceptual-motor difficulties and postural control problems and appears to have been received for approximately 2 years. Physiotherapy focused on improving her gross motor abilities and balance and was received for approximately a year. Some Speech Therapy has also been received to remediate her verbal and expressive speech difficulties. The duration for which she required Speech Therapy however, is unknown. In view of her difficulty attending in class with poor quality of concentration and impulsivity being apparent, CB has been diagnosed as suffering from ADHD (experiencing particularly attention based difficulties although increased energy, talkativeness and restlessness was also apparent in class and at home). CB was prescribed Ritalin which she took for one year. Her mother discontinued this however since she considered that the medication did not improve CB's ability to focus in class. She was not taking any medication while involved in this study.

CB started Grade 0 in a mainstream primary school where she also completed Grades I – III. Her attentional difficulties were evident in Grade I and it was at this time that Ritalin was prescribed. Despite this, CB struggled to focus in class and lagged behind particularly in numeracy and literacy compared to her peers. Her reading and spelling abilities were below average and she struggled to complete her work. CB is noted however to be a very friendly, outgoing child with excellent social skills. She relates well to authority figures and has many friends. She is noted to suffer from depression at times however, particularly when she feels inadequate in terms of her ability to perform academically. Her self esteem is low. CB has received a course of child psychotherapy in view of these issues, which appears to have resulted in some improvements. In Grade III, CB continued to struggle academically and, following psycho-educational assessment, she entered full time remedial schooling in Grade IV. She is currently completing Grade V at this school. In class, CB is described as being a mature, friendly and helpful person, who has made progress in her academic skills. Although her concentrational abilities and problem solving skills are noted to still be problematic, over the remedial intervention period, gains have been evident in her creative writing ability and reading skills, as reported by her teacher. Little progress has been noticed by her teacher in her spelling abilities however and her teacher considers that she can still be careless in this

regard. Her mother reports her oral reading to have become more fluent and also notices that she seems more willing now to engage in writing tasks although she continues to be distractible with the need for encouragement to complete tasks.

CB was tutored biweekly in accordance with traditional phonological remedial techniques. Her attendance of sessions was excellent and she appeared to be internally motivated to participate. In totality, 30 tutorial sessions were given (See summary of daily diary of sessions in appendix xxiii).

5.6.2 Mental imagery:

Summary of CB's ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (*Key: ✓ = ability to engage in an element*)

<u>Specific element in the targeted revisualisation process</u>	<u>Post testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓
3. Is able to transform the revisualised image of the word into written output.	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.	
5. Is able to transform the mental image of a word into written output after a delayed period of time.	
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	✓
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.	✓
8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.	✓
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.	
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.	✓
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.	
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.	

Since CB was a participant of the contrast group, she was only post testing using the imagery questionnaire to assess her visual imagery abilities. As indicated in the summary above, CB reported that when she visualised a stimulus, she was able to picture the word, as it was spelt on the page, in her mind and manipulate this image into oral and written output. Typically, the

word was visualised as if written in black ink although upon a background of colour. CB reported that the image faded gradually in her mind, and faded more rapidly if she is distracted. She noted that at times she may be able to recall the image, although it was likely to be less clear. At other times however, the word may not come back into her mind, despite her trying hard to recall the image. Upon revisualisation, CB noted that she may not be able to see the exact spelling of the word due to it's decayed over time. CB reported that the mental image was stationary. CB reported that if she was visualising a word, she may also see, or get a sense, of a picture image of the word in her mind, which helped her to recall the word (e.g. see the image of a flower if she is revisualising the word *flower*).

5.6.3 Intelligence and cognitive processing test scores (see table 25.4 in appendix xx for raw scores):

CB underwent psychological assessment in July 2003 and her intellectual abilities were assessed using the SSAIS-R. Her Full Scale IQ score was assessed to fall within the average range. Her Verbal and Non-Verbal IQ scores also fall within the average range although her verbal abilities are slightly stronger than her non-verbal abilities. No significant difference exists between her scores on the two subscales.

Although her verbal abilities are her relative strength, analysis of the intertest scatter that exists between her verbal subscale scores reveals areas of relative strength and weakness. As per her performance on the IQ battery, verbally, her abilities appear to be adequately developed and she appears to be able to recognise and interpret single words on a receptive level. Her expressive language skills are also adequate. Her auditory perceptual skills, such as her short term memory for contextualised and non-contextualised information, verbal sequencing skills, verbal discrimination skills and comprehension abilities appear to be below that expected for her age. Abstract verbal reasoning is a relative weakness for her although her ability to engage in concrete verbal reasoning and numerical tasks appears to be adequate. Her concrete problem solving and planning skills therefore appear intact although CB experiences difficulty engaging with abstract verbal material. Her verbal processing skills are also slightly reduced.

Although her non-verbal abilities fall within the average range, marked intertest scatter exists, yielding areas of significant non-verbal strength and weakness. Her significant non-verbal strength is her understanding of part-whole relationships with her scoring within the superior

range on the Pattern Completion subtest of the IQ battery. Her understanding of concrete spatial relationships and her concrete spatial reasoning abilities appear adequate although her abstract non-verbal reasoning abilities are less developed. Her visual discrimination skills are significantly weak, with her score on the Missing Parts subtest falling within the delayed range. Her non-verbal sequencing and processing abilities are also reduced as apparent from her borderline performance on the Coding subtest. This is likely to significantly impact on her reading and writing abilities in view of her reduced psychomotor speed. Her complex attentional abilities are reduced which are also likely to have impacted on her test performance. Her level of distractibility is of concern.

Table 11: Pre and post testing CAS and K-ABC results of participant CB:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	0	Nonverbal Matrices	-1
Sentence Repetition	1	Verbal Spatial Relations	0
Sentence Questions	5	Figure Memory	3
Sum of gains made	6	Sum of gains made	2

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	-1	Gestalt Closure	2
Number Recall	4	Triangles	1
Word Order	1	Matrix Analogies	-3
Sum of gains made	4	Spatial Memory	-1
		Photo Series	1
		Sum of gains made	0

As apparent from the above description of CB's intellectual capabilities and intertest scatter as measured on the IQ battery, CB experiences some cognitive difficulties of both a simultaneous and successive processing nature. Her sequential processing ability appears to be her relative strength although there is evidence to indicate that CB can process information simultaneously. Her performance on those subtests within the IQ battery requiring sequencing and logical mental processing fall within the average range, both verbally and non-verbally,

indicating that she prefers to process information successively. Some difficulties in this regard are still apparent however, as evident from her limited English vocabulary, comprehension skills and ability to use words within the context of sentences and paragraphs. Her poor coding ability is also evident of problems with her sequential processing ability particularly at speed and in tasks which require motor output. Simultaneous processing appears to be her relative weakness in comparison. CB performed more competently on some of the IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information but the intertest scatter indicates that there are areas of concern on tasks which demand intact simultaneous processing skills. Her slightly higher Verbal IQ is characteristic of learners who prefer to process information successively as opposed to simultaneously.

Over the course of the remedial period utilising traditional phonological techniques, CB made improvements in both her successive and simultaneous processing abilities as apparent upon perusal of her pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. Overall, the gains she made on the K-ABC and CAS correspond.

Although her relative strength, gains in her successive/sequential processing abilities are apparent. CB made a raw score gain of 6 as measured on the CAS and 4 as measured on the K-ABC. Her raw score gain of 5 on the Sentence Question subtest of the CAS is indicative of an increased ability to process information logically and express verbal information more coherently. This is also suggested by her raw score gain of 1 on the Sentence Repetition subtest. The gains made on the Number Recall subtest (raw score gain of 4) and Word Order subtest (raw score gain of 1) indicate that gains in her ability to process and organise verbal information sequentially are apparent. The slightly negative raw score gain of -1 that CB made on the Hand Movements subscale of the K-ABC is indicative of a subtle decline in her ability to process visual information sequentially as related to tasks requiring motor output.

Gains in her simultaneous processing abilities are also evident, although these are less marked than the gains she made in her sequential processing skills. CB made a raw score gain of 2 and 0 on the simultaneous processing subtests of the CAS and K-ABC respectively. Raw score gains of 3 in the Figure Memory subtest of the CAS and 2, 1 and 1 on both the Gestalt Closure, Photo Series and Triangle subtests respectively are indicative of her improved ability to process and recall spatial/visual information holistically and to discern the spatial

relationships that are apparent therein. Some decline in her simultaneous processing ability is also evident over the course of the remediation period as apparent from the decrease in some of CB's scores, including a negative gain of 1 on the Nonverbal Matrices subtest of the CAS and -3 and -1 on the Matrix Analogies and Spatial Memory subtests of the K-ABC respectively. This may be because of CB's increasing reliance on her sequential as opposed to simultaneous processing abilities as apparent from her raw score gains.

5.6.4 Phonic inventories (See table 25.1 and 25.2 in appendix xx for results):

CB shows some improvements in her spelling abilities as evident from an analysis of her errors made on the Phonic Inventories in pretesting and post testing. On Level One, CB made slight improvements in her ability to use medial vowels (5 errors to 2). No improvements in her ability to utilise ending blends are apparent on Level One although 1 less error was made in her utilisation of ending consonants. On Level Two, CB's greatest improvements were made in her ability to utilise ending consonant blends/clusters (from 6 to 4). Slight improvements (by 1 error respectively) were apparent in her usage of medial vowels and medial vowel digraphs. She also made slightly fewer long-short vowel and consonant-sound confusions on post testing. On Level Three, CB showed no improvement in her usage of suffixes or prefixes and with syllabification however she showed improvement in her usage of ending consonant blends (8 errors to 3).

5.6.5 Reading and spelling scores (see table 25.3 in appendix xx for raw scores):

Table 12: Pre and post testing reading and spelling scores results of participant CB:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	11 months	4
Schonell One Word Spelling Test	11 months	9
Schonell One Word Reading Scale	5 months	4
Schonell Graded Dictation B	4 (positive score gain)	3 Reduction of errors
Schonell Graded Dictation C	5 (positive score gain)	5 Reduction of errors
Schonell Graded Dictation D	4 (positive score gain)	5 Reduction of errors

It is apparent from the above table that CB made improvements in both her reading and spelling ability as evident from the comparison of her results obtained on the pre and post testing battery. In reading, CB attained a raw score gain of 4 on the Holborn Reading Scale and 9 on the Schonell One Word Reading Scale. Her reading abilities are noted to have increased in fluency with her pronunciation of words increasing in accuracy. An increased desire to read and to “uncover the information” in the text to be read because of a sense of

internal motivation to do so, is also noted. Some gains in her ability to pick out key concepts in texts being read are also described.

As apparent from the above results, CB has also made improvement in her spelling ability with a raw score gain of 4 on the Schonell One Word Spelling Test. Increased performance on the Schonell Graded Dictation tests is also evident. CB shows an ability to use ending consonant blends more accurately. She also shows an increased ability to use long and short vowels more correctly. Her usage of medial vowel diagraphs remains of concern however, particularly in words that are not phonologically regular, suggesting an over reliance on phonological rules in spelling.

5.6.6 Writing ability:

It is apparent from analysis of CB's writing at pre and post testing that she increased in confidence as well as in her understanding of the usage of English grammar, sentence structure and punctuation over the remediation period. Although still reluctant to engage in creative writing independently, CB became increasingly able to write sentences pertaining to a single idea which then follows on to form a paragraph and subsequently a story. Facilitation from a tutor was required to assist CB to structure her thoughts logically and mind-mapping techniques appeared to be useful to assist CB in this regard. She still seemed to struggle to do so without guidance and did not appear to implement these techniques independent outside of the tutorial sessions.

5.7 Participant CC (see appendix xxi):

5.7.1 Background information:

CC is a second language English speaking female who was 11 years 10 months old at the time of commencement of the remediation. CC resides with her parents and two elder siblings (a brother and sister, who are attending university and a mainstream high school respectively). CC is of South African decent and her home language is Northern Sotho. She is also conversant in Zulu and basic Afrikaans (oral and written). She speaks English fluently and is schooled in English. She has been exposed to some English at home since infancy however.

CC was born at full term via caesarean section. Her mother's pregnancy with her was uneventful although her delivery was complicated by slight foetal distress and cyanosis and

she required incubation for several days post-natally as a result. She weighed 3,2 kg at birth. Medically, CC dislocated her right shoulder at the age of 2 years after falling of her bed however, following a short period of hospitalisation, she recovered from this without incident. She has no other medical history of note. CC's physical and verbal milestones are reported to have fallen within the normal range. Some evidence of underlying anxiety is noted however, and CC still suffers from primary enuresis once every three to four months. CC received Speech Therapy for a total of two years, when 6 years old and later when 8 years old. The aim of Speech Therapy was to improve her expressive verbal abilities and auditory processing skills. CC was not receiving any other form of remediation or medication at the time of receiving this study intervention.

CC commenced Grade 0 at a mainstream remedial school where she also completed Grades I – III. She is described as being a very helpful, friendly and sociable child, although some evidence of performance anxiety and a low self esteem is apparent. Since commencing her schooling, CC performed below average academically compared to her peers. CC repeated Grade I at the mainstream remedial school, which could also have been due to her having to adjust to receiving schooling in English, which is not her home language. In Grade III, she still struggled to read and write at an age appropriate level. Her numeracy skills were also below that expected for her age. Following psycho-educational assessment, she continued her schooling in Grade 4 in a remedial school. Although her concentration span is noted to have been good, CC is reported to have struggled with problems solving tasks and in activities which require good planning and organisational abilities. Some difficulties in her ability to follow instructions are apparent. Her confidence in her ability to engage in academic tasks is also noted to have been reduced.

CC is described as being an out going, friendly and sociable individual who is well liked by her peers and teachers alike. She is noted to still struggle with following instructions in class, engaging in higher-order problems solving and abstract reasoning. Her writing is creative although she is noted to at times struggle to express herself logically in writing, with a tendency to confuse pronouns and tenses. Over the course of the remediation period, CC reports finding it easier to engage in creative writing. Her teacher described some improvements in her spelling and comprehension abilities to be apparent, with a greater awareness of the rules of the English language, although she still struggles with the spelling of words which contravene the regular rules of the English language.

CC was tutored biweekly in accordance with traditional phonological remedial techniques. Her attendance of sessions was excellent and she appeared to be internally motivated to participate. In totality, 29 tutorial sessions were given (See summary of daily diary of sessions in appendix xxiii).

5.7.2 Mental imagery:

Summary of CC's ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (*Key: ✓ = ability to engage in an element*)

<u>Specific element in the targeted revisualisation process</u>	<u>Post testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓
3. Is able to transform the revisualised image of the word into written output.	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.	
5. Is able to transform the mental image of a word into written output after a delayed period of time.	
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.	
8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.	
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.	
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.	
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.	
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.	

CC was tutored according to phonological remedial techniques and was therefore only post tested using the mental imagery questionnaire. As noted in the above summary, CC reported that although she was able to visualise and revisualise words and pictures, these images fade very quickly from her mind. She described the images to move quickly within her mind and to therefore be very blurry in quality, making it difficult to manipulate the images. She reported struggling to be able to focus clearly on the image so that she can see the detail of the image clearly. Although CC was able to perceive mental images in colour, the colours were

dull and “fuzzy”, as described by CC, implying that the boundaries of the various colour blocks blended into each other. This contributed to the blurry nature of the mental images perceived by CC and the short period of time that CC appeared to be able to retain the mental image. CC also noted that she struggles to revisualise the image without relooking at the original stimulus since this faded significantly over time.

5.7.3 Intelligence and cognitive processing test scores (see table 26.4 in appendix xxi for raw scores):

CC underwent psycho-educational assessment in November 2003. CC’s Full Scale IQ on the SSAIS-R places her in the below average range of intellectual functioning. There is no significant difference between her Verbal and Non-Verbal IQ scores. Her Verbal IQ falls within the upper limits of the below average range. Her Non-Verbal IQ falls within the lower limits of the average range. Her non-verbal abilities are therefore her relative strength.

There is however significant intra- and inter-test scatter indicating areas of learning difficulty. With regards to the verbal scales, her relative strengths appear to be her understanding of social and moral norms and memory for contextual verbal information. Numerous relative verbal weaknesses exist however, including her auditory/verbal processing and sequencing skills, memory for non-contextual information, numerical abilities and expressive English language skills. Her English vocabulary abilities are also reduced.

Although her relative strength, the inter-test scatter within the non-verbal subtests indicates that difficulties are apparent. Relative non-verbal strengths are CC’s understanding of part whole relationships and her visual processing and sequential abilities, with her scoring within the above average range on the Coding subtest. Relative non-verbal weaknesses exist including a reduced visual memory capacity, reduced concrete and abstract non-verbal reasoning skills, visual discrimination abilities and a decreased ability to mentally manipulate spatial designs. There is evidence from the assessment that CC is hypervigilant with underlying anxiety being present. Some evidence of limited planning and problem-solving (verbal and non-verbal) capacities is apparent. This is likely to have further reduced her scores on the verbal and non-verbal subtests.

Table 13: Pre and post testing CAS and K-ABC results of participant CC:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	0	Nonverbal Matrices	0
Sentence Repetition	0	Verbal Spatial Relations	-2
Sentence Questions	1	Figure Memory	4
Sum of gains made	1	Sum of gains made	2

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	1	Gestalt Closure	2
Number Recall	-1	Triangles	2
Word Order	5	Matrix Analogies	0
Sum of gains made	5	Spatial Memory	1
		Photo Series	0
		Sum of gains made	5

As apparent from the above description of CC's intellectual capabilities and intertest scatter as measured on the IQ battery, CC experiences cognitive difficulties of both a simultaneous and successive nature. Although still reduced, her simultaneous processing abilities appear to be her relative strength however. Her performance on those subtests within the IQ battery requiring sequencing and logical mental processing are reduced, both verbally and non-verbally, indicative of difficulties that she experiences in successive processing. Her English vocabulary, comprehension skills and ability to use words within the context of sentences and paragraphs are limited, which is indicative of her reduced successive processing skills. Simultaneous processing appears to be her relative strength in comparison. CC performed more competently on those IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information. These are tasks which demand intact simultaneous processing skills. Her higher Non-Verbal IQ is characteristic of learners who prefer to process information simultaneously as opposed to successively.

Over the course of the remedial period utilising traditional phonological techniques, CC made improvements in both her successive and simultaneous processing abilities as apparent upon

perusal of her pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. Of interest is that the gains made on the K-ABC in this regard exceed the gains made on the CAS.

With regards to her successive/sequential processing abilities, CC made a raw score gain of 1 as measured on the CAS and 5 as measured on the K-ABC. Her raw score gain of 1 on the Sentence Question subtest of the CAS is indicative of a slightly increased ability to process information logically and express verbal information more coherently. This is also suggested by her raw score gain of 5 on the Word Order subtest. Her slightly negative performance (-1 raw score gain) on the Number Recall subtest of the K-ABC and 0 gain on both the Word Series and Sentence Repetition of the CAS indicate that difficulties in these areas are still apparent however. The slight raw score gain of 1 that CC made on the Hand Movements subscale of the K-ABC is indicative of a subtle improved ability to process visual information sequentially as related to tasks requiring motor output.

Although her relative strength, gains in her simultaneous processing abilities are also apparent. CC made a raw score gain of 2 and 5 on the simultaneous processing subtests of the CAS and K-ABC respectively. Raw score gains of 4 in the Figure Memory subtest of the CAS and 2 on both the Gestalt Closure and Triangle subtests respectively are indicative of her improved ability to process and recall spatial/visual information holistically and to discern the spatial relationships that are apparent therein. These improvements were apparent over the course of the remediation period.

5.7.4 Phonic inventories (See table 26.1 and 26.2 in appendix xxi for results):

CC shows improvements in her spelling abilities as evident from an analysis of her errors made on the Phonic Inventories in pretesting and post testing. On Level One, CC made improvements in her ability to use medial vowels (8 errors to 5). 3 fewer errors were made in her utilisation of ending consonants blends (13 to 10). On Level Two, CC's greatest improvements were made in her ability to utilise ending consonant blends/clusters (from 15 to 7). No gains are apparent in her usage of medial vowels and medial vowel digraphs on this level. She also made slightly fewer long-short vowel and consonant-sound confusions on post testing. On Level Three, CC showed some improvement in her usage of suffixes (11 errors to 7), prefixes (2 errors to 0) and in syllabification (1 error).

5.7.5 Reading and spelling scores (see table 26.3 in appendix xxi for raw scores):

Table 14: Pre and post testing reading and spelling scores results of participant CC:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	5 months	2
Schonell One Word Spelling Test	3 months	2
Schonell One Word Reading Scale	5 months	4
Schonell Graded Dictation B	- 1 (positive score gain)	-1 Reduction of errors
Schonell Graded Dictation C	2 (positive score gain)	2 Reduction of errors
Schonell Graded Dictation D	Not done – too advance	Not done – too advance

It is apparent from the above table that CC made some improvements in both her reading and spelling ability as evident from the comparison of her results obtained on the pre and post testing battery. In reading, CC attained a raw score gain of 2 on the Holborn Reading Scale and 4 on the Schonell One Word Reading Scale. CC has improved in her knowledge of the English vocabulary and understanding of a greater range of English words. Her ability to read with greater understanding has therefore increased and her pronunciation of words when reading orally is noted to have increased. Her comprehension skills may have slightly increased although CC tends to read very quickly when reading silently and therefore struggles to recall key concepts at times after reading.

As apparent from the above results, CC has also made improvement in her spelling ability with a raw score gain of 2 on the Schonell One Word Spelling Test. A slight increase in her performance on the Schonell Graded Dictation tests is also evident. CC appears to have made marked improvements in her ability to use prefixes, suffixes and different tenses in her writing of words and sentences, demonstrating a greater understanding thereof. Her ability to use long and short vowels and consonant blends correctly has improved, although CC still struggles with medial vowel digraphs, particularly in phonically irregular words, suggesting an over reliance on phonological rules when spelling.

5.7.6 Writing ability:

Analysis of her writing at pretesting showed that CC tends to write short sentences comprising of only several words. She struggled with pronouns, tenses and correct grammatical construction of sentences. Punctuation was also problematic. Her sentences tended to be non-descript in nature and stories lacking in creativity. CC lacked motivation to engage in writing tasks and tended to avoid words which she did not know how to spell, thus further restricting the range of her writing. Analysis at post testing showed some

improvements in CC's usage of pronouns and her ability to write in the past tense. Her ability to write sentences in the future tense remained problematic however. With tutor facilitation, CC showed an increased ability to structure her thoughts more logically. Her sentences tended to be slightly more descriptive in nature and she was less reluctant to use words which were less familiar to her and which she felt less confident to spell, thus increasing the creativity of her writing.

5.8 Participant CD (see appendix xxii):

5.8.1 Background information:

CD is a first language English speaking male who was 11 years 10 months old at the time of commencement of the remediation. On weekends, CD resides with his parents and 2 younger sisters (4 years younger and 5 years younger respectively) who attend mainstream schooling. His parents are separated and he spends alternate weekends with each parent. During the week, CD resides with his grandparents and aunt, since they live closer to the remedial school he is currently attending, which makes travelling arrangements less problematic. This has been the living arrangements since he commenced remedial schooling in Grade 1. His relationship with his parents (and to authority figures in general) is reported to be problematic. He has a conflictual relationship with his siblings. CD is of South African decent and his home language is English. He is also conversant in Afrikaans (oral and written).

CD was born several weeks premature via normal vaginal delivery. CD was small at birth, weighing 2 kgs. He was cyanosed due to the prolonged delivery process and he required incubation for 2 weeks post nately while recovering from a lung infection and jaundice. His mother's pregnancy with him is otherwise noted to have been uneventful, although she smoked during the pregnancy. He was sickly as an infant, suffering from gastritis at the age of 3 months, requiring a short period of hospitalisation to recover. He also cried excessively as an infant. His physical and verbal developmental milestones are reported to have been slightly delayed. CD has received both Occupational Therapy and Speech Therapy for 3 years. The focus of Occupational Therapy was on improving his visual-spatial difficulties, normalising his bodily tone and improving his postural control. Attention was also given to remediating reversal and improving the quality of his pencil control and pressure. Speech Therapy focused on improving his auditory processing abilities and expressive verbal skills.

CD entered Grade 0 in a mainstream school. He was found to suffer from behavioural problems with acting out tendencies. His concentration span and attentional abilities were also found to be reduced and he was very distractible. Impulsivity and decreased motivation to engage in class work was apparent. ADHD was diagnosed at the time and Ritalin was prescribed, although CD did not continue to take this during the year that he was involved in the remedial intervention programme. CD underwent psycho-educational assessment in Grade 0 and commenced remedial primary schooling in Grade 1, where he is currently completing Grade V. His attention span is reported to have remained problematic with decreased motivation to engage in academic tasks. His reading, writing, comprehension and numeracy skills remain delayed for his age and he struggles to engage with tasks creatively or on an abstract level. CD also experiences difficulty problem solving independently and his reasoning abilities are reduced. CD is reported to be defiant and stubborn at times, with anger management problems. He struggles to express himself or his feelings and this results in him acting out on his emotions. He also has a tendency to portray a sense of bravado in an attempt to compensate for his low self esteem. Socially, he tends to be a loner, with a tendency to dominate his peers.

His teacher considers that over the intervention period, some gains in CD's spelling ability have been apparent. No gains in his reading and writing ability were described by the teacher and he is noted to still be reluctant to engage in these tasks. CD is uncertain as to the gains he has made as a result of the remedial intervention.

CD was tutored biweekly in accordance with traditional phonological remedial techniques. He was not internally motivated to attend sessions and his motivation to work in sessions tended to fluctuate as time progressed. CD appeared to only attend sessions since this was the desire of his parents for him to do. In total, 22 tutorial sessions were given (See summary of daily diary of sessions in appendix xxiii).

5.8.2 Mental imagery:

Summary of CD's ability to engage in various elements of the targeted revisualisation process at pre-testing and post-testing as per *A Mental Imagery Checklist* proposed by Potter (2006) (See appendix xi for the full version of the Mental Imagery Checklist including operational definitions and cognitive processes required) (*Key: ✓ = ability to engage in an element*)

<u>Specific element in the targeted revisualisation process</u>	<u>Post testing</u>
1. Is able to mentally visualise an image of the sequence of letters in a word.	✓
2. Is able to revisualise the mental image of the word by orally reading and analysing the word from its mental image.	✓
3. Is able to transform the revisualised image of the word into written output.	✓
4. Is able to revisualise the mental image of the word accurately after a delayed period of time.	
5. Is able to transform the mental image of a word into written output after a delayed period of time.	
6. Is able to mentally manipulate a series of revisualised mental images of words into a sequence of words.	✓
7. Is able to orally read a series of mental images of words from a sequence of their revisualised mental images.	✓
8. Is able to write down a series of words accurately from a sequence of their revisualised mental images.	✓
9. Is able to mentally revisualise a sequence of words accurately after a delayed period of time.	
10. Is able to use reading, imaging, revisualisation and written output processes in constructing sentences.	✓
11. Is able to use reading, imaging, revisualization and written output processes in constructing paragraphs.	
12. Is able to use reading, imaging, revisualisation and written output processes in constructing sequences of paragraphs, without interference or overload.	

Since CD was a participant in the contrast group of the study, he was only post tested using the visual imagery questionnaire. CD reported that he was able to visualise words although noted that the words were not very clear and that he experienced difficulty reading and identifying the spelling of the words in his mind. He reported the words in his mind to be written in black on a grey background. He noted that the words faded quite quickly in his mind after visualisation, particularly after he may have transformed to image into oral or written output, or if he stopped concentrating on the word. Thereafter, if he again wanted to recall the word, he could, however the word was unclear and again faded quickly. In view of his high level of distractibility, CD reported to experience difficulty focusing on the word in his mind and noted that the image moved around and also faded into his head after revisualisation. CD noted that he did not typically sees colour in his visualisations even if colour is present in the word that he is visualising. He reported some ability to manipulate mental images.

5.8.3 Intelligence and cognitive processing test scores (see table 27.4 in appendix xxii for raw scores):

CD underwent psycho-educational assessment in May 2002. His intellectual capacities were assessed utilising the WISC-III. His Full Scale IQ was measured to fall within the borderline range. His Verbal IQ falls within the below average range and Non-Verbal/Performance IQ within the borderline range. Although a large difference between his Verbal and Non-Verbal IQ scores were found to exist, this is not quite significant. His verbal abilities are therefore his relative strength however, these still fall within the below average range. His globally reduced intellectual scores indicate the presence of cognitive processing and learning difficulties.

There is intra- and inter-test scatter indicative of more specific areas of relative strength and weakness. With regards to the verbal scales, his relative strengths are his understanding of social and moral norms, although this remains concrete. Although still reduced, his comprehension abilities are also relatively strong when compared to his performance on the other verbal subtests. His relative weaknesses within the verbal realm are his verbal abstract reasoning skills, auditory memory for verbal information, numerical reasoning and language (expressive and receptive) skills.

Non-verbally, his visualisation abilities, discrimination skills, concrete and abstract spatial reasoning skills, non-verbal sequencing and non-verbal processing skills are relative weaknesses for him. Relative non-verbal strengths are his understanding of part-whole relationships. He has slow psychomotor and visual processing speeds which will impact on his ability to perform timed tasks. This also negatively affects his ability to engage in reading and writing activities. His reduced attentional skills and emotional neediness/immaturity with a tendency to act out and display attention seeking behaviour is considered to have also contributed to his reduced scores. His level of distractibility is considered to be high and internal motivation to engage in work related tasks reduced.

Table 15: Pre and post testing CAS and K-ABC results of participant CD:

CAS			
Successive Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Word Series	0	Nonverbal Matrices	1
Sentence Repetition	1	Verbal Spatial Relations	0
Sentence Questions	1	Figure Memory	1
Sum of gains made	2	Sum of gains made	2

K-ABC - Mental Processing Subtests			
Sequential Processing Subtests		Simultaneous Processing Subtests	
Subtest	Raw Score Gains	Subtest	Raw Score Gains
Hand movements	0	Gestalt Closure	0
Number Recall	1	Triangles	0
Word Order	0	Matrix Analogies	1
Sum of gains made	1	Spatial Memory	1
		Photo Series	0
		Sum of gains made	2

As apparent from this description of CD's intellectual capabilities and intertest scatter as measured on the IQ battery, CD experiences relative cognitive difficulties of both a successive and simultaneous processing nature. His performance on those subtests within the IQ battery requiring sequencing and logical mental processing are reduced, both within the verbal and non-verbal spheres, indicative of difficulties that he experiences in successive processing. His processing speed is also reduced, as apparent from his reduced coding score and weak numerical abilities, for which inadequate successive processing abilities are essential. CD suffers from complex attentional difficulties, poor planning skills and his level of distractibility is high. This is likely to affect his cognitive processing. CD's simultaneous processing abilities are also reduced. CD performed below average on most of those IQ subtests involving the conceptualisation of spatial dimensions and processing of spatial information. These are tasks which demand intact simultaneous processing skills. CD suffers from a learning disorder. His cognitive processing abilities appear to be globally reduced and these impact on his ability to read and write in an age appropriate manner.

Over the course of the remedial period utilising traditional phonological techniques, CD made slight improvements in both his successive and simultaneous processing abilities as apparent upon perusal of his pre- and post test raw scores obtained on the CAS and K-ABC successive/simultaneous and sequential/simultaneous processing subtests respectively. The apparent gains made in this regard on the CAS and K-ABC corresponds.

With regards to his successive/sequential processing abilities, CD obtained a raw score gain of 2 as measured on the CAS and 2 as measured on the K-ABC. His raw score gains of 1 on the Sentence Question and Sentence Repetition subtests of the CAS respectively are indicative of a slightly increased understanding of grammar and the composition of the

English language, improvement in his ability to process information logically and to express verbal information more coherently. This is also suggested by his raw score gains of 1 on Number Recall subtests of the K-ABC. He made no improvement in his ability to process non-contextual verbal information sequentially which is evident from the 0 gains he made on the Word Series and Word Order subtests. CD made no gains in his performance on the Hand Movements subscale of the K-ABC. This suggests that there is little improvement in his ability to process visual information sequentially in those tasks which require a motor output.

Slight gains in his simultaneous processing abilities are also apparent. CD obtained a raw score gain of 2 on both the simultaneous processing subtests of the CAS and K-ABC respectively. Raw score gains of 1 on both the Nonverbal Matrices and Figure Memory subtest of the CAS respectively are indicative of a subtle improvement in his ability to process and recall spatial/visual information holistically and to discern the spatial relationships that are apparent therein. Slight gains are apparent on the Matrix Analogies and Spatial Memory subtests of the K-ABC, which are also indicative of these subtle improvements. He made no improvements in his performance on the Gestalt Closure and Triangles subtests of the K-ABC and Verbal Spatial Relations subtest of the CAS, which suggests that he still experienced marked difficulties in this regard. As previously noted, CD suffers from marked attentional and emotional difficulties and these are likely to affect his academic performance and cognitive processing thus worsening his global performance.

5.8.4 Phonic inventories (See table 27.1 and 27.2 in appendix xxii for results):

CD shows slight improvements in his spelling abilities as evident from an analysis of his errors made on the Phonic Inventories in pretesting and post testing. On Level One and Two, CD made slight improvement in his utilisation of ending consonants blends (3 to 1 error). No gains in his utilisation of medial vowels/digraphs are apparent and his scores in these categories remained unchanged, indicating that no improvements are apparent. On Level Three, CD showed some improvement in his usage of suffixes (5 errors to 3) and in syllabification (1 error). No other gains are apparent.

5.8.5 Reading and spelling scores (see table 27.3 in appendix xxii for raw scores):

Table 16: Pre and post testing reading and spelling scores results of participant CD:

Test	Gained Scale Score	Gained Raw Score
Holborn Reading Scale	3 months	1
Schonell One Word Spelling Test	0 months	0
Schonell One Word Reading Scale	- 4 months	-3
Schonell Graded Dictation B	0 (positive score gain)	0 Reduction of errors
Schonell Graded Dictation C	0 (positive score gain)	0 Reduction of errors
Schonell Graded Dictation D	0 (positive score gain)	0 Reduction of errors

It is apparent from the above table that CD made limited improvements in both his reading and spelling ability as evident from the comparison of his results obtained on the pre and post testing battery. In reading, CD's scores essentially remained unchanged. He attained a raw score gain of 1 on the Holborn Reading Scale and -3 on the Schonell One Word Reading Scale, likely because of careless errors that CD appeared to make in post testing. CD displayed little motivation to engage in reading tasks which affected his progress significantly in this regard, hence the similarity between his pre and post test scores.

As apparent from the above results, CD made little improvement in his spelling ability with a raw score gain of 0 on the Schonell One Word Spelling Test. He made no improvements in his performance on the Schonell Graded Dictation tests, indicating that overall, his spelling abilities remained unchanged as a result of the remediation. Again, the limited progress evident in CD's spelling ability is likely to also be largely due to motivational issues as well as his reluctance to engage fully in school related tasks. His reduced cognitive abilities are also likely to have played a significant role in the reduced progress he made in this regard.

5.8.6 Writing ability:

Analysis of CD's writing ability at time of pre testing showed his usage of short and unstructured sentences. His usage of tenses was problematic and grammatical composition of sentences poor. In addition, CD's usage of descriptive words was limited by his reduced spelling ability since CD appeared reluctant to utilise words which he did not know how to spell in his writing. Analysis of his writing upon post testing showed no marked improvements in structure, grammar or punctuation. However, CD's writing may have become slightly more descriptive and he may have become more adventurous in terms of his usage of words which he did not know how to spell. He still requires external motivation to

engage in and complete writing tasks as a result of reduced motivation, concentration and attentional difficulties.

5.9 Summary of Chapter:

In this chapter, the case studies including the background histories and results of the pre- and post tests of the participants were described in detail. The progress made by each participant over the six month intervention period was qualitatively discussed. The case studies of the participants of the experimental group, tutored utilising a high mental imagery approach, were initially presented followed by those from the contrast group taught via a phonological approach, to whom the participants from the experimental group had been matched. Attention in the case studies was given particularly to the cognitive gains made by the participants as apparent through comparison of their pre and post test scores obtained on the assessment battery administered. These results will be discussed in further detail in the next chapter and the matched case studies pairs aggregated in accordance with aggregated cross-contrast case study methodology.

Chapter Six: Discussion

In this chapter, in accordance with aggregated cross-contrast case study methodology, the results of the individual case studies of the participants in the experimental and contrast groups comprising the matched pairs are collaborated and trends evident in the progress made by each participant of the matched pairs in their simultaneous and successive processing abilities, reading, writing and spelling skills over the intervention period discussed and similarities and differences evident in this regard highlighted, contrasted and elaborated upon. As discussed in the methodology chapter, the participants within the sample from each group were matched as closely as possible based on their level of intelligence, type of learning disorder and particularly their spelling and reading abilities as determined by their results obtained in the pre-testing battery. This allows for the relative progress made by the participants remedially tutored either with high mental imagery techniques or in accordance with traditional phonologically based spelling techniques depending into which group they fell, to be compared. Thereafter the progress made by all of the participants comprising the experimental and contrast groups is discussed in comparison to one another. Finally the results of this study, as related to the results obtained by previous studies done within this area, are explored.

6.1 Case Study Aggregation of Matched Pairs EA and CA:

EA is a first language English speaking female who was 11 years 6 months old at the time of commencement of the remedial programme. She suffers from attentional difficulties and has been diagnosed as suffering from ADHD although she is not taking medication for this condition. Cognitive processing difficulties, particularly in her simultaneous processing abilities are apparent although some difficulties with sequential processing are evident. Her reading, writing and spelling abilities are below that expected for her age. CA is also a first language English speaking female who was 11 years 3 months old at the time of commencement of remediation. She also suffers from attentional difficulties, as well as problems in her sequential and simultaneous processing skills, however these difficulties are likely to be related to neurological fallout following a closed head injury sustained at the age of 5 years old. She also presents with reduced reading, spelling and writing skills. Both EA and CA were eager to engage in their respective remedial programmes although required significant external structuring to facilitate their appropriate engagement with tasks,

particularly in view of their reduced attentional skills. Over a 6 month period, EA was tutored in accordance with high mental imagery remedial techniques receiving 30 sessions over the intervention period. CA was tutored via traditional phonological remedial methodology and had 25 sessions from start to finish of the study.

IQ testing done indicates that EA has a full IQ score falling within the below average range. Her verbal abilities are her significant strength, with her Verbal IQ falling within the average range. Her non-verbal skills are a relative weakness for her, with her Non-Verbal IQ score falling within the borderline range. The significant difference between her two IQ scores indicates that EA suffers from a non-verbal learning disability. On the other hand CA's full scale IQ score falls within the borderline range. Her non-verbal abilities are her relative strength with her obtaining a Non-Verbal IQ score falling within the below average compared to her borderline range Verbal IQ score. Her globally reduced IQ scores however indicate that although her non-verbal abilities are her relative strength, she experiences both verbal and non-verbal learning difficulties.

Both EA and CA showed gains in their successive and simultaneous processing abilities over the course of the intervention period as evident upon comparison of their pre- and post-test scores on the CAS and K-ABC. Although EA's sequential processing abilities were a relative strength for her prior to her involvement in the remedial program, she made marked improvement therein over the course of the remedial programme, with a raw score gain of 5 on the successive processing subscales of the CAS and a raw score gain of 6 on the sequential processing subtests of the K-ABC. In particular, her improved ability to processing verbal/auditory information logically and a greater appreciation for composition and structure of the English language is apparent, as suggested by her raw score gain of 4 on the Sentence questions subtest. Notable gains are also evident in her verbal memory ability as apparent from her raw score gain of 3 and 1 on the number recall subtest of the K-ABC and 1 on the CAS respectively. CA's sequential processing abilities are a relative weakness for her and she also showed gains therein over the remedial sessions. She obtained a raw score gain of 3 on the successive processing subscale of the CAS and 1 on the sequential processing subscale of the K-ABC. CA also obtained a raw score gain of 4 on the Sentence Question subtest, which corresponds to the improvement that EA made on this subtest, also suggesting that she had greater appreciation for English grammar and was able to process sequential verbal information more effectively at the end of the remedial period. CA demonstrated a decline in

her ability to recall and order single words however, as evident from her negative gains of -1 and -2 on the Word Series and Word Order subtests of the CAS and K-ABC subtests respectively.

With regards to simultaneous cognitive processing, EA showed notable gains, with a raw score gain of 4 and 2 on the corresponding simultaneous processing subtests of the CAS and K-ABC respectively. Gains in her ability to relate verbal and associated visual information and perceive the relationship between associated spatial information is apparent from examination of her gains made on the various simultaneous processing subtests. Her gains are spread out fairly evenly over the subtests, suggesting overall improvement in her simultaneous processing skills. CA also made improvements in her simultaneous processing skills as apparent from her raw score gains of 1 and 4 on the CAS and K-ABC simultaneous processing subtests respectively. CA's total gains made in this regard are comparable to EA's total gains although EA's gains were slightly greater. CA's performance on the various subtests of the simultaneous processing subscales indicate however, that CA demonstrated improvements primarily in the Spatial Memory subtest of the K-ABC with a raw score gain of 5. Unlike EA however, CA demonstrated little other improvements on the other simultaneous subtests suggesting that her gains made are more isolated to specific as opposed to her general simultaneous processing skills.

Both EA and CA showed improved reading scores with EA obtaining a scaled score of 8 years 8 months as measured by the Holborn Reading Scale and 8 years 8 months as measured on the Schonell One Word Reading Scale. CA obtained a score of 8 years 3 months and 8 years 8 months on these subtests respectively. EA showed a gained score of 5 months in her reading performance as measured by the Holborn Reading Scale. She furthermore showed an improvement of 5 months in her ability to read as measured on the Schonell One Word Reading Scale. CA, on the other hand, showed a gained scale score of 1 month and 3 months in her reading ability as measured on both these test respectively. EA therefore appears to have made the greatest improvement in her reading ability in comparison to that of CA.

EA obtained a pre-test spelling score of 8 years 7 months on the Schonell One Word Spelling Test in comparison to CA's score in this regard of 8 years and 2 months. Both EA and CA made improvements in their spelling ability over the intervention period as evident from the difference in their pre and post test scores obtained on the Schonell One Word Spelling Test.

EA made improvements of 10 months in this regard as compared to CA's 4 month gains in her spelling ability as measured on this test. Analysis of errors made on the Schonell Graded Dictation Tests show that while both EA and CA made improvements and showed a reduction in their number of errors on these tests, EA has made the greatest improvements.

With regards to their writing ability, it is clear that both EA and CA improved in confidence and motivation to engage in writing tasks. They both improved in their ability to structure and plan their writing. EA's writing became more descriptive and creative whilst CA's grammatical structure of her sentences appeared to improve. Through analysis of their writing, it is apparent that both EA and CA made improvements in this regard however in different areas of their writing ability.

It is apparent through the above comparison that EA made greater gains than CA in her cognitive processing skills and ability to spell and read as revealed in her gains in scores obtained in the pre and post testing battery. Both EA and CA however made improvements in their cognitive processing skills, reading, writing and spelling abilities although EA's improvements appear to be most noticeable in this regard. EA was tutored in accordance with the high imagery remedial techniques principles.

6.2 Case Study Aggregation of Matched Pairs EB and CB:

EB is a second language English speaking female who was 11 years 8 months old at the time of commencement of the remedial programme. Cognitive processing difficulties of both a simultaneous and sequential nature are apparent. Her reading, writing and spelling abilities are below that expected for her age. CB is a first language English speaking female who was 11 years 2 months old at the time of commencement of remediation. She suffers from attentional difficulties and has been diagnosed as suffering from ADHD however she no longer takes medication for this. She suffers from some simultaneous and successive processing difficulties although the latter are a slight relative strength for her. She also presents with reduced reading, spelling and writing skills. Both EB and CB were eager to engage in their respective remedial programmes although required external structuring to facilitate their appropriate engagement with tasks. Over a 6 month period, EB was tutored in accordance with high mental imagery remedial techniques receiving 25 sessions over the

intervention period. CB was tutored via traditional phonological remedial methodology and had 30 sessions from start to finish of the study.

IQ testing done indicates that EB has a full IQ score falling within the below average range. Her non-verbal abilities are a slight relative strength, with her Non-Verbal IQ falling within the lower limits of the average range. Her verbal skills are a slight relative weakness for her, with her Verbal IQ score falling within the upper limits of the below average range. No significant difference exists. CB's full scale IQ score however, falls within the average range. Her verbal abilities are a slight relative strength although both her Verbal and Non-Verbal IQ's fall within the average range. Similarly to EB, no significant difference exists between these two scores.

Both EB and CB showed gains in their successive and simultaneous processing abilities over the course of the intervention period as evident upon comparison of their pre- and post-test scores on the CAS and K-ABC. With regards to her sequential processing abilities, EB made marked improvement therein over the course of the remedial programme, with a raw score gain of 3 on the successive processing subscales of the CAS and a raw score gain of 6 on the sequential processing subtests of the K-ABC. In particular, her improved verbal memory skills and ability to process verbal/auditory information logically with a greater appreciation for composition and structure of the English language is apparent, as suggested by her raw score gain of 2 on the Sentence Questions subtest and 5 on the Word Order subtest. The gains that CB made in her sequential processing abilities are comparable to that of EB and are marked. It is evident that CB's sequential processing abilities are a significant strength for her and that these were further improved over the course of the remedial intervention period. She obtained a raw score gain of 6 on the successive processing subscale of the CAS and 4 on the sequential processing subscale of the K-ABC. CB also obtained a raw score gain of 5 on the Sentence Question subtest, suggesting that she had greater appreciation for English grammar and was able to process sequential verbal information more effectively at the end of the remedial period. Her other sequential gains were spread throughout the various sequential processing subscales although a notable improvement has also been made in her verbal memory as evident from her raw score of 4 on the Number Recall subtest. Likewise, EB's raw score gains made were also well spread throughout most of the sequential subtests.

With regards to simultaneous cognitive processing, EB showed notable gains, with a raw score gain of 5 and 9 on the corresponding simultaneous processing subtests of the CAS and K-ABC respectively. Gains in her ability to relate verbal and associated visual information and perceive the relationship between associated spatial information is apparent from examination of her gains made on the various simultaneous processing subtests. Her gains are spread out fairly evenly over the subtests, suggesting overall improvement in her simultaneous processing skills. A marked improvement is apparent on her performance in the Spatial Memory subtest with a raw score gain of 4. CB also made improvements in her simultaneous processing skills although these are slight as apparent from her raw score gains of 2 and 0 on the CAS and K-ABC simultaneous processing subtests respectively. CB's performance on the various subtests of the simultaneous processing subscales indicate however, that CB demonstrated slight improvements in her Spatial Memory and ability to more holistically perceive spatial relations. Decline in her abilities in this regard are apparent however.

Both EB and CB showed improved reading scores with EB obtaining a post test scaled score of 10 years 1 month as measured by the Holborn Reading Scale and 9 years 6 months as measured on the Schonell One Word Reading Scale. Similarly, CB obtained a post test score of 10 years 1 months and 9 years 5 months on these subtests respectively. EB showed a gained score of 14 months in her reading performance as measured by the Holborn Reading Scale. She furthermore showed an improvement of 15 months in her ability to read as measured on the Schonell One Word Reading Scale. CB, on the other hand, showed a gained scale score of 11 months and 5 months in her reading ability as measured on both these test respectively. Although their post test reading scale scores are similar, EB therefore appears to have made the greater improvement in her reading ability in comparison to that of CB when their pre-test scale scores are taken into account.

EB obtained a pre-test spelling scale score of 9 years 0 months on the Schonell One Word Spelling Test in comparison to CB's score in this regard of 7 years and 11 months. Both EB and CB made improvements in their spelling ability over the intervention period as evident from the difference in their pre and post test scores obtained on the Schonell One Word Spelling Test. EB made improvements of 14 months in this regard as compared to CB's 11 months gains in her spelling ability as measured on this test. Analysis of errors made on the Schonell Graded Dictation Tests show that both EB and CB made improvements and showed

a reduction in their number of errors on these tests. The nature of the improvements made in this regard are comparable in quantity overall.

With regards to their writing ability, it is clear that both EB and CB improved in confidence and motivation to engage in writing tasks. They both improved in their ability to structure and plan their writing and in their grammatical understanding of English sentences. Through analysis of their writing, it is apparent that both EB and CB made improvements in this regard however in different areas of their writing ability.

It is apparent through the above comparison that EB made greater gains than CB in her cognitive processing skills and ability to spell and read as revealed in her gains in scores obtained in the pre and post testing battery. Both EB and CB however made improvements in their cognitive processing skills, reading, writing and spelling abilities although, overall, EB's improvements appear to be most noticeable in this regard. EB was tutored in accordance with the high imagery remedial techniques principles.

6.3 Case Study Aggregation of Matched Pairs EC and CC:

EC is a first language English speaking male who was 11 years 11 months old at the time of commencement of the remedial programme. Cognitive processing difficulties of both a simultaneous and sequential nature are apparent. EC suffers from dyslexia and his reading, writing and spelling abilities are below that expected for his age. CC is a second language English speaking female who was 11 years 10 months old at the time of commencement of remediation. She suffers from some simultaneous and successive processing difficulties although her simultaneous abilities are a slight relative strength for her. She also presents with reduced reading, spelling and writing skills. Both EC and CC were eager to engage in their respective remedial programmes although required external structuring to facilitate their appropriate engagement with tasks. Over a 6 month period, EC was tutored in accordance with high mental imagery remedial techniques receiving 25 sessions over the intervention period. CC was tutored via traditional phonological remedial methodology and had 29 sessions from start to finish of the study. Both EC and CC suffer from underlying anxiety, which is likely to affect their academic performance.

IQ testing done indicates that EC has a full scale IQ score falling within the lower limits of the average range. His non-verbal abilities are a slight relative strength, with his Non-Verbal IQ falling within the average range. His verbal skills are a slight relative weakness for him, with his Verbal IQ score falling within the lower limits of the average range. No significant difference exists. CC's full scale IQ score however, falls within the below average range. Like EC, her non-verbal abilities are a slight relative strength for her with her Non-Verbal IQ falling within the lower limits of the average range. Her Verbal IQ Score falls within the upper limits of the below average range. Similarly to EC, no significant difference exists between these two scores.

Both EC and CC showed gains in their successive and simultaneous processing abilities over the course of the intervention period as evident upon comparison of their pre- and post-test scores on the CAS and K-ABC. With regards to his sequential processing abilities, EC made marked improvement therein over the course of the remedial programme, with a raw score gain of 3 on the successive processing subscales of the CAS and a raw score gain of 8 on the sequential processing subtests of the K-ABC. In particular, his improved verbal memory skills and ability to process verbal/auditory information logically with a greater appreciation for composition and structure of the English language are apparent, as suggested by his raw score gain of 3 on the Sentence Questions subtest and 2 on the Word Order subtest. EC also made marked gains in his ability to produce correct motor output following verbal input as apparent from his raw score gain of 5 on the Hand Movements subtest, which is likely to positively affect particularly his writing skills. The gains that CC made in her sequential processing abilities are notable although reduced in comparison to that of EC. She obtained a raw score gain of 5 on the successive processing subscale of the CAS and 1 on the sequential processing subscale of the K-ABC. A notable improvement was also been made in her verbal memory as evident from her raw score of 5 on the Number Recall subtest. Although slight other gains are apparent, CC tended to make specific gains in her sequential processing ability, such as in verbal sequencing and memory.

With regards to simultaneous cognitive processing, EC also showed marked gains, with a raw score gain of 6 and 3 on the corresponding simultaneous processing subtests of the CAS and K-ABC respectively. Gains in his ability to relate verbal and associated visual information and perceive the relationship between associated spatial information is apparent from examination of his gains made on the various simultaneous processing subtests. His gains are

spread out fairly evenly over the subtests, suggesting overall improvement in his simultaneous processing skills. A notable improvement is apparent in his performance in the Figure Memory subtest with a raw score gain of 3. Likewise, CC also made marked improvements in her simultaneous processing skills although these are slightly reduced in comparison to those of EC, as apparent from her raw score gains of 2 and 5 on the CAS and K-ABC simultaneous processing subtests respectively. CC's performance on the various subtests of the simultaneous processing subscales indicate however, that CC also demonstrated notable improvements in her Spatial Memory (with a raw score gain of 4) as well as in her spatial perceptual abilities.

Both EC and CC showed improved reading scores with EC obtaining a post test scaled score of 10 years 1 month as measured by the Holborn Reading Scale and 10 years 2 months as measured on the Schonell One Word Reading Scale. CC, on the other hand, obtained a post test score of 8 years 8 months and 8 years 2 months on these subtests respectively. EC showed a gained score of 6 months in his reading performance as measured by the Holborn Reading Scale. He also showed an improvement of 6 months in his ability to read as measured on the Schonell One Word Reading Scale. CC, in comparison, showed a gained scale score of 5 months in her reading ability as measured on both these test respectively. EC therefore appears to have made the greater improvement in his reading ability in comparison to that of CC when their pre-test scale scores are taken into account.

EC obtained a pre-test spelling scale score of 8 years 5 months on the Schonell One Word Spelling Test in comparison to CC's score in this regard of 7 years and 9 months. Both EC and CC made improvements in their spelling ability over the intervention period as evident from the difference in their pre and post test scores obtained on the Schonell One Word Spelling Test. EC made improvements of 7 months in this regard as compared to CC's 3 months gains in her spelling ability as measured on this test. Analysis of errors made on the Schonell Graded Dictation Tests show that both EC and CC made improvements and showed a reduction in their number of errors on these tests however, it is clear from the error reduction scores, that EC made greater improvements in this regard.

With regards to their writing ability, it is clear that both EC and CC improved in confidence and motivation to engage in writing tasks. They both improved in their ability to structure and plan their writing, in their grammatical understanding of English sentences and the

descriptiveness thereof. Through analysis of their writing, it is apparent that both EC and CC made improvements in this regard however in different areas of their writing ability.

It is apparent through the above comparison that EC made greater gains than CC in her cognitive processing skills and ability to spell and read as revealed in her gains in scores obtained in the pre and post testing battery. Both EC and CC however made improvements in their cognitive processing skills, reading, writing and spelling abilities although, EC's improvements appear to be most noticeable in this regard. EC was tutored in accordance with the high imagery remedial techniques principles.

6.4 Case Study Aggregation of Matched Pairs ED and CD:

ED is a first language English speaking male who was 11 years 7 months old at the time of commencement of the remedial programme. ED experiences relative cognitive processing difficulties of particularly a successive processing nature; his simultaneous processing skills appear to be a relative strength. ED's reading, writing and spelling abilities are below that expected for his age. CD is a first language English speaking female who was 11 years 10 months old at the time of commencement of remediation. He suffers from some simultaneous and successive processing difficulties. He also presents with reduced reading, spelling and writing skills. Both ED and CD were not internally motivated to engage in the remedial programme and suffer from significant behaviour and emotional difficulties, requiring extensive external structuring and prompting to facilitate their appropriate engagement with tasks. Their behaviour and emotional difficulties impacted upon ED and CD's ability to learn effectively within their respective remedial programmes. ED and CD also suffer from reduced attentional abilities which also affected their performance. Over a 6 month period, ED was tutored in accordance with high mental imagery remedial techniques receiving 25 sessions over the intervention period. CD was tutored via traditional phonological remedial methodology and had 22 sessions from start to finish of the study.

IQ testing done indicates that ED has a full scale IQ score falling within the above average range. His non-verbal abilities are a slight relative strength, with his Non-Verbal IQ falling within the above average range. His verbal skills are also strong however, with his Verbal IQ score also falling within the above average range. No significant difference exists. CD's full scale IQ score however falls within the borderline range. ED's verbal abilities are a relative

strength for him with his Verbal IQ's falling within the below average range. His Non-Verbal IQ score falls within the borderline range. A large, although not quite significant, difference exists between his verbal and non-verbal IQ.

Both ED and CD showed gains in their successive and simultaneous processing abilities over the course of the intervention period as evident upon comparison of their pre- and post-test scores on the CAS and K-ABC. With regards to his sequential processing abilities, ED made notable improvement therein over the course of the remedial programme, with a raw score gain of 7 on the successive processing subscales of the CAS and a raw score gain of 2 on the sequential processing subtests of the K-ABC. In particular, his ability to process verbal/auditory information logically with a greater appreciation for composition and structure of the English language are apparent, as suggested by his raw score gain of 3 on the Sentence Questions subtest and 3 on the Sentence Repetition subtest. Gains in his verbal sequencing skills and verbal memory are apparent. The gains that CD made in his sequential processing abilities are reduced in comparison to that of ED. He obtained a raw score gain of 2 on the successive processing subscale of the CAS and 1 on the sequential processing subscale of the K-ABC. A slight improvement was made in his verbal memory as evident from his raw score of 1 on the Number Recall subtest and 1 on the Sentence Questions subtest.

With regards to simultaneous cognitive processing, ED also showed notable gains, with a raw score gain of 7 and 2 on the corresponding simultaneous processing subtests of the CAS and K-ABC respectively. Gains in his ability to relate verbal and associated visual information and perceive the relationship between associated spatial information is apparent from examination of his gains made on the various simultaneous processing subtests. He made marked gains on the Verbal Spatial Relations subtest (raw score gain of 3) and Nonverbal Matrices subtest (raw score gain of 3). His gains are spread out fairly evenly over the subtests, suggesting overall improvement in his simultaneous processing skills. Likewise, CD also made some improvements in his simultaneous processing skills although these are greatly reduced in comparison to those of ED, as apparent from his raw score gains of 2 and 2 on the CAS and K-ABC simultaneous processing subtests respectively. CD's performance on the various subtests of the simultaneous processing subscales indicate that CD made slight gains in his visual perceptual skills however these gains are limited in comparison to those made by ED.

Both ED and CD showed improved reading scores with ED obtaining a post test scaled score of 9 years 5 month as measured by the Holborn Reading Scale and 8 years 7 months as measured on the Schonell One Word Reading Scale. CD, on the other hand, obtained a post test score of 10 years 1 months and 9 years 9 months on these subtests respectively. ED showed a gained score of 9 months in his reading performance as measured by the Holborn Reading Scale. He also showed an improvement of 13 months in his ability to read as measured on the Schonell One Word Reading Scale. CD, in comparison, showed a gained scale score of 3 months and a negative gain of (-)4 in his reading ability as measured on both these test respectively. ED therefore appears to have made the greater improvement in his reading ability in comparison to that of CD when their pre-test scale scores are taken into account.

ED obtained a pre-test spelling scale score of 7 years 2 months on the Schonell One Word Spelling Test in comparison to CD's score in this regard of 9 years and 2 months. Both ED and CD made improvements in their spelling ability over the intervention period as evident from the difference in their pre and post test scores obtained on the Schonell One Word Spelling Test. CD's gains are very slight however. ED made improvements of 4 months in this regard as compared to CD's 0 month gains in his spelling ability as measured on this test. Analysis of errors made on the Schonell Graded Dictation Test show that ED made a slight improvement with some reduction in the number of errors he obtained on these tests. CD made no improvements on his performance on the Graded Dictation Tests however. ED therefore made greater improvements in this regard.

With regards to their writing ability, ED improved slightly in confidence and motivation to engage in writing tasks. His ability to structure and plan his writing also improved to a limited extent. CD on the other hand, made little obvious improvement in his writing ability apart from a possible slight increase in the descriptiveness of his writing style. It is apparent that ED made greater improvements when compared to CD in this regard.

It is apparent through the above comparison that ED made greater gains than CD in his cognitive processing skills and ability to spell and read as revealed in his gains in scores obtained in the pre and post testing battery. Both ED and CD however made improvements in their cognitive processing skills, reading, writing and spelling abilities although, ED's

improvements appear to be most noticeable in this regard. ED was tutored in accordance with the high imagery remedial techniques principles.

6.5 Aggregation of Experimental and Contrast Group Clusters:

Table 17: Comparison of gained cognition raw scores of experimental and contrast groups:

	CAS		K-ABC	
	Successive Processing Subtests	Simultaneous Processing Subtests	Sequential Processing Subtests	Simultaneous Processing Subtests
Experimental Group Raw Score Gains				
EA	5	4	6	2
EB	3	5	6	9
EC	3	6	8	3
ED	7	7	2	2
Total Score	18	22	22	16
Contrast Group Raw Score Gains				
CA	3	1	1	4
CB	6	2	4	0
CC	1	2	5	5
CD	2	2	1	2
Total Score	12	7	11	11

Table 18: Comparison of gained cognition raw scores (intertest scatter) of experimental and contrast groups on the CAS and K-ABC:

	CAS					
	Successive Processing Subtests			Simultaneous Processing Subtests		
	Word Series	Sentence Repetition	Sentence Question	Non Verbal Matrices	Verbal Spatial Relations	Figure Memory
Experimental Group Raw Score Gains						
EA	1	0	4	1	1	2
EB	1	0	2	2	1	2
EC	0	0	3	3	0	3
ED	1	3	3	3	3	1
Total Score	3	3	12	9	5	8
Contrast Group Raw Gains						
CA	-1	0	4	0	1	0
CB	0	1	5	-1	0	3
CC	0	0	1	0	-2	4
CD	0	1	1	1	0	1
Total Score	-1	2	11	0	-1	8

K-ABC								
	Sequential Processing Subtests			Simultaneous Processing Subtests				
	Hand Movements	Number Recall	Word Order	Gestalt Closure	Triangles	Matrix Analogies	Spatial Memory	Photo Series
Experimental Group Raw Score Gains								
EA	2	3	1	1	0	0	0	1
EB	1	0	5	1	1	1	4	2
EC	5	2	1	1	0	0	1	1
ED	0	1	1	1	1	0	0	0
Total Score	8	6	8	4	2	1	5	4
Contrast Group Raw Score Gains								
CA	1	2	-2	-1	0	0	5	0
CB	-1	4	1	2	1	-3	-1	1
CC	1	-1	5	2	2	0	1	0
CD	0	1	0	0	0	1	1	0
Total Score	1	6	4	3	3	-2	6	1

Table 19: Comparison of gained orthography raw scores of experimental and contrast groups:

Group	Holborn Reading Scale (Gained raw score)	Schonell Reading Scale (Gained raw score)	Schonell Spelling Scale (Gained raw score)	Schonell Graded Dictation B (Gained positive score)	Schonell Graded Dictation C (Gained positive score)	Schonell Graded Dictation D (Gained positive score)
Experimental Group						
Participant EA	2	4	9	4	2	-
Participant EB	5	12	12	2	7	1
Participant EC	2	5	6	2	5	-
Participant ED	3	11	3	1	-	-
Total Gain	12	32	30	9	14	1
Contrast Group						
Participant CA	1	3	3	1	0	-
Participant CB	4	4	9	3	5	5
Participant CC	2	4	2	-1	2	-
Participant CD	1	-3	0	-	-	-
Total Gain	8	8	14	3	7	5

As evident from the total gains made in the scores in the pre- and post testing assessment battery as reflected in the above tables, it is apparent that the experimental group, who were tutored in accordance with the high imagery techniques, made *greater gains in their cognitive processing skills and ability to read and spell* in comparison to those gains made by the contrast group who were tutored in accordance with traditional phonologically based remedial methods.

With regards to their *successive processing abilities*, the experimental group made overall gains of 18 and 22 on the Successive Processing Subscale and Sequential Processing Subscale of the CAS and K-ABC respectively. The contrast group also demonstrated improved sequential processing skills although these are reduced in comparison to that obtained by the experimental group, with overall raw score gains of 12 and 11 on the Successive Processing Subscale and Sequential Processing Subscale of the CAS and K-ABC respectively. With regards to simultaneous processing, it is evident that the experimental group gains made in this regard also exceeded that of the contrast group. The experimental group obtained gains of 22 and 16 on the Simultaneous Processing Subscales of the CAS and K-ABC respectively. In comparison, the gains made by the contrast group in this regard are slightly reduced, with overall gains of 7 and 11 on the Simultaneous Processing Subscales of the CAS and K-ABC respectively. It is clear therefore, that the experimental group out-performed the contrast group with regards to gains made in their cognitive processing abilities including both their successive and simultaneous processing skills.

When considering the raw score gains apparent in the various subtests of the CAS and K-ABC, it is clear that with regards to their sequential processing skills, both the experimental and contrast groups made comparable gains in their performance on the Sentence Question subtest of the CAS, with gains of 12 and 11 obtained on this subtest over the remediation period. This suggests that both the experimental and contrast groups made notable improvements in their ability to process verbal information sequentially and in their English language grammatical skills. Although less notable gains are apparent on the Word Series and Sentence Repetition subtests of the CAS by both the experimental and contrast groups, the experimental group out-performed the contrast group on both of these subtests, indicating that overall the experimental group made greater improvements therein. With regards to their relative performance on the K-ABC subtests, the experimental group made markedly increased gains on the Word Order and Hand Movements subtests in comparison to the contrast group. This suggests that the experimental group made greater gains in their verbal sequencing skills as compared to the contrast group. Further more, the marked improvement of a raw score of 8 on the Hand Movements subtest made by the experimental group as compared to 1 on this subtest made by the contrast group, indicates that the experimental group made a notable improvement in their ability to process visual information sequentially and produce a corresponding motor response. The equivalent gains made by the experimental

and contrast groups on the Number Recall subtest suggests that similar gains were made by both groups in their ability to recall sequential verbal information.

In *simultaneous processing*, the experimental group demonstrated marked improvements in comparison to those made by the contrast group on the Non Verbal Matrices and Verbal Spatial Relations subtest of the CAS. This suggests that the experimental group showed an improved ability to perceive the relationship between associated spatial information as well as in their ability to correctly discern the relationship between verbal and spatial information which is linked. As measured on the CAS, similar gains in the performance on the Figure Memory subtest is apparent for both the experimental and contrast group suggesting that both groups made equivalent gains in their visual memory. Greater intertest scatter is apparent in the two groups' relative gains made on the simultaneous processing subtests of the CAS and K-ABC. The experimental group made notably greater gains on the Photo Series subtest which suggests that they made greater improvements in their ability to process visual information sequentially. The experimental group also made slightly greater gains in their performance on the Gestalt Closure and Matrix Analogies subtests, suggesting improved visual spatial skills. The contrast group however, in turn, demonstrated slightly greater gains in their improvements on the Triangles and Spatial Memory subtests. The marked gains made by both on the Spatial Memory subtest indicates that both the experimental and contrast groups made noticeable gains in their visual memory ability.

By implication therefore, for overall gains to be apparent in the simultaneous and successive processing abilities of the participants in this study, with the gains made by the experimental group exceeding those made by the contrast group in this regard, it is highly likely that the procedures and requirements inherent to the high imagery techniques utilised in this study tap into the inherent simultaneous and successive processing abilities of the participants.

As previously outlined, *simultaneous processing* is a mental process by which the individual integrates separate elements of perceived stimuli into a single perceptual or conceptual whole or group. Simultaneous processing has strong spatial and logical-grammatical components. The spatial aspects involve both the perception of stimuli as a group and the internalised formation of complex visual images while, in the synthesis of spoken and written language, the logical-grammatical dimension allows for the integration of words into ideas through the comprehension of word relationships, prepositions, and inflections, thus allowing for the

synthesis of parts into integrated groups (Luria, 1966). *Successive processing* on the other hand, is a mental process by which the individual integrates stimuli into a specific order that forms a chain-like progression. Successive processing has both strong serial and syntactic components. The serial aspect of successive processing involves the perception of stimuli in sequence and the formation of sounds and movements in order while the syntactic aspect of successive processing allows for the comprehension of the meaning of narrative speech and written text (Luria, 1966). Furthermore, as noted by Das et al (1994), simultaneous and successive processing is related to functioning of the *working memory*. Successive processing refers to the holding of chunks of information, with greater successive processing being required to hold more independent chunks of information. Simultaneous processing refers instead to the formation of chunks, with more simultaneous processing being required to form more complex chunks. Das et al (1994) and Bain (1993) also note that children suffering learning disabilities are likely to be *either less able* than other children *to use simultaneous or successive processing*, or, *less inclined* to use a particular type of cognitive processing, which in turn results in the specific skill deficits they may suffer, as apparent in their reading, writing or spelling abilities.

In this regard, it is apparent therefore that high mental imagery techniques as applied in this study, necessitate both simultaneous and successive processing skills and the integration thereof. It is clear that in order to successfully form a visual image by visually perceiving the visual stimuli and integrating the perceived visual information to form a holistic mental image, as required in the process of visualisation and revisualisation, simultaneous cognitive processing is vital. As the child's visualisation and revisualisation skills develop and they are able to image sentences and paragraphs (i.e. more complex chunks of information), greater use particularly of their simultaneous processing skills is necessary. The integration of ideas and understanding of the relationship between letters, words, sentences, paragraphs, ideas and concepts also necessitate simultaneous cognition. Although, as Das et al (1994) note, simultaneous and successive processing normally work in conjunction with each other, simultaneous processes are most essential to the formation of visual images and relation of ideas. It is through the consistent and repetitive application of high imagery techniques which demands simultaneous processing skills therefore, that these skills appear to be improved. This is in keeping with research results available, as outlined in the literature review of this study, including those by Krywaniuk and Das (1976, in Das et al, 1994), Brailsford et al (1984, in Das et al, 1994), Das et al (1994), Das and Kendrick (1997, in Naglieri, 1999),

Carlson & Das (1997, in Naglieri, 1999) and Naglieri (1999), all of which indicate that training of simultaneous and successive processing abilities can result in gains in this regard.

Furthermore, as described by Das et al (1994), successive processing skills are vital for the mental holding of these images, as demanded by the high mental imagery techniques applied in this study and through the process of targeted revisualisation. In addition, as elaborated upon in Chapter Two of this study, high mental imagery techniques are implemented in a hierarchical and sequential manner. Demands are placed upon logical thought and the serial ordering of the mental imagery chunks, thoughts and ideas of the child to write and comprehend words, sentences and paragraphs successfully. This inherently necessitates successive cognitive processing. Again, with ongoing repetition and practicing of visual imagery, logical thought and sequential ordering of letters, words and thoughts to create meaningful English orthography, gains in sequential cognitive processing appear to be made.

With regards to reading, the contrast group made a total improvement of 8 on their raw score obtained on the Holborn Reading Scale in pre-testing compared to that of 12 made by the experimental group. Likewise raw score gains on the Schonell One Word Reading Scale show a total gain of 32 for the experimental group and of 8 for the contrast group.

These results suggest that not only are high mental imagery techniques as useful in *improving the learners' reading abilities* as a more traditional approach to remediation, but that it also yields much greater improvements in this regard. It is considered that the utilisation of comics and of the emphasis placed upon silent reading, the decoding, colour coding and visualisation and revisualisation of words, as well as the verbalisation of imaged words thus making the English orthography more accessible to the learner, may have facilitated these improvements.

In addition, whilst this is likely to have assisted the participants in their ability to pronounce words read aloud, it is also considered that the emphasis placed on silent reading in particular encouraged reading for meaning and improved comprehension abilities. In addition, the visualisation of words encouraged the development of a whole word and top down approach to reading and facilitated progress to the orthographic stage of reading and spelling development as outlined in Frith's (1980) developmental model of reading and spelling. By contrast, reading aloud does not implicitly encourage reading for meaning and the development of comprehension skills and encourages more of a phonological and bottom up

approach to reading in comparison to visual imagery which, by its very nature, facilitates top down processing which, as described Frith's (1980) developmental model's, is the approach utilised by skilled readers to read familiar words.

Furthermore, as emphasised by the *connectionist model* of reading as described by Plaut et al (1996, in Eysenck & Keane, 2000), as well as the *McClelland and Rumelhart* (1981, 1982 in Ruddell & Unrau, 1994) *model of reading, both bottom up and top down* approaches can be utilised to read, depending upon the consistency of the word in the former model or familiarity of the word in the latter. In this regard, through *decoding*, high imagery techniques facilitate an understanding of the structure of the English orthography. This is also encouraged by the utilisation of a *seven vowel system*. In this way, in collaboration with reinforcing a top down approach to reading and spelling, a bottom up approach is also encouraged, particular with words unfamiliar to the child.

Also apparent from table 19, is that the experimental group made *greater improvements in their spelling ability* as revealed in their total gained raw score of 30 obtained on the Schonell One Word Spelling Scale as compared to that of 14 obtained by the contrast group participants on this test. Furthermore, examination of the gained positive scores obtained by the experimental group on the Schonell Graded Dictation tests in comparison to those obtained by the contrast group, provides evidence as to the higher overall gains made by the experimental group in their spelling ability.

In view of these results, the high mental imagery approach is considered to have facilitated a greater understanding of the orthography of the English language through *decoding, colour coding and syllabification*. In this way, the learner was able to improve in his/her understanding as to how, amongst other, the English language is constructed, the rules that apply to its construction, as well as the many irregularities and inconsistencies that exist in this regard, particularly with reference to the English language which is deep or opaque in nature.

Research has shown however, that although for 'normal' readers phonological awareness is the best predictor of reading and spelling ability, for learning disordered individual's, *phonological awareness is often very problematic*, which is considered to be one of the primary reasons why such children often really struggles to gain mastery over English

orthography through a phonologically based approach. This was evident in this study, with numerous of the children being described as having auditory discrimination, integration or memory difficulties which, by their very nature, will result in very poor phonological awareness and phonic skills. In addition, analysis of the errors made by most of the children did indicate difficulties in phonological awareness with sound confusions being common. Furthermore, apparent over reliance on phonologically based principles, likely as a result of *not yet having progressed to Frith's (1980) orthographic stage* of reading and spelling, was also apparent in all of the children in the study who, as a result, would spell a word as it may sound to them although this would commonly be wrong due to the inconsistent nature of English as already mentioned above.

Through the use of *visual imagery and colour* therefore, *multiple senses*, but particularly the visual sense, was utilised to improve the complex skill of the learner's ability to spell. In addition, as noted above, visual imagery encourages the orthographic as opposed to a phonological approach to spelling in accordance with the alphabetic principle which learning disorders individuals typically struggle to grasp. In accordance with Frith's (1980) developmental model, the orthographic stage of spelling is the ultimate stage and comprises the stage in which the skilled spelling functions and therefore is considered to be the ultimate goal to achieve in any spelling remedial education approach.

Furthermore, *emphasis on context* as opposed to single words is also key to high imagery remedial techniques. This is in keeping with the *connectionist* (Plaut et al, 1996, in Eysenck & Keane, 2000) and *interactive models of reading* (McCelland and Rumelhart, 1981, 1982 in Ruddell & Unrau, 1994; 1986), as well as the *schemata theories* (Ruddell & Unrau, 1994) of comprehension which emphasise the importance of context in skilled reading and writing and in reading and writing for meaning. In addition, in the interactive and connectionist models of reading, similarly to the word superiority effect, the sentence and paragraph superiority effect is also emphasised and this is also considered to assist in reading and writing ability and in the acquisition of skill thereof. This is maximised in the high mental imagery approach through revisualisation of sentences and subsequently paragraphs at a later stages in the programme. Words in their context is of prime importance to the principles of the high mental imagery approach.

Therefore, it is likely that due to the *multi-sensory targeting and utilisation of visual imagery* of the approach which does not place over emphasis on the phonological composition of words, that these notable improvements in the experimental groups' cognitive processing skills and abilities in reading and spelling in comparison to those made by the contrast group, are apparent.

The findings of this study also suggest that through repetitive utilisation of high imagery techniques, the ability of the participants to harness mental imagery to facilitate their learning process may improve.

6.6 Comparison of Study Findings with those of Previous Related Studies:

A number of previous studies have been conducted investigating the effectiveness of high imagery remedial techniques in improving the cognition and English orthography of learners suffering learning disorders over the past several years (Abelheim, 2002; Els, 2003; George, 2001; MacReadie, 2001; Picton, 2002; Ravencroft, 2002; Sampson, 2002; Sfetsios, 2002; Wilson, 2001). In addition, Ravencroft (forthcoming) conducted a meta-analysis of the results of the findings of the studies done to date in this regard. Ravencroft's preliminary findings (forthcoming) and statistical analyses of the results obtained, indicate that not only are high imagery remedial techniques as useful as a traditional phonological approach to remediate a learners reading, writing and spelling abilities, but that it produces gain scores in excess, suggesting that it is significantly better than the traditional phonologically based approaches in improving reading, writing and spelling skills. This is particularly the case where the programme is used with children who are treatment resisters (i.e. children with whom a variety of other remedial approaches have been used with little positive effect). Studies previously conducted by Sfetsios (2002) and Potter (2004) have demonstrated that associated cognitive gains, as apparent upon intellectual/cognitive testing, are also apparent upon post testing after the consistent usage of high imagery remedial techniques over a period of time with a learner suffering learning difficulties in the realm of their English language skills.

The findings of this study are thus *similar to those of related previous studies* on the use of high imagery remedial techniques with children suffering learning difficulties. This study indicates clearly that those children who were tutored using high imagery teaching techniques, following the principles and methodologies of the high imagery remediation,

made greater improvements in their cognition, spelling, reading and writing abilities as compared to those gains made by children tutored according to more traditional approaches.

This study therefore provides additional evidence as to its usefulness in working with children suffering learning difficulties. It suggests, in addition, that high imagery teaching techniques have value, and that more widespread utilisation of these is warranted, particularly with children with whom other remedial techniques have shown not to be successful.

This study is *cross cultural* and two children who are second language English speakers were included, one in the contrast group and one in the experimental group. Both made gains in their cognitive, reading, spelling and writing skills although the experimental participant made greater improvements therein, thus yielding results which reflect the trends apparent in the rest of the study sample. This study therefore provides preliminary evidence to suggest that increased cross cultural application of high imagery remedial techniques may be warranted. It should be noted that this however has not been specifically researched to date, particularly within the South African context.

6.7 Summary of Chapter:

In this chapter, a discussion of the results obtained by the matched pairs as well as the general trends apparent in the results of the participants comprising the experimental and contrast groups were presented. It is suggested from integration and cross contrast of the case study results, that not only is a high mental imagery approach as effective as a traditional phonologically based approach to the remediation of English orthography, but also that a high mental imagery approach may yield greater improvements in comparison. In addition, greater improvements seem apparent in the underlying simultaneous and successive mental processing abilities of those participants who were tutored with high mental imagery techniques when compared to those participants in the contrast group.

Chapter Seven: Summary and Evaluation

7.1 Introduction:

It has been estimated that approximately 10 - 15% of all children in South Africa are *learning disordered* (Murray, 1969; Werner, 1996). Learning disorders are specific difficulties affecting children from all ethnic and cultural backgrounds who, although by definition are not deaf, blind or mentally retarded, are unable to learn effectively within the traditional mainstream educational schooling system (Kirk, 1972, in Sfetsios, 2002). In particular, children with specific learning disorders usually show problems of varying severity in the areas of cognitive processing, reading, writing and numeracy, which are the skills that form the basis of school instruction and achievement. Furthermore, it is common for children who struggle to learn to read proficiently, to frequently experience difficulties with spelling due to the resultant deficiency in their store of word-specific knowledge (Prior, 1996). It is clear therefore that reading, writing and spelling are very difficult skills to learn and acquire, requiring the input and coordination of multiple complex cognitive and perceptual processes and abilities and an extended period of apprenticeship before fully mastered (Oakhill, 1996).

In this regard, Luria (1966) described two overarching dichotomous cognitive information processes, namely simultaneous and successive processing. *Simultaneous processing*, as defined by Luria (1966), is a mental process by which the individual integrates separate elements of perceived stimuli into a single perceptual or conceptual whole or group. According to Luria (1966), simultaneous processing has strong spatial and logical-grammatical components. *Successive processing* on the other hand, also referred to as *sequential processing*, is a mental process by which the individual integrates stimuli into a specific order that forms a chain-like progression. Successive processing is therefore an essential requirement when stimuli must follow each other in a strictly defined order. Successive processing has both strong serial and syntactic components (Luria, 1966).

Das et al, (1994) note that children suffering *learning disorders* of reading and written expression are likely to be either *less able than other children to use simultaneous or successive processing*, or, less inclined to use a particular type of cognitive processing. In examining the information processing strategies of children suffering learning disabilities,

problematic sequential processing has been implicated as a major factor in reading and spelling difficulties (Das, 2002; Joseph et al, 2003).

In this regard, the *Spelling, Imagery, Reading and Revisualisation Programme*, otherwise known as the Targeted Revisualisation Programme, conceptualises high mental imagery techniques as integral to the process of learning of the English language by children. It is a method of remediation designed for implementation with children suffering learning disorders affecting, in particular, their English reading, writing and spelling abilities.

By following a *hierarchical and sequential framework and utilising high mental imagery* techniques as central to the approach taken to the remediation of the development of oral and visual communication abilities, this approach purposes to link language and visuo-spatial modalities on receptive, integrative and expressive levels (Potter, 2003). The child is taught to use perception, mental imagery and language in combination through a process referred to as '*targeted revisualisation*'. Single words are first visually imaged and spelled orally, then revisualised and written, demanding the use primarily of *simultaneous mental processing* as well as the *serial* component of one's *successive processing abilities*. The development of sequential memory and particularly the *syntactical* component of *successive mental processing* is later emphasised through extension of this revisualisation process to sentences and paragraphs (Potter, 2000; 2001). Although the potential links apparent between the high mental imagery techniques utilised, cognitive gains apparent and improvements in the English language abilities made have been suggested by preliminary study results, limited research has been conducted specifically in this regard to date however.

This study therefore, focused on the efficacy of high mental imagery teaching techniques in improving the English orthographic abilities of children suffering learning disorders of reading and written expression. In particular, the main aim of this study was to explore, through the use of aggregated case study methodology, the associated gains that occur in the simultaneous and successive processing abilities of children who have been exposed to high mental imagery remedial techniques when compared to those who have been tutored via a traditional remedial approach.

7.2 Research Questions:

This study has therefore addressed the following research questions:

7.2.1 Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their *successive processing ability*?

The results of this study indicate that the participants who were *tutored via high mental imagery remedial techniques* showed *overall improvements in their successive processing abilities*, as apparent from gains made by the participants on the corresponding subtests of the CAS and K-ABC when comparing their pre and post test scores. The results also indicate that not only are these gains similar to those made by the participants who were tutored via a traditional phonologically based approach to remediation who also showed some general improvements in this regard, but furthermore, that the participants who received tutoring in accordance with a high mental imagery approach tended to show greater overall improvements in their successive processing ability in comparison to those made by the participants who were taught via traditional phonological based remedial techniques.

These results therefore suggest that *children with learning disorders of reading and written expression* who have been taught via *high mental imagery techniques* show *improvements in their successive processing ability* and that the gains made in this regard appear to be greater than those made by children suffering similar learning disorders who are not tutored in accordance with this approach.

7.2.2 Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their *simultaneous processing ability*?

Likewise, the results of this study show that *the participants who were taught in accordance with high mental imagery techniques* also show *overall improvements in their simultaneous processing ability* which surpassed those made by the participants taught in accordance with the traditional phonological based approach to remediation. This is apparent when the overall gains made by the participants in the experimental and contrast groups on the corresponding subtests of the CAS and K-ABC between pre and post testing, are compared.

This therefore provides evidence to suggest that participants with *learning disorders of reading and written expression* who have received remedial tuition via a *high mental imagery approach* show *overall improvements in their simultaneous processing ability* which appears to exceed the improvements made in this regard by participants tutored via a traditional remedial approach of their English orthographic abilities.

7.2.3 Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their spelling ability?

The results of this study further indicate that the *participants who were tutored via high mental imagery remedial techniques* showed *improvements in their English spelling ability* as reflected in the gains made when comparing their pre and post test scores on the spelling test battery administered. The results also indicate that not only are these gains similar to those made by the participants who were tutored via a traditional phonologically based approach to remediation who also showed improvements in this regard but, moreover, that the children receiving tutoring in accordance with a high mental imagery approach showed greater improvements in their spelling ability in comparison to those made by the participants who were taught via traditional phonological based remedial techniques.

These results therefore suggest that *children with learning disorders of reading and written expression* who have been taught via *high mental imagery techniques* show *improvements in their spelling ability* and that the gains made in this regard are greater than those made by children suffering similar learning disorders who were tutored via a phonological approach.

7.2.4 Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their reading ability?

In addition, the results of this study show that not only did the *participants who were taught in accordance with high mental imagery techniques* show *improvements in their reading ability* which were comparable to those made by the participants taught in accordance with the traditional phonological based approach to remediation, but also that these gains made in reading surpassed those made by the latter participants.

This therefore provides evidence to suggest that *children with learning disorders of reading and written expression* who have received remedial tuition via a *high mental imagery approach* show *improvements in their reading ability* and moreover, that this improvement is marked.

7.2.5. Do children with learning disorders of reading and written expression who have been taught via high mental imagery techniques show improvements in their writing ability?

Both the *participants remedially tutored in accordance with high imagery techniques* and via a phonologically based approach showed *improvement in their writing abilities* however, as a result of the qualitative and subjective approach taken to the analysis thereof in this study, it was difficult to determine the exact nature of the improvements made by each group in comparison to each other. Both the experimental and contrast group participants appeared to improve in their willingness and confidence to engage in writing tasks as well as in the creativity and descriptiveness of their writing abilities. Improvements in grammar and punctuation usage were also general trends evident in both the experimental and contrast groups. Although it cannot be determined conclusively, it appears that the children who were tutored in accordance with the high imagery approach may have showed an increased ability to structure their thoughts and ideas in writing over the course of the intervention period in comparison to the contrast group in this regard.

This study therefore provides evidence to suggest that *children with learning disorders of reading and written expression taught via high mental imagery remedial techniques* show *improvements in their writing ability*. However, from this study's results it is difficult to determine the exact nature of the improvements made in this regard and how this compares to improvements made by participants suffering similar learning disorders who were tutored in accordance with a traditional remedial approach.

7.3 Usefulness of High Mental Imagery Techniques and Implications of the Study findings:

Previous studies conducted over the past several years through the Department of Psychology of the University of the Witwatersrand have shown *high mental imagery remedial techniques to be related to improvements made in the English spelling, reading and writing abilities of children with specific learning disorders* (Abelheim, 2002; George, 2001; MacReadie, 2001;

Picton, 2002; Ravencroft, 2002; Sampson, 2002; Sfetsios, 2002; Wilson, 2001). Preliminary findings of meta-analysis of these results by Ravencroft (forthcoming) show that high imagery remedial techniques yield greater improvements in this regard in comparison to traditional phonological based methods to remediation. This study therefore provides further evidence to suggest that high mental imagery remedial techniques are effective in improving the English reading, writing and spelling abilities of children with specific learning disorders.

Furthermore, studies previously conducted by Sfetsios (2002) and Potter (2004) have demonstrated that *associated cognitive gains*, as apparent upon intellectual/cognitive testing, are also apparent upon post-testing after the *consistent usage of high imagery remedial techniques* over a period of time with a participant suffering learning difficulties in their English language skills. Although very scanty literature is available exploring the specific link between high imagery remedial techniques and simultaneous and successive processing abilities and no published studies appear to be available describing previous investigations that have been done to research this particular relationship, this study has provided case study evidence to suggest that an association between high mental imagery techniques and gains in simultaneous and successive processing abilities of learning suffering learning disorders affecting their English reading and writing skills, are apparent.

This study has therefore provided evidence to support the *value of high mental imagery remedial techniques in working with children suffering learning disorders* who are in full-time remedial education and have not made progress when taught with more conventional phonologically based remedial teaching strategies. *Associated gains in the underlying cognitive processing abilities* of the learners are also apparent as a result thereof. It is thus recommended that high imagery remedial techniques be implemented more widely with similar children who are treatment resisters in the future. Research into whether it is possible to introduce and integrate high mental imagery teaching techniques into classrooms in the existing South African remedial schooling system is also indicated, particularly because of the approach's inexpensive nature and the relative ease with which it can be implemented and maintained.

This study also provided data relevant to *cross-cultural issues and the usefulness of high imagery techniques* in improving the *English orthographic abilities and cognitive processing skills of second language English speaking learners*. Based on these positive results when

used with cross-cultural learners, there would also be value in investigating the usefulness of high imagery remedial techniques with children in other cross-cultural, bilingual or second language teaching settings. Following such investigation, the more widespread implementation and integration of high imagery remedial techniques within South Africa and into international remedial schooling systems could also be explored.

7.4 Summary of Chapter:

In this chapter, the research questions which this study set out to answer at its outset, were addressed. The results suggest that processes inherent to the procedure of targeted revisualisation and high imagery techniques demand usage of the simultaneous and successive processing abilities of the learner. Furthermore, this study has provide evidence to suggest that when implemented with Grade 5 learners suffering learning disorders of reading and written expression, the structured, targeted and ongoing usage of high mental imagery remedial techniques can result in improvements in the simultaneous and successive processing abilities of these learners which may surpass improvements made in this regard when phonologically based English remedial techniques are administered with similar learners in a similar manner. The overall findings of this study also suggest that high imagery techniques are useful in improving the reading, spelling and writing abilities of these learners. Furthermore, the gains made in the reading and spelling abilities of those learners tutored in accordance with high mental imagery techniques appeared to be greater than those tutored via a more traditional phonologically based approach to remediation of their English orthographic abilities. The findings of this study therefore indicate that high mental imagery techniques may be a useful method of remediation of English language skills and mental processing abilities of learners suffering learning disorders of reading and written expression who have not responded well to a phonologically based remedial approach.

Chapter Eight: Limitations of the Study and Suggestions for Further Research

8.1 Limitations of this Study:

8.1.1. Limitations due to the research design:

The design of this research has been based on an exploratory multi-method design, which has involved analysis of both qualitative and quantitative data. It can be described as being pre-experimental as it has involved analysis of both children taught under an experimental and a contrast as opposed to a control condition. In addition, the small number of children in both experimental and contrast groups has posed limitations to this study and the conclusions that can be drawn from it.

On the sampling level, although participants were randomly assigned to either the experimental or contrast groups, they were first matched, as far as possible, according to their age, type of learning disorder, intellectual level and spelling ability before being randomly assigned into either group. The degree to which randomisation occurred therefore, was limited by the initial matching of the participants, as well as the small sample size, with only four participants being assigned to each group.

In addition, although an experimental and contrast group did exist within this study and manipulation of the independent variable i.e. the implementation/withholding of high mental imagery techniques, did occur, the presence of a control group not receiving any form of remediation was not included in the design. The children in the contrast group received remedial tutoring in accordance with traditional alphabetic/phonic remediation guidelines, and were not tutored according to high mental imagery techniques. The children in the experimental group were tutored using high imagery techniques.

Thus all children in the study received some form of remedial intervention. This took the form of additional tutoring sessions provided after school. It is also important to note that all children were in addition receiving remedial tuition in the morning, and that the type of remedial programme received by both experimental and contrast groups in the mornings was provided by experienced and trained remedial teachers.

While the experimental and contrast groups varied in that only the experimental group received tuition using high mental imagery techniques, it is likely that a combination of the effects of remedial tuition in the mornings and the additional tutoring in the afternoons accounted for the improvements in the abilities of the participants reported in this study.

Under these conditions, the presence of a third group, namely a control group in the study, who could have been pre - and post tested but received no additional form of remedial tutoring until the completion of the current study would have strengthened the design. It would have enabled comparison between the control group results and those obtained by both experimental and contrast groups to have occurred, thereby allowing for further exploration of the effects that the absence or presence of remedial tutoring may have had on the participants' abilities. However, this was not possible for both practical and ethical reasons.

Given these limitations, it has only been possible for the researcher to describe the relative progress made by the participants in their cognitive and English orthographic abilities, and to compare trends apparent in the data with those from previous research. While the results with respect to the utilisation of high mental imagery techniques and improvements in successive and simultaneous processing abilities and reading, writing and spelling skills of the participants appear to be firm and consistent across all the children studied, they can only be regarded as of interest on an exploratory level. Given the inherent weaknesses in the design however, with the absence of true experimentation, no causal or widely generalisable conclusions or knowledge claims regarding the effectiveness of high mental imagery techniques could be formulated as a result of this study's findings.

8.1.2 Threats to the internal validity of the study:

Furthermore, this design was longitudinal in nature since pretesting was followed by 6 months of a specific remedial intervention strategy after which post testing occurred.

However, as a direct result of its longitudinal nature, maturation of the participants over the study time frame is likely to have posed a significant threat to the internal validity of this study. All participants are children and as such were, despite their learning disorders, continuously developing physically, cognitively, socially and psychologically during this time frame. Improvements in the participants' simultaneous and successive processing abilities as well as their reading, writing and spelling skills as a result solely of maturational factors are

likely to have occurred and the impact that this growth and development may have had on the research findings could not be controlled for by the researcher. Maturation effects are likely to have affected each participant differently over the course of the study, even within the matched pairs, despite them being matched as far as possible according to age and type of learning disorder. Due to the lack of true randomisation and the limited sample size, the effects of maturation could not be fully accounted for within this study and therefore presented as a significant confounding variable, the impact of which cannot be accurately determined, due to the absence of a true control group.

In addition, although attempts were made to standardise the research procedures as far as possible, since each participant was tested and tutored individually over the 6 month period, history too posed a significant threat to the internal validity of the study as a result of its longitudinal and cross sectional nature and the inevitably vastly different background histories, everyday circumstances and familial realities of each participant involved in the study. This is likely to have been a factor also within the matched pairs since participants were not matched according to the similarities and differences in their background histories.

Furthermore, although the participants were selected to participate in the research based upon their impaired spelling abilities as revealed by recent test scores obtained reflected in their school records, they were matched as far as possible to allow for meaningful comparison of their cognitive, spelling, writing and reading abilities. It was however, not possible to match the participants on the basis of all these defining characteristics. In addition to type of learning disorder and age, initial spelling ability formed the primary matching criteria. The simultaneous and successive processing abilities and reading and writing skills of the participants were therefore not considered at the time of selection or matching. Therefore, any initial differences that existed in the pre test scores and abilities of participants composing the matched pairs and two study groups in any of the above mentioned categories are likely to be related to their post-test scores, thus making comparisons between the participants difficult given this variability. The trends reported as a result of aggregation of the individual case studies should therefore be interpreted with caution.

Although attempts were made to ensure that the members of each pair in particular, received similar numbers of tutorial sessions throughout the intervention period to allow for more accurate comparison of improvements made as a result thereof, ill health and the impact of

occasional unscheduled extra mural activities, affecting both the children and tutors, resulted in sessions of all the participants having to be cancelled and rescheduled from time to time. As a result of this however, the number of sessions given in total to each participant were not exactly equal, limiting the standardised nature thereof, which impacted on the researcher's ability to compare the progress made by each child accurately in this regard,

Moreover, although the participants were purposely selected from different Grade V classes in the school to limit the impact of diffusion of information about the different approaches to the remedial methodologies between the contrast and experimental group with the experimental group working on the computers at times during sessions and utilising visual imagery to learn English words and the contrast group being exposed to more traditional classroom forms of remediation, this may still have occurred since many of the participants from the different groups were friends and did have contact with each other during breaks and after school. This may have had confounding effects, possibly leading to feelings of compensatory rivalry or demoralisation within the contrast group participants which may have impacted on the study results.

In this regard, as detailed in previous chapters of this research project, the usage of computers is core to the implementation of high imagery techniques as specified by the Targeted Revisualisation Programme. Whilst computers were used with the experimental group during tutorial sessions as often as possible, difficulty with the availability and accessibility of computers at the school during the year of implementation of this study did limit the extent to which computers could be used in comparison to previous years when similar studies investigating the efficacy of high mental imagery techniques had been implemented at the school. This reduction in computer usage with the experimental group during the year of implementation of this study is likely to have had a confounding effect on the results of this research. Although the impact of this can not be quantified given the pre experimental nature of this study, it is postulated that this is likely to have contributed to the reduction in the gains made by the participants in the experimental group of this study as compared to the gains made by participants in experimental groups of similar previous studies with unlimited access to computers, thereby ensuring that the suggested methodology of implementation of the high mental imagery techniques according to the Targeted Revisualisation Programme could occur unhindered and without concern of resource restriction.

The lack of psychometric information available for the Schonell tests and Holborn reading test also poses a limitation to this study since, although these measures are used in clinical practice both in South Africa and internationally with children suffering learning disorders, the degree to which they reliably and validly assess reading, spelling and writing within the South African population as well as the usefulness of these tests in assessing these abilities in children suffering learning disorders to date, has not yet been statistically determined or thoroughly researched. Due to their clinical significance however, the use of these instruments was seen as valid for the purposes of this pre-experimental qualitative study which intended to only describe trends between pre and post test raw scores obtained on these tests, thereby exploring any apparent improvements in these abilities.

In a similar vein, the CAS and K-ABC are limited in their usefulness to accurately assess the cognitive abilities of children within a South African context given the lack of availability of South African norms for both tests, with neither having been standardised or even extensively researched to date pertaining to their reliability, validity and usefulness in South Africa. As a result, the American/British norms available for these tests are applied in clinical practice in South Africa, but with caution, given the high likelihood of cultural and racial biases in subsequent result interpretation, particularly with children who speak English as a second language. This did present as a significant limitation to the internal validity of this research and, in an attempt to account for the impact of cultural bias in interpretation of the cognitive gains made by participants as a result of remedial tuition received, as assessed by these instruments, the raw scores were reported for the CAS and K-ABC and the raw score gains made by each participant were carefully considered within context of each participants' demographic information and personal history. Caution in the interpretation of these results is still necessary however to ensure the impact of cultural bias on the scores obtained is acknowledged and taken into account.

In addition, since the focus of this research project pertains to the exploration of improvements made in the successive and simultaneous cognitive processing abilities of participants following the implementation of a remedial programme, the corresponding subtests of the CAS and K-ABC were administered only. However, despite standardising the administration of the assessments with all participants during pre and post testing as far as possible, only specific components of these tests were administered, thereby possibly altering the psychometric properties of the assessments which are typically determined based upon the

administration of all components of the tests in a predetermined order. The confounding effect of instrumentation on the results obtained in this research project cannot therefore be ruled out.

Furthermore, although utilised in previous studies of a similar nature, the Phonic Inventories and mental imagery questionnaire have not been standardised and there is also limited information currently available regarding their validity and reliability in the assessment of phonic skills and mental imagery. The Phonic Inventories however, did provide useful information regarding the participant's use of the alphabetic principle and their patterns of integrities and errors made in spelling which were used to plan the remedial sessions and were therefore considered appropriate for use in this study, given its interventional nature.

The mental imagery questionnaire and checklist and tutorial session feedback reports were also considered to be sufficient and appropriate to allow for the gathering of additional qualitative data to monitor the participants' progress over the intervention period and to inform the quantitative scores obtained by the participants. The mental imagery questionnaire and mental imagery checklist has been designed by Potter (2000; 2001; 2006), an expert in the field, based on Piagetian theory to qualitatively explore a child's mental imagery capacity. It is therefore likely to have adequate content validity. Piloting of this questionnaire and checklist however, would allow for less tentative and more substantiated deductions to be made in this regard.

Although the utilisation of the above pre and post testing battery, in collaboration with the qualitative data obtained, allowed for the exploration and description of the improvements made in the participants' cognitive, reading and spelling abilities in accordance with the research aims, the assessment of the improvement of the writing ability of the participants however was subjective in nature, relying primarily upon the researcher's and child's class teachers' opinion of the child's improvement in this regard. The utilisation of a more standardised method of analysis of creativity and writing ability during pre and post is likely to have allowed for the assessment of the improvement in the child's writing ability to be more accurately and objectively determined, which would allow this aim to have been addressed more substantially.

Finally, despite attempts to control for the impact of experimenter effects in this study by standardising the approach to tutoring of the participants taken by the various tutors involved in the study, both within the experimental and control groups, since each child was tutored by the same tutor throughout the duration of the study, the individual differences and approach of each tutor which inevitably existed, as well as their differences in appearance, personality, motivation, tutoring experience, knowledge and ability to motivate and handle the temperament, behaviour and specific nature of the learning disorder of the child to whom they had been assigned to tutor, is likely to have had an influential, yet unquantifiable, impact on each child's performance both during pre- and post testing and in the tutoring sessions throughout the intervention period. Experimental effects therefore have also limited the internal validity of this study.

8.1.3 Threats to the external validity of the study:

With regards to external validity of the study, population validity remains low because of the small and specific nature of the sample drawn only from a single grade attending one school. Although it may therefore be possible for the results from this study to be generalised to the Grade V population attending the local remedial primary school where the study was conducted, this could only be done very tentatively and cautiously because participants were selected to participate in the research because of their poor spelling abilities as compared to the remainder of their class and are therefore likely not to be representative of their class. The results can not however be generalised to any particular form of learning disorder, any other age or grade nor to either gender or different cultures due to its lack of diversity in these respects.

The ecological and temporal validity of this study is also low since the participants, who were completing Grade V in 2004, were drawn from only one remedial school. The results can therefore not be generalised to any other schools either within South Africa or internationally, be they remedial or mainstream in nature, or to any other time frame or grade.

Although this study therefore has considerable limitations in both internal and external validity as discussed above and can therefore not provide major knowledge claims as a result, the design of this study, described by the aggregated case survey methodology, given the resources available, is argued to have been appropriate to meet the study aims. It is also argued to have been a necessary design, particularly given the vast variability of the sample,

with each participant differing in terms of the nature of their learning disorder, background history, culture etc, as well as their progress made throughout the intervention period which could not have been described as richly as it was in this study by utilising a more quantitative or experimental approach or a larger sample size.

8.2 Suggestions for Further Study:

Further studies in this area could consist of three groups, namely an experimental, contrast and control group to which participants of the same ages suffering the same or similar types and severity of learning disorders e.g. dyslexia, receiving full time remedial education could be randomly assigned. Studies could also be conducted concurrently at several English medium remedial schools located in different geographical locations in South Africa with multiple grades to allow for cultural, age and socio economic factors to be accommodated for, which would improve the external validity of the study.

Equivalent experimental and contrast groups could also both initially receive traditional forms of individual remedial tutoring for an equal and extended period of time, following which testing could be done after which the contrast group could continue to receive the traditional form of remedial tutoring while the experimental group could then begin to receive tutoring using high mental imagery techniques in accordance with the principles of targeted revisualisation for a period of time equal to that of the initial part of the study. The improvements in cognitive and language abilities of participants as evident in post testing done at the end of this second phase of intervention could then be compared to gains made in previous and initial testing, thus allowing more causal links to be determined and generalisable conclusions drawn as to the effectiveness of the high mental imagery remediation. The presence of control groups at each school in this study would also allow the researcher to more accurately determine this.

However, the results would still not be generalisable to the various types of learning disorders nor to all remedial schools in South Africa which differ vastly in terms of medium of instruction, resources and facilities available depending on their location and therefore studies investigating the effectiveness of high mental imagery remediation with second language English speakers and upon samples more representative of the South African population group to include different cultural and economic backgrounds to increase population validity

could also be conducted. More variables such as the effects of age and gender and type of learning disorder on the effectiveness of high mental imagery techniques could also be studied.

A team of researchers, in collaboration with other experts in the area of remedial education could analyse the data obtained together to avoid the impact of experimenter effects on data analysis and in an attempt to determine in as accurate and unbiased manner as possible, the improvements made by the participants.

In this light, it should be noted that this research project intended to serve as a pilot study to explore the cognitive gains apparent as a result of the implementation of high imagery remedial techniques as specified by the Targeted Revisualisation Programme. This research provides initial evidence to suggest that the implementation of high imagery techniques does result in numerous cognitive gains which, in this study, tended to exceed the cognitive gains made by the participants tutored according to a phonological remedial approach. Given the pre-experimental qualitative design of this study however, the drawing of only tentative conclusions in this regard was possible. Further research of a more experimental nature with a larger sample size focused on investigating specific cognitive and neuropsychological abilities and changes apparent therein as a result of the application of various remedial techniques, including the high imagery approach, could allow for more conclusive and generalisable knowledge claims to be made in this regard. Retesting after a temporal period of not receiving any remedial intervention would also provide useful information as to the permanency of the gains made.

Further research into the gains made in the simultaneous and successive processing abilities of participants as a result of the application of high mental imagery techniques using a larger sample size and focusing more specifically on changes apparent in single cognitive variables and investigating and describing these in greater detail would also be beneficial. Tuition of the experimental group utilising high mental imagery techniques as specified by the methodology of the Targeted Revisualisation Programme and the contrast group utilising the remedial programme suggested by the developer of the CAS, Das et al (1994), to improve comprehension, reading, writing, successive and simultaneous processing abilities could be useful in providing additional information about the nature of the cognitive gains made as a result of their participation in the two remedial programmes and allowing for comparison in

this regard. Ongoing research focusing specifically on the underlying cognitive processes and neuropsychological skills involved could facilitate the development of a hypothetical explanatory model detailing the potential links between high mental imagery techniques, gains made in reading, writing and spelling and the cognitive and neuropsychological processes involved therein.

Furthermore, as discussed within the literature review chapter of this study, debate regarding the existence and usefulness of the delineation of cognitive processes into simultaneous and successive processing abilities still exists. In particular, very limited research in this light has been conducted within the South African context. Ongoing research investigating the nature of simultaneous and successive processes and the usefulness and validity of this distinction, both internationally as well as nationally is vital.

In addition, since psychometric data is sparse for many of the tests used in the study and the tests had not yet been standardised on the South African population although utilised clinically, the ability to answer the research questions as to the improvements made in cognition, reading and spelling based solely on these test scores without additional descriptive qualitative data to inform the scores, was limited. Likewise, since no standardised quantitative assessment of the writing ability of the children was used in this study, improvement in the children's writing ability could not be determined through quantitative analyses unless a quantitative assessment of writing suitable for use with children suffering learning disorders in the South African context was developed or found. Research could therefore also be undertaken to standardise the Schonell tests and Holborn Reading test on the South African population, as well as to standardise a measure of creative writing ability in children as this would greatly enhance the internal validity of any study using these measures in South Africa the future. Likewise, since at present no measures of paediatric/adolescent cognitive psychological assessment has been standardised for use in South Africa, attempts to standardise the K-ABC and/or CAS for use on the South African population could be particularly beneficial.

Moreover, as described by Durrell and Catterson (1980), the richness of imagery flow, especially in reading, is probably the most important aspect of comprehension. Durrell and Catterson (1980) drew attention to the fact that minimal research has been done pertaining to mental imagery and language to date due to the recent neglect thereof in current professional

scholarship, suggesting that the study of imagery flow, particularly in reading, would be of great future importance. In this light, research into the nature of the mental imagery used by the children in the learning of words, such as reflected in their responses on the mental imagery questionnaire, could provide additional valuable insight into the characteristics and utilisation thereof. Collaboration of the data collected to date in this regard through the various studies already done investigating the efficacy of high mental imagery techniques could assist in increasing our understanding of how mental imagery abilities can best be harnessed and trained to facilitate improvement in the cognition and English orthography of children, both learning disordered and not.

8.3 Summary of Chapter:

In this chapter the significant limitations of this study both in design and in its internal and external validity have been highlighted, substantiating why, despite this study having met its aims, it is only possible to draw conclusions of a correlational nature and to describe apparent trends evident in the progress made by the participants over the intervention period. No causal conclusions or major knowledge claims are possible based on this study's findings due to its pre experimental design and the small and diverse nature of its sample.

Thereafter, suggestions for further research in the area of cognition, spelling, reading and writing remediation involving the high mental imagery techniques were discussed with emphasis particularly on its use within a South African context. Ongoing research focusing specifically on the underlying cognitive processes and neuropsychological skills involved therein to facilitate the possible development of an explanatory model detailing the potential links between high mental imagery techniques, gains made in reading, writing and spelling and the cognitive and neuropsychological processes involved therein could be of particular use. Ideas were explored to enable more causal and generalisable conclusions to be drawn from future research which could be based on larger more representative samples, matched on more defining criteria, involving experimental, contrast and control groups and utilising instruments which could be subjected to further standardisation for use within the South African context.