

https://dspace.org/

The bilingual mind...simultaneous and sequential processing and spelling ability in monolingual English and bilingual Afrikaans-English children

De Sousa, Diana Soares

2007-02-14T11:03:42Z
http://hdl.handle.net/10539/1976

Downloaded from a DSpace repository. https://dspace.org/

THE BILINGUAL MIND…

SIMULTANEOUS AND SEQUENTIAL PROCESSING AND SPELLING ABILITY IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN.



Diana Soares De Sousa

A dissertation presented to the Faculty of Humanities, in partial fulfillment

For the Degree of:

Master of Arts

University of the Witwatersrand,

Johannesburg.

2006

THE BILINGUAL MIND…

SIMULTANEOUS AND SEQUENTIAL PROCESSING AND SPELLING ABILITY IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN.

DIANA SOARES DE SOUSA

Department of Psychology
School of Human and Community Development

University of the Witwatersrand

ABSTRACT

In South Africa, the majority of children are bilingual and little research exists on the cognitive processes bilingual children use to spell. This has far-reaching and challenging implications for cognitive models of spelling. Specifically, bilingualism exhibits a *pervasive influence* on children's literacy development (Bialystok, 2002). The majority of research on children's spelling has been conducted internationally with monolingual English children. From international literature, cognitive processing (simultaneous processing and sequential processing) has been identified as an important area for consideration in the spelling acquisition process of English children (Kaufman & Kaufman, 1983b). Simultaneous processing is important for whole word spelling, whilst sequential processing is important for decoding letter sound correspondences. Cross-linguistic research demonstrates a bias towards one or the other spelling strategy may be tied to the depth of a language's orthography, possibly due to the different demands the language orthography places on how children learn to spell (Frost et al., 1987; Wimmer & Hummer, 1990, 1994; Goswami et al., 1998).

The present study examined the relationship between simultaneous and sequential processing and spelling in Grade 3 monolingual English-speaking children and bilingual Afrikaans-English speaking children at one point in time. Thirty bilingual Afrikaans-English children (Afrikaans first language, English second language) and were learning to spell in Afrikaans and in English simultaneously, and thirty monolingual (English first language) learning to spell in English. Simultaneous and sequential processing subtests of the Kaufman Assessment Battery (K-ABC) were administered to the monolingual and to the bilingual children. Monolingual English-speaking children received the English word and non-word spelling tests, while the bilingual Afrikaans-English children were asked to spell English and Afrikaans words and non-words (Klein, 1993). The results suggest that lexical (logographic or simultaneous) and non-lexical (alphabetic or sequential) routes are available in English and Afrikaans, but orthography did exert an influence on cognitive processing strategies. Sequential processing demonstrates a higher relationship than simultaneous processing with spelling in English and Afrikaans, although sequential processing contributes more to spelling in a shallow orthography, because the reliable relationship between spelling supports easier and faster computation than in an opaque orthography. Additionally, the results

demonstrate that in the bilingual Afrikaans-English children spelling in a second language (L2) rely on spelling skills in a first language (L1), even when the same teaching strategies are used for spelling instruction. Orthography as a tool of academic literacy instruction, influences whether the transfer of spelling skills has a positive or negative influence on spelling in English as a second language in bilingual Afrikaans-English children with a transparent L1. A dual-route model that incorporates the influence of orthographic depth is supported (Seymour, Bunce & Evans, 1992).

The present research study concludes that (1) simultaneous processing and sequential processing influence and predict the production of spelling in L1 and L2 in both English and Afrikaans alphabetic orthographies that differ in orthographic transparency, (2) orthographic demands of learning to spell in different orthographies varies and influences cognitive processing resources and decoding skills, which may provide an indication of a cumulative or challenging development of L2 spelling skills particularly when the L1 is transparent. The present research has implications for assessment, traditional spelling models and teaching bilingual children learning to spell in a second language, which is orthographically opaque relative to their transparent mother tongue.

Key Words: bilingualism; cross-linguistic orthographic studies; K-ABC simultaneous and sequential cognitive processing; spelling development; orthographic depth.

DECLARATION:

I declare that this dissertation is my own, unaided work. It is being submitted in fulfilment of the requirements for the Degree of Masters of Arts in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

DIANA SOARES DE SOUSA

0006815V

_____ day of _____ 2006.

ACKNOWLEDGEMENTS:

The researcher would like to acknowledge her sincere gratitude to Dr Kirston T Greenop, for her valuable support, encouragement and guidance were an integral part of this research report. I am grateful for her constructive suggestions and expert direction. I appreciate the comments and support from the Department of Psychology at the University of the Witwatersrand. Thank you to Dr Almarie R Peirson for her insightful interest and encouragement towards the present research study. In addition, special thanks to the Principals, Head of Department and teachers of both Rewlatch Primary and W. H Coetzee Primary schools for allowing me to carry out research at their respective schools, their valuable assistance was greatly appreciated. Thanks also to the all the children that participated in this study, who were always unfailingly willing and cheerful subjects. I appreciate their interest and enthusiasm shown in this research project. Finally I wish to express my sincere appreciation to my family, friends who displayed unfailingly ongoing moral support and encouragement throughout the year, and The Lord God, without whom nothing would be possible.

TABLE OF CONTENTS:

CONTENTS **PAGE**

ABSTRACT I

DECLARATION: III

ACKNOWLEDGEMENTS: IV

TABLE OF CONTENTS: V

TABLE OF FIGURES IX

TABLE OF TABLES X

TABLES IN APPENDIX H: STATISTICAL ANALYSES XII

TABLES IN APPENDIX I: QUALITATIVE SPELLING ANALYSES XII

CHAPTER 1: INTRODUCTION 1

1.1 LITERACY ACQUISITION IN SOUTH AFRICA 1

1.2 BILINGUALISM, LITERACY AND LEARNING TO SPELL IN SOUTH AFRICA. 4

1.3 AIMS OF THE PRESENT STUDY 12

CHAPTER 2: LITERATURE REVIEW: 13

2.1 COGNTIVE PSYCHOLOGY:INFORMATION PROCESSING MODELS 13

2.2 SIMULTANEOUS AND SEQUENTIAL PROCESSING THEORIES 16

2.2.1 Luria's (1970) Neuropsychological Theory of Brain Functioning 16
2.2.2 Naglieri and Das's (1988) Planning Attention Simultaneous and Successive (PASS) Model 17
2.2.3 Kaufman and Kaufman's (1983) K-ABC and simultaneous processing, simultaneous processing and spelling 19

2.3 MODELS OF SPELLING: 31

2.3.1 Dual-Route Model of Spelling 31
2.3.2 Frith's (1985) Developmental Stages in Spelling 36
2.3.3 Seymour, Bunce and Evan's (1992) "dual- foundation model" 39

2.4 THE RELATIONSHIP BETWEEN SIMULTANEOUS AND SEQUENTIAL PROCESSING AND SPELLING DEVELOPMENT 40

2.5 SPELLING CROSS-LINGUISTICALLY 43

2.6 BILINGUALISM AND THE TRANSFER OF SPELLING STRATEGIES 48

2.7 THE SOUTH AFRICAN SITUATION: ENGLISH AND AFRIKAANS ORTHOGRAPHIES 54

2.8 RESEARCH RATIONALE 58

2.9 RESEARCH AIMS 59

2.10 RESEARCH QUESTIONS 60

2.11 CHAPTER SUMMARY 60

CHAPTER 3: METHOD 61

3.1 DESIGN 61

3.2 PARTICIPANTS 61

3.3 INSTRUMENTS 63

3.3.1 Kaufman Assessment Battery for Children (K-ABC) *63*
3.3.2 Klein's (1993) Spelling English and Afrikaans Words and Non-Words *67*

3.4 PROCEDURE 68

3.5 ETHICAL CONSIDERATIONS 69

3.6 DATA ANALYSES 69

3.6.1 Quantitative Statistical Analyses *69*
3.6.2 Qualitative Error Analyses *71*

3.7 CHAPTER SUMMARY: 73

CHAPTER 4: RESULTS 74

4.1 DESCRIPTIVE STATISTICS 74

4.2 INFERENTIAL STATISTICS 81

4.2.1 Simultaneous and Sequential Cognitive processing 81
4.2.2 Spelling Words and Non-Words 83
4.2.3 Spelling skills in a first and second language compared in bilingual Afrikaans English children 85
4.2.4 Relationship between Simultaneous processing and Sequential processing and Spelling Scores. 87
4.2.4.1 Relationship between Simultaneous processing and Sequential processing and Spelling in monolingual English children 87
4.2.4.2 Relationship between Simultaneous processing and Sequential processing and Spelling in bilingual Afrikaans-English children 88

4.5 SUMMARY OF RESULTS 92

CHAPTER 5: DISCUSSION AND CONCLUSIONS 93

5.1 SIMULTANEOUS AND SEQUENTIAL PROCESSING IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN 96

5.2 SPELLING WORDS AND NON-WORDS IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN 101

5.2.1 Spelling English words and Afrikaans words compared 106
5.2.2 Spelling English non-words and Afrikaans non- words compared 109

5.3 CROSS-LANGUAGE TRANSFER OF SPELLING STRATEGIES IN A FIRST LANGUAGE TO SPELLING IN A SECOND LANGUAGE 111

5.4 THE RELATIONSHIP BETWEEN SIMULTANEOUS PROCESSING AND SEQUENTIAL PROCESSING AND SPELLING IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN 113

5.4.1 Predictors of Spelling English Words 115
5.4.2 Predictors of Spelling English Non-Words 118
5.4.3 Predictors of Spelling Afrikaans Words and Non-Words 121

5.5 IMPLICATIONS OF FINDINGS: 124

5.6 CRITIQUE: STRENGTHS AND LIMITATIONS OF THE PRESENT STUDY.....126

5.5.1 Design Considerations..... 127
5.5.2 Sample and Sampling Strategy..... 127
5.5.3 Instrumentation and Data Analysis Techniques..... 129

5.7 SUMMARY OF FINDINGS IN THE PRESENT STUDY.....130

5.8 CHAPTER SUMMARY.....131

REFERENCE LIST.....132

APPENDIX A: THE K-ABC SUBTESTS CONTRIBUTION TO SPELLING.....155

APPENDIX B: THE K-ABC REMEDIATION PROGRAMME PRINCIPLES 157

APPENDIX C: KAUFMAN ASSESSMENT BATTERY COGNITIVE PROCESSING MEASURES...
.....160

APPENDIX D: KLEIN'S (1993) SPELLING ENGLISH AND AFRIKAANS WORDS AND NON-WORDS TESTS/AANHANGSEL D: KLEIN (1993) SE SPELLING TOETS VAN ENGELSE EN AFRIKAANSE WOORDE EN NIE-WOORDE. 169

APPENDIX E: PERMISSION TO CONDUCT RESEARCH BY THE GAUTENG PROVISIONAL GOVERNMENT AND GAUTENG DEPARTMENT OF EDUCATION (GDE).....
.....170

APPENDIX F: UNIVERSITY COMMITTEE ETHICAL CLEARANCE CERTIFICATE.....174

APPENDIX G: LETTERS OF PARENTAL CONSENT, ...175

APPENDIX H: STATISTICAL ANALYSES.....178

APPENDIX I: QUALITATIVE SPELLING ERROR ANALYSES.....180

TABLE OF FIGURES

FIGURE **PAGE**

FIGURE 2.1: Spelling Orthographic Units (Fromkin & Rodman, 1988, p.269)……26

FIGURE 2.2: Kirby's (adapted from Kirby, 1988, p. 160) model of phonological awareness, simultaneous processing, sequential processing and spelling……..……...27

FIGURE 2.3: Dual Route Model of Spelling (Ellis & Young, 1996, p.50)……..…….32

FIGURE 2.4: Seymour and Evan's (1993, p.118) dual foundation model of orthographic development…….39

FIGURE 2.5: Relation between first and second language spelling (Bialystok, 2002, p.26)…….51

FIGURE 2.6: Map of Afrikaans Speakers in South Africa……...55

FIGURE 2.7: Map of English speakers in South Africa……56

FIGURE 2.8: Percentage of Afrikaans and English spoke in South Africa across all nine provinces (Statistics South Africa, 2004, p.2)……..57

FIGURE 4.1: Overall simultaneous processing and sequential processing cognitive profile in the monolingual English and bilingual Afrikaans-English children……75

FIGURE 4.2: Simultaneous processing and sequential processing in the monolingual English Children (*n* =30)……..……..……..77

FIGURE 4.3: Simultaneous processing and sequential processing in the bilingual Afrikaans-English children (*n*=30)……77

FIGURE 4.4: Spelling ability profile of monolingual English and bilingual Afrikaans-English Children (*n*=60)……...……....78

TABLE OF TABLES

TABLE **PAGE**

TABLE 2.1: Number of different speech sounds and symbols in English and Afrikaans (Coetzee, 1985)……58

TABLE 3.1: Descriptive summary of gender and age of monolingual English and bilingual Afrikaans-English Children……..62

TABLE 3.2: K-ABC subtests that make-up the Simultaneous and Sequential Processing Scales……65

TABLE 3.3: Reliability analyses of spelling tests used……..68

TABLE 4.1: Overall simultaneous processing and sequential processing Mean (*M*) and Standard Deviations (*SD*) scores in the monolingual English and the bilingual Afrikaans-English children ……...74

TABLE 4.2: Mean (M) and Standard Deviations (SD) on K-ABC subtests standard scores for the monolingual English and the bilingual Afrikaans-English children……76

TABLE 4.3: Spelling words and non-words in monolingual English and bilingual Afrikaans-English children……...78

TABLE 4.4: Results of two-independent sample *t*-test for gender differences on the K-ABC global scale scores ……...80

TABLE 4.5: Results of two-independent sample t-test for gender differences on the K-ABC processing subtests for females and males……..…….80

TABLE 4.6: Results of two-independent sample t-test of significance of overall simultaneous processing, sequential processing and mental processing means scores between the monolingual English and the bilingual Afrikaans-English children……81

TABLE 4.7: Results of a two-independent sample t-test of significance of the K-ABC simultaneous processing and sequential processing individual subtests between the monolingual English and the bilingual Afrikaans-English children……82

TABLE 4.8: Results of a between two-independent sample t-test of significance of spelling ability between the monolingual English and the bilingual Afrikaans-English children ……83

TABLE 4.9: Results of dependent sample t-test of spelling English words and non-words in the monolingual English children……..…84

TABLE 4.10: Results of a dependent t-test of significance in the bilingual Afrikaans-English children…….……85

TABLE 4.11: Pearson's correlation matrix between simultaneous processing, sequential processing and spelling in monolingual English children …….....87

TABLE 4.12: Pearson's correlation matrix between simultaneous processing, sequential processing and spelling in the bilingual Afrikaans-English children……...88

TABLE 4.13: Simultaneous processing and sequential cognitive processing predictors of spelling English, and Afrikaans words and non-words ……...90

TABLES IN APPENDIX H: STATISTICAL ANALYSES

TABLE **PAGE**

TABLE H.1: Tests for Normality…….178

TABLE H.2: Levene's Tests…….179

TABLES IN APPENDIX I: QUALITATIVE SPELLING ANALYSES

TABLE **PAGE**

TABLE I.1: Qualitative Error Analyses of spelling English words in the monolingual English children…….……...180

TABLE I.2: Qualitative Error Analyses of spelling English non-words in the monolingual English children……..……181

TABLE I.3: Qualitative Error Analyses of spelling English words in the bilingual Afrikaans-English children…….……...….182

TABLE I.4: Qualitative Error Analyses of spelling English non-words in the bilingual Afrikaans--English children……...183

TABLE I.5: Qualitative Error Analyses of spelling Afrikaans words in the bilingual Afrikaans-English children…….……...184

TABLE I.6: Qualitative Errors Analyses of spelling Afrikaans non-words in the bilingual Afrikaans-English children…….…...…….185

CHAPTER 1: INTRODUCTION

1.1 LITERACY ACQUISITION IN SOUTH AFRICA

> *"Literacy is the most effective weapon we have for eliminating poverty. Literacy breaks the cycle of poverty by giving people choices about their lives, economic prospects, and the ability to empower themselves with writing skills. Without literacy people are excluded from participation in civic life, and stripped of their dignity as human beings. The ability to read and write is a fundamental human right, one that must be promoted at every level of society."* (Pandor, 2004, p.2).

The above words from Naledi Pandor (2004), the current Minister of Education, highlight the fundamental role literacy plays in everyday activities in South Africa as well as emphasises that two of the most important skills that children learn when entering school are reading and writing. The present educational policy, *Curriculum 2005,* aims to enshrine that the goals of schooling need to focus on language (Chisholm, 2000; Pandor 2004). Literacy and communication are seen as intrinsic to human development and life-long learning (Pandor, 2004). Therefore, literacy skills pervade school activities and have an effect on how children come to think and know about their own language (Bradley & Bryant, 1985; Pandor, 2004), and this illustrates the personal and social implications that failure to learn to spell may have.

Current research on the development of literacy skills in English is extensive, but the development of literacy in other orthographies is lacking (Hanon, 1995; Geva & Wang, 2003). Most research on reading and spelling has focused on English, resulting in a constrained understanding of literacy, characterised by English and it's writing system, which might not generalise to reading or spelling in other languages. In an attempt to broaden knowledge of literacy, researchers have turned to cross-linguistic studies (Treiman & Bourassa, 2000). This research has tended to focus on reading (Aro & Erksine, 2003, Delfior, Martos & Cary, 2002; Seymour, Aro & Erksine, 2003). The present study adopts a cross-linguistic perspective and extends cross-linguistic research studies by investigating spelling in two South African writing systems: those of English and Afrikaans. The purpose of the present study was to investigate the development of literacy; spelling ability, within an information-processing model that focuses on the cognitive processing styles that Grade three

South African children use to spell in English and Afrikaans. According to Donaldson (1991) Afrikaans is mostly no longer spoken in isolation from English. This has resulted in a high degree of bilingualism among Afrikaans and English speakers, particularly in the Johannesburg area (Census, 2001). Although most adults find spelling an effortless straightforward activity, observations of children labouring to learn the processes involved in spelling reveals the underlying complexity of this skill, as well as illustrates that children become literate in a developmental manner (Frith, 1985; Adams, 1990; Treiman, 1993; Treiman & Bourassa, 2000). The present study of children's spelling is designed to shed light on the nature of the spelling system that children in South Africa by examining the way sounds are cognitively processed and organized into orthographic spelling units that guide spelling. Research on children's spelling from a unique cognitive developmental perspective leads directly to an understanding of how phonological and orthographic knowledge and processing styles associated with spelling acquisition are acquired and change with the development of spelling ability (Treiman, 1993; Cunningham, 2005). In investigating the literacy development and processing skills of children growing up as monolingual English and bilingual Afrikaans-English speaking children, it is important to contextualise the environment of these children. This chapter will provide a brief overview of the South African government's educational polices, which are relevant to literacy research in the multilingual South African context.

Literacy is defined as the ability to read and write (De Oliveira &Valsiner, 1998), and has historically been dominated and concerned with reading research and in doing so has largely neglected the importance of learning to spell. But without the ability to spell as a broader aspect of writing a person could scarcely be called literate (Adams, 1990; Bryant, Bradley MacLean, & Crossland, 1990; Treiman & Bourassa, 2000). A full understanding of spelling development requires one to consider the development of spelling skills and cognitive processing strategies that children use to spell individual words. The ability to spell words easily and automatically provides an important foundation for good-writing skills and allows for a more automatised procedure for spelling at higher levels (Adams, 1990). However, it was only more recently that spelling has received attention in research, (Frith, 1985; Perry, Ziegler & Coltheart, 2002; Geva & Wang, 2003) partly due to research and analysis of children's spelling errors. Children's spelling errors reveal knowledge of spelling rules and strategies used to spell familiar and decode unknown words (Read, 1975; Gentry, 1982; Ehri, 1986; Treiman, 1993). This perspective has permitted a resurgence of interest in spelling

research and highlights the complexity of it's acquisition, where children attempt to represent the phonological or sound form of words and spelling patterns they hear in their spelling (Treiman, 1993).

South Africa is a multilingual society recognizing eleven official languages (Afrikaans, English, IsiNdebele, IsiXhosa, IsiZulu, Sepedi, SeSotho, Setswana, SiSwati, TsiVenda, Xitsonga). The Educational Policy on literacy acquisition, Curriculum 2005: Curriculum for the 21st Century (Department of Education, 2005, p1, retrieved, 2005/02/20) highlights that both societal and individual bilingualism represents the defining characteristic of literacy acquisition in South Africa. As such, it adopts an additive model of bilingualism and assumes that learning more than one language is a general practice and principle in South African society (Deumert and Swann, 2000; Leap & Mesthrie, 2000; Buthelezi, 2003). An ***additive model of bilingualism*** implies that learners are taught to spell in their home language and learn an additional language as a taught subject at primary school. The advantage of this educational viewpoint is supported by immersion or parallel medium instruction, in which a child adds "a second socially relevant language to his/her repertoire of language skills without losing the skills and fluency of his/her first language" (Cummins, 1999, p.40). The success of parallel instruction French-English immersion programmes in terms of cognitive, language, comprehension and production skills in Canada contrasts with the relative failure of bilingual education programmes offered to children of immigrants and minorities in many American states (Ovando & Collier, 1998, cited in Berk, 2002). In the latter case, the home language is used initially to build up the skills in the socially dominant language, which soon takes over as the medium of instruction. This is often termed a ***'transitional model of bilingualism'*** (Lambert, 1978). If this condition persists it often results in the learning of a socially dominant language leading to the loss of skills (or complete loss) of the home language called ***subtractive bilingualism*** (Lambert, 1978).

Very few countries are monolingual, whilst others pretend to be monolingual; when the reality is that they have a recessive history of language extinction (Campbell, 1998). For example, Scotland, it is an English-speaking country, but it's historical language Gaelic, is as good as extinct. "Language extinction is one of the greatest threats to human heritage" (Buthelezi, 2003, p.3). The question is how to ensure that indigenous languages such as Afrikaans do not erode and die, whilst Curriculum 2005 strives for learners to become competent in English (Pandor, 2004). The Language in Education Policy (14 July, 1997),

states that that children should be taught literacy in their mother tongue, while ensuring exposure to additional languages. However, very few schools in South Africa implement the use of indigenous languages as a medium of instruction. In most primary schools in South Africa, the medium of instruction is English, and only a few dual-medium schools exist that teach all subjects in Afrikaans and teach English as an additional language (Buthelezi, 2003), from which the current sample of bilingual Afrikaans-English children in Johannesburg were sampled. With 11 official languages, and schools being given the choice regarding language of instruction, in some dual-medium schools where Afrikaans is spoken by the bilingual Afrikaans-English children the majority of the time in the class, some educators may choose to focus on using Afrikaans as a medium of instruction to facilitate these children's understanding of their learning material and as a result they may ***code-switch*** between English and Afrikaans when teaching bilingual Afrikaans-English children to spell English (Swann, 2000). Luckett (1991) argues that use of the mother tongue and English provides and encourages the development of bilingualism in South African homes. This situation may impact on literacy development providing its own strengths and challenges.

1.2 BILINGUALISM, LITERACY AND LEARNING TO SPELL IN SOUTH AFRICA.

Buthelezi (2003) notes that internationally, there is growing support for the use of the mother tongue to teach literacy. Research has shown that if children are taught to spell in a language other than their mother tongue, this leads to the diminishing of cognitive foundation skills on which alphabetic instruction builds on, and also undermines the learner's culture (Macdonald, 1989). Snow, Griffith and Burns (1998) suggest that the most effective way to build learners' literacy skills in their first language is to begin by teaching them to read and write in their first language. These researchers concur, with research findings that demonstrate that bilingual learners who acquire literacy in their first language, form a solid grammatical and cognitive base for learning a second (Cummins, 1981; 1999; van Tonder, 2001). Most American children speak only one language, their native tongue of English. Yet throughout South Africa, many children grow up bilingual and learn to two languages during childhood (Buthelezi, 2003). Children become bilingual in mainly two ways: (1) by acquiring both languages at the same time, or (2) by learning a second language after mastering the first. Children of bilingual parents who teach them both languages in early childhood show no

problems with language development. Although, initially their vocabularies in each language are smaller than those of monolingual children they readily catch up. Also, bilingual toddlers have been found to mix their two languages. But this is not a sign of confusion, since bilingual parents rarely maintain strict language separation, and 1- and 2-year olds use each language more with the parent who customarily speaks that language (Bhathia & Ritchie, 1999). Early language mixing reflects bilingual children's desire to use any means available to communicate (Genesee, Lambert & Holborow, 1986).

A large body of carefully conducted investigations show that bilingualism and exposure and experience with learning to spell in more than one language is associated with advanced cognitive skills that allows bilingual children to perform better on tests of selective attention, analytical reasoning, concept formation and cognitive flexibility than their monolingual peers (Bialystok, 1991,1999, 2002, Bialystok, Majumder & Martin, 2003; Cummins, 1999; Jared & Kroll, 2003). Also, their metalinguistic skills are well developed. They are more aware that words are arbitrary symbols, and more conscious of some aspects of language sounds, capacities that have been found to enhance reading as well as spelling achievement (Bialystok, 2003). However, Kamwangamalu (1997) also points to other researchers (Fasold, 1984;, cited in Kamwangamalu, 1997, Makoni, 1994 cited in Kamwangamalu, 1997) who argue that there is no clear evidence that teaching children in their mother tongue leads to greater cognitive gains. However, in South Africa the reality is that children are bilingual, which makes it inevitable that learning to spell includes learning to spell in a second language, which warrants a study in the development of spelling, the manner in which spelling skills are attained and difficulties they experience. Adams (1990) notes debates among educators about how to best teach children has been debated from whole-language to phonics approaches, resulting in learning to spell becoming a contentious issue. Research now indicates that a combination of these two teaching approaches is necessary for learning to spell (Snow et al., 1998; Paris, 2005).

For many years, the development of theories about the way that children learn to spell has been dominated by studies of English-speaking, monolingual populations (Frith, 1985; Bradley & Bryant, 1985; Bryant et al., 1990) while less research has examined the cognitive processes that bilingual children use to spell (Geva, 2000; Geva & Wang, 2003). In addition, research in bilingual children's spelling processes is fairly new, which has far-reaching and challenging implications for theories of spelling, and teaching children to spell in more than

one language (Bialystok, 2002). Thus, the present research study contributes to research on the cognitive processes that bilingual children use to spell in dissimilar alphabetic languages in South Africa, which permits insight into the role of bilingualism on cognitive and spelling development. Frith (1985) describes spelling as a complex cognitive-linguistic skill, which demands a higher level of analysis and control than oral skills (Bialystok, 1991, 2002). Thus, spelling requires deliberate and conscious attempts to master, and thereby neither an easy skill to master nor an automatic skill; rather deliberative effort is needed (Luria, 1970: Hsieh & Rapp, 2004). "Learning to spell, unlike speaking, is an 'evolutionary recent' skill and therefore is unlikely to have a genetic blueprint for neural instantiation (Hsieh & Rapp, 2004, p.1). The components of the spelling process are associated with activation in the left inferior frontal gyrus, angular gyrus, and supplementary motor area cortex traditionally associated with expressive language, spatial representation, attention and visual-object simultaneous representation and sequential processing (Hseih & Rapp, 2004). Spelling represents one of the greatest accomplishments in childhood because it is the foundation of learning and academic achievement (Paris, 2005).

Kaufman and Kaufman (1983b), Luria (1970), Das, Kirby and Jarman, (1975b) and Treiman and Bourassa (2000) argue that for children to spell, at least two cognitive processes are necessary namely, ***sequential processing*** is necessary to decode the individual sounds (phoneme) and represent these with their corresponding letters (Frith, 1985, Kaufman & Kaufman, 1983b; Ellis & Young, 1996), whilst ***simultaneous processing*** is important for the ability to visually recognize letter shapes and spelling patterns to spell words. Although the Kaufmans have made a convincing case about the utility of the distinction between simultaneous and sequential processing, factor-analytic evidence exists that these two types of learning are not entirely independent (Bracken 1985; Keith, 1985). Therefore, some tasks may require one type of cognitive processing; however this does not mean that the other does not play a role. Children may use either strategy depending on his/her processing strength or habitual processing style, but spelling success is dependent on the development of both modes of processing (Luria, 1970; Kaufman & Kaufman, 1983b).

Recommendations for teaching and remediation based on Kaufman and Kaufman's (1983b) idea of "processing strength" can be derived from the Kaufman Assessment Battery for Children (K-ABC) test findings. This model of test interpretation and consequential intervention for spelling remediation, involving segmenting the sounds in words as well as

recognizing spelling patterns in multi-syllabic words, illustrates aspects of phonological awareness (Kirby, 1988; Greenop, 2004). Theoretical support regarding the relationship between simultaneous processing, sequential processing and phonological awareness has been proposed by Kirby (1988), Kaufman and Kaufman (1983b). Greenop's (2004) study examined this hypothesis and found that simultaneous processing and sequential processing is related to phonological awareness in 119 10-year-old South African English, Sotho and Zulu children. Greenop's (2004) results indicated that simultaneous processing, sequential processing, and phonological awareness tasks, demonstrated shared variance. Therefore, phonological awareness and simultaneous processing and sequential processing measure the same broad underlying processing abilities involving decoding sounds, manipulating and holding sounds in memory in order for a word to be spelt.

Phonological awareness refers to the ability to manipulate sounds and segment spoken words into smaller units of sound segments, including syllables, onset-rime and phonemes (Cisero & Royer, 1995). These skills are thought to form a hierarchy, with certain forms of phonological awareness being precursors and developing before others and children need to acquire a certain level of competence in syllable, onset, and rime awareness before they can benefit from explicit instruction in phoneme awareness (Adams, 1990; Cisero & Royer, 1995). Phonological awareness has been shown to predict success in reading as well as spelling in alphabetic languages, in which letters stand for speech sounds (Blachman, 2000). In addition training children in phonological awareness has been found to encourage spelling development (Tangel & Blachman, 1992, 1995). For example, phonemes represent the smallest unit of sound; phonemic awareness thus refers to the awareness that words are made up of individual phonemes (Cisero & Royer, 1995). Phonemic awareness is related to sequential processing, which permits the decoding of the letter sound in reading and spelling (Kaufman & Kaufman, 1983b; Kirby, 1988; Boden & Kirby, 1995). Phonemic awareness represents the most sophisticated form of phonological awareness as it develops alongside spelling acquisition, and children who are not exposed to print are not aware that words are made of isolated phonemes, such as "d" "o" "g" but rather perceive the word as one unit "dog" (Cisero & Royer, 1995, p.275). Children need to be aware of phonemes and their orthographic representation for later spelling success. Words are made up of onsets and rimes (Cisero & Royer, 1995; Fromkin & Rodman, 1998). Onset and rime awareness would rely on sequential processing to link a sound to a particular letter, however simultaneous processing would be more relied upon to recognise the groups of letters that make up the

onset and rhyme units (Kirby, 1988). Syllables awareness represents the most basic level of phonological awareness, as the syllable is an easily recognizable speech unit (Cisero & Royer, 1995; Kirby, 1988). Syllable awareness in contrast to the phoneme awareness develops spontaneously and has been found in pre-spellers (Frith 1985; Treiman & Bourassa, 2000). Syllable awareness would make use of simultaneous processing for arranging the syllables and on sequential processing for pronouncing the letter sounds represented by the letters that comprise the syllable (Frith, 1985; Kirby, 1988). Thus, phonological awareness is made up of a variety of skills and is often used as an umbrella term to encompass children's understanding of written language or the sounds in language. There is consensus among researchers that certain phonological awareness skills develop spontaneously such as (syllable, onset and rime) but serve as precursors to the development of phoneme awareness that develops alongside exposure to alphabetic spelling instruction (Adams, 1990; Goswami & Bryant, 1990). Research that has examined children's spelling has also tended to focus on phonological awareness, (Frith, 1985; Blachman, 2000; Geva & Wang, 2003), which has been shown to be implicitly tapping into simultaneous processing and sequential processing strategies (Kirby, 1988; Greenop, 2004). However no study has clearly addressed the relationship between simultaneous processing, sequential processing and spelling, especially not within normal bilingual development in the South African context. Furthermore, the orthography or language structure that children are learning to spell in may affect this relationship due to the demands of the language's orthography for spelling acquisition (Frost, Katz & Bentin, 1987).

The orthographic structure of language has been shown to affect the strategies that children use in learning how to spell (Frost et al., 1987). The orthographic depth theoretical framework is often used to discuss differences in reading and spelling among alphabetic languages, which approximate a consistent 1:1 mapping between letters and phonemes, such as in Finnish, Italian, Spanish, German, and Dutch from which Afrikaans originates with those, which contain orthographic inconsistencies and complexities including multiple-letter graphemes, irregularities and morphological influences on spelling such as in French, English, and Danish (Seymour et al., 2003). According to this hypothesis, there are differences among alphabetic orthographies in terms of how regularly spelling and phonology can be mapped. In shallow orthographies there is a relatively 1:1 correspondence between letters and sounds. Conversely in deep orthographies there is a more complex or opaque relation between letters and sounds. Therefore, the demands of different language's

orthographies may influence the acquisition of spelling skills. This means that the difficulty of literacy will increase as one moves from shallow to deep orthographies. Hence, if linguistic complexity of language orthography affects spelling acquisition, spelling acquisition will be acquired with greater ease and faster in shallow orthographies than in deeper orthographies (Seymour et al., 2003). Cross-linguistic research has shown that although children acquire phonological awareness the rate and pattern may vary across language orthographies at different points of reading and spelling development (for example, Caravoulas & Bruck, 1993; Wimmer & Hummer, 1990, Wimmer, Landerl & Schneider, 1994; Greenop, 2004). Thus, the research indicates that the development of phonological skills occurs in an approximately equivalent way in different languages, and the effect of orthographic complexity influences only later when the orthographic spelling system emerges and shapes the extent to which level of phonological awareness is relied upon in a particular language that guides spelling in that language (Seymour et al., 2003). The relationship between phonological awareness and spelling has been researched extensively, and evidence suggests that phonological awareness is highly correlated with word recognition and spelling (Adams, 1990; Goswami & Bryant, 1990) and that instruction in phonological awareness is effective in word recognition and spelling, especially when training includes alphabetic knowledge as well (Ball & Blachman, 1991; Byrne & Fielding-Barnsley, 1995; Ehri, Nunes, Willows, Schuster, Yaghourub-Zadeh & Shanahan, 2001). Across many monolingual populations (Czech, Danish, English, French, German, Dutch, Italian, Spanish) high levels of phonological awareness has been shown to accompany high levels of word recognition and spelling (Carovoulas & Bruck, 1993; Lundberg, Olofossen & Wall, 1980; Cossu, Shankweiller, Liberman, Katz & Tola, 1988; Wimmer & Hummer 1990; Durgunoĝlu & Oney, 1999). Many studies have shown that phonological awareness levels are correlated with word recognition and spelling across orthographies in bilingual children and in children learning English as a second language (Cisero & Royer, 1995; Durgunoĝlu, Nagy & Hancin-Bhatt, 1993; Comeau, Cormier, Grandmaison & Lacroix, 1999). Furthermore studies have also demonstrated that phonological awareness skills can transfer cross-linguistically and predict word recognition and spelling development in the bilingual child's first language (L1) and second language (L2) (Geva, Wade-Wooley & Shany, 1997; Geva 2000; Geva & Wang, 2003).

Spelling and reading processes both draw upon and reflect a common underlying base of orthographic knowledge or lexicon (Zutell & Rasinski, 1989; Richgels, 1995; Ganske &

Scharer, 1996; Ehri, 1997; Burt & Tate, 2002). Perfetti (1992) notes "spelling and reading use the same lexical representation. In fact, spelling is a good test of the quality of representation" (p. 170). However, other research has highlighted that spelling and reading represent different skills and that spelling is not just a process of reading in reverse (Bradley & Bryant, 1980) but rather a complex system of representation capable of both deeper lexico-morphemic levels of language (Ellis & Young, 1996) as well as the mapping of phonology to orthographic units. Spelling is different from reading, because there are more possible graphemes for a given sound than ways of sounding out a grapheme (Frith, 1985; Schlagal, 2001). As such learning to spell is a highly complex intellectual achievement in it's own right, and worthy of psycholinguistic interest in the same way as other language based skills, such as speech perception, speech production and reading comprehension (Eysenck & Keane, 1995). Frith (1985) and Treiman and Bourassa (2000) suggest that examining children's simultaneous processing and sequential processing spelling strategies can provide insights about the types of perceptual units engaged during spelling. The way in which the speller spells a word provides insight into the type of orthographic knowledge he or she is using to perceptually process the word during the process of spelling.

A large body of research has documented the effects of differences in orthographic depth on learning to read and spell in different orthographies (Cossu et al., 1988; Durgunoĝlu & Oney, 1999; Frith, Landerl &Wimmer, 1998; Goswami, Gombert & Barrera, 1998; Geva 2000). For example, readers or spellers of shallow orthographies demonstrate an advantage in phonological phoneme awareness such as using the sounds of words to help them decode at the outset of spelling development as spelling words in these languages is more regular and predictable. Phonemes are the spoken orthographic units of words, which represent the sounds that make-up a word in a direct and unambiguous manner (Frost et al., 1987; Coetzee, 1985) and a good guide to reading or spelling in shallow orthography in contrast to readers or spellers in deep orthographies (Cossu et al., 1988; Goswami, 1999). Deep orthographies are characterised as having a more opaque letter to sound relationship and thereby difficult to decode using letter sound relations alone as the same letter may represent different phonemes in different contexts; or it may be the case that different letters may represent the same phoneme (Frost et al., 1987; Spenser & Hanley, 2003). Goswami, et al., (1998) found that children who learn to read or spell in a less transparent orthography are more likely to benefit from processing large orthographic units such as rimes, than children who learn to read or spell in a highly transparent orthography.

Recent research suggests that the orthographic framework can be extended to simultaneous and sequential processing strategies and reading development. Greenop' s (2004) study examined the relationship between simultaneous processing and sequential processing and reading. Greenop's (2004) findings indicated that simultaneous processing and sequential processing is influenced by the orthography system or language system that the child is learning to read in: English (opaque), Zulu (shallow), and Sotho (shallow). Although both simultaneous processing, and sequential processing were found in all groups the English children relied on simultaneous processing to greater extent relative to sequential processing, which was attributed to learning to read in an opaque orthography, in which sequential processing is needed to decode words, but simultaneous processing is used to a greater extent as many words cannot be decoded using sound alone. In comparison to the English children the Zulu and Sotho children demonstrated a clearer sequential processing preference over simultaneous processing thereby demonstrating how a shallow orthographies places emphasis on decoding words using grapheme-phoneme correspondences. However, whether this trends remains to be seen as spelling and reading are different skills that may imply differential reliance on simultaneous processing, sequential processing and spelling and developmental trajectories in diverse orthographies (Frith, 1985).

The present study sought to examine the relationship between simultaneous processing, sequential processing and spelling in monolingual English and bilingual Afrikaans-English children. Theoretical support for the relationship between simultaneous processing and sequential processing strategies is argued by Kaufman and Kaufman (1983b), although no research has investigated this relationship directly as most of the research conducted with the K-ABC has focused on simultaneous processing, sequential processing and reading (Das et al., 1975; Boden & Kirby 1995). Thus, the present study adopts the orthographic depth framework (Frost et al., 1987) to explore and explain differences in children learning to spell in a shallow orthography such as Afrikaans, compared to a deep orthography such as English. The difference in sound-print relationship in orthographies may trigger different simultaneous processing and sequential processing strategies to achieve spelling proficiency. More studies on how bilingual children process their orthographies are needed in order for educators to facilitate spelling in more than one language. The present research takes into account the variation in spelling strategies that occur across languages by investigating the relationship between simultaneous processing sequential processing and spelling in monolingual English and bilingual Afrikaans-English children, within an information-processing model of

cognitive ability. In light of the comparison between language and writing systems, second language researchers (L2) claim that the linguistic and orthographic differences among different language and writing system affects L2 acquisition in spelling and that spelling skills transfer from the first language (L1) to a L2. Very few studies have explored children learning to spell in a second language and whether these children transfer spelling skills in a first language when learn to spell in English (Geva & Wang, 2003; Durgunoĝlu et al., 1993; Geva, 2000; Durgunoĝlu, 2002). No study has directly assessed whether simultaneous processing and sequential processing strategies transfers in bilingual Afrikaans-English children who are learning to spell in a transparent first language are able to transfer these spelling skills to learn to spell in English, which motivated the present study.

1.3 AIMS OF THE PRESENT STUDY

The purpose of the current study is to investigate spelling in two writing systems: those of monolingual English speaking and bilingual Afrikaans-English speaking children. In light of the orthographic differences in English and Afrikaans, examining the relationship between simultaneous processing, sequential processing and spelling provides an indication as to why some languages are easier to learn to spell than others; whether children can learn to spell in a transparent orthography more quickly than they can learn to spell in an opaque orthography. Secondly, whether children adopt different qualitative strategies to spell a transparent alphabetic orthography compared to children learning to spell in an opaque orthography. If so, are different skills required in learning a transparent orthography as opposed to an opaque one. The present study aims to investigate the relationship between simultaneous and sequential cognitive processing and learning to spell in monolingual English speaking children and how this differs or is similar to bilingual Afrikaans-English speaking children learning to spell in Afrikaans and in English. Furthermore, by investigating bilingualism and learning to spell in another language and the potential transfer of spelling strategies cross-linguistically, the present study aims to address gaps in traditional spelling models, in order to discover how spelling in two orthographies provides information about language specific and universal aspects of spelling.

CHAPTER 2: LITERATURE REVIEW:

Many cognitive theories of spelling are termed information-processing models as they conceptualise spelling as a fluid ability, and dynamic process comprising various cognitive processes (auditory and visual discrimination, memory, sequentialisation, analysis, synthesis and integration) and components (lexical and non-lexical word components). (Kaufman & Kaufman, 1983a; Frith, 1985; Ellis & Young, 1996). This chapter discusses the debates surrounding the information processing theories of Luria, (1970) Das and colleagues (Das, 1972, Das, Kirby & Jarman 1975; Naglieri & Das, 1988) and the Kaufman Assessment Battery for Children (K-ABC) as an appropriate measure of cognitive processes necessary to explain and understand the cognitive processes and processing components of spelling development. Subsequently, models of spelling (Frith, 1985; Ellis & Young, 1996) and models of bilingualism (Cummins, 1981; Bialystok, 2002) will be presented as these highlight the importance of the stages or the developmental progression of spelling ability. The importance of learning to spell in a language other than English is emphasised (Geva et al., 1997; Geva, 2000).

2.1 COGNTIVE PSYCHOLOGY:INFORMATION PROCESSING MODELS

> *"The human mind is a complex symbol manipulating system through which information flows and that changes in mental functioning occurs through some combination of improvements in basic capacities, strategies and content knowledge*" (Klahr, 1992, cited in Chen and Siegler, 2000, p, 96).

As the above quote illustrates, an information processing approach to cognition focuses on the human mind as a computer and on the mechanism by which information is processed, in particular ***how*** information is processed, rather than ***what*** is processed and what produces intellectual development or change (Luria, 1970; Cohen & Swerderlik, 2001). Many other types of information-processing theories have been proposed from more recent connectionist models (McClelland & Rumelhart, 1986; Seidenberg & McClelland, 1989; Glosser, Friedman, & Roeltgen, 1996; Djiksta, Veuven & Grainger 1998). All approaches have in

common in that they place emphasis on what produces intellectual change or development of cognition. This is in contrast to theories of intelligence which utilise a simple measure of intelligence, implied in a single static intelligence quotient (IQ) score, which has limited use in measuring the cognitive-processes used in spelling, as it masks the varying developing levels, types of knowledge and cognitive processing skills and strategies that children use to spell (Tangel & Blachman, 1992, 1995; Treiman & Cassar, 1997; Treiman & Bourassa, 2000). Therefore, an information processing measure represents an alternative to traditional IQ measures, which focus on the *processes* rather than the *products* of cognition (Luria, 1966a, 1966b, Das, 1972; Das et al., 1975a; Das et al., 1975b; Naglieri & Jensen, 1987; Naglieri, 1989; Das 1992 a; Das 1992b).

Cognitive psychologist have engaged in efforts to conceptualise models of spelling and have proposed that models of spelling consist of specific processes and components accomplished by a information processing system consisting of components responsible for performing a specific function that is influenced by developmental age changes in noticing, encoding, decoding, transferring, combining, retrieving or acting on information (Sternberg, 1994). Given this assumption, attempts at modelling spelling consist of statements about what the subcomponents are, how they are interrelated, how they are acquired and what happens when these processes do not function properly. Thus, at the most basic level the ability to spell is a fluid dynamic process, and as parts of the spelling system develop together and interact cognitive psychologists gain insight into the cognitive processes that underlie spelling acquisition and development (Frith, 1985; Patterson & Morton, 1985; Seidenberg & McClelland, 1989; Eysenck & Keane, 1995).

In addition, information processing models and measures developed in this tradition, represent a merge of neuropsychological and cognitive theories that assume that cognitive ability is not static, but rather reflects how one processes information (Kamphaus, 1992; Eysenck & Keane, 1995) Neuropsychological theories (Luria, 1970) provide information about how the brain processes information, whilst cognitive theories provide information on the developmental of spelling strategies, and thereby together provide different views of research into the cognitive processes that make up spelling (Frith, 1985; Seymour, Evans & Bunce, 1992).

Das (1992a) has argued that children of the same IQ can exhibit very different cognitive processing abilities, thus highlighting the importance of investigating the underlying cognitive processes. Therefore, an understanding of human intelligence or cognitive ability remains incomplete, without at least knowing how individuals process information, and insight into the possible cognitive-processing strengths from which to derive prescriptions for training, teaching and remediation of identified cognitive difficulties (Kaufman & Kaufman, 1983b; Das, 1992b).

Stanovich (1988) has proposed that cognitive processing skills deficits or difficulties are at the basis of spelling problems. Siegel's (1999) study investigated this hypothesis, in a sample of 1493 children, including pre-school through school-aged spellers on a variety cognitive processing tasks (analytical and logical tasks, spelling word and non-word measures, recognising the visual form of a pseudowords) and found that cognitive processing skills are important for spelling. Similarly, Das's (1992) longitudinal study of pre-school to Grade 3 children indicates that both processing skills are important for spelling in both pre-school and school groups, but the pattern of development of sequential processing and simultaneous processing is reflected in the way children are taught to write and spell. At school children learn the alphabet and learn to write letters and words, which requires the child to recognise letter features and the visual-shape of letters in order to reproduce these letters. This involves simultaneous processing, which if not developed properly could result in letter confusions such as reversing '*p*' when trying to write a '*d*' (Das, Naglieri & Kirby, 1994). Gradually the simultaneous processing of letters and words, results in the child learning that these letters form a temporal order, which requires sequential processing to decode the sounds within unknown or new words (Das, Naglieri & Kirby, 1994). The influence of cognition and spelling development is mutually influential as both simultaneous processing and sequential processing skills and cognition increase as an effect of formal spelling instruction and age of the child.

The Kaufman Assessment Battery for Children (K-ABC) represents a cognitive information processing measure, which aims to measure the cognitive processing skills, which a task like spelling utilises (Luria, 1970; Kaufman & Kaufman, 1983b; Kamphaus, 1992). The next section discusses the information processing theories of Luria (1966a; 1966b; 1970), Naglieri and Das (1988) and Kaufman and Kaufman's (1983b) information processing models as they relate to spelling.

2.2 SIMULTANEOUS AND SEQUENTIAL PROCESSING THEORIES

2.2.1 Luria's (1970) Neuropsychological Theory of Brain Functioning

In terms of information-processing Luria (1966a; 1966b, 1970) was the first to propose the dichotomy between simultaneous processing and sequential processing, by noting when particular brain regions were damaged a specific type of aphasia would result. Luria (1970) attributes sequential processing to the fronto-temporal areas, which are implicated in the ability to analyse a series of speech sounds. Patients with lesions in these areas (fronto-temporal lobes) cannot distinguish /*b*/ from /*p*/ and /*t*/ from /*d*/, and many make unsuccessful attempts to find the content sounds of words that they are trying to write. In contrast, Luria (1970) attributes simultaneous processing to the parietal-occipital regions, which are responsible for understanding complex logic-grammatical relations and are necessary for the coding of sounds units (phonemes) into their respective orthographic units (graphemes). Patients with lesions in these regions (occipital-parietal lobes) have the normal ability to analyse speech sounds, but show marked difficulty in recognizing and forming written letters. In particular, they find it difficult to visualise the required visual-spatial structure of the letter, and are unable to grasp the spatial relations of the parts of words (onsets and rimes) and put these parts together to form words. Luria did not focus on the content, but on how information was processed simultaneously or sequentially and attempted to base these cognitive behaviours within brain regions or areas that work together to produce behaviour (Kagan & Saling, 1988).

However, Luria (1970) noted that different languages might entail different emphasis in the functioning of these cortical areas responsible for written language. For example Luria (1970) observed cases of Chinese patients with severe lesions in the acoustic regions of the frontal and temporal lobes yet demonstrated no difficulty in distinguishing the sounds that make up words, because their Chinese writing system is made up of ideographs instead of words. An ideographic writing system captures ideas and does not record the phonetic composition of words, and thus does not require the process of phonetic analysis but instead necessitates a more complex visual-spatial-orthographic analysis attributed to simultaneous visual processing of the parietal-occipital regions of the cortex (Luria, 1970; Fromkin & Rodman, 1998; Meschyan & Hernandez, 2005). In contrast in purely phonetic and alphabetic languages, phonetic analysis and synthesis is necessary to record the phonetic composition of

words associated with phonological sequential processing (Luria, 1970; Meschyan & Hernandez, 2005). Thus, differences in the phonological and orthographic systems of a particular language may entail the emphasis of different cortical systems and processing of written language, which may influence the acquisition and progress of learning to spell in diverse language orthographies. Thus, whilst both simultaneous processing and sequential processing are present in different language orthographies and cultures, simultaneous processing and sequential processing strategies as they relate to spelling in different language orthographies may differ.

Luria's (1970) theory suggests that simultaneous processing is broadly localised to the occipital parietal regions, while sequential processing is found in the fronto-temporal regions. In contrast Kaufman and Kaufman (1983) point out that some researchers (for example, Bogen, 1975; Gazzinga, 1975; Kinsbourne, 1978, cited in Kaufman & Kaufman, 1983a) adopt a more cerebral specialisation view. For example Morris and Biegler (1987) have suggested that sequential processing is localised to the left hemisphere, while simultaneous processing is a right hemisphere function. The Kaufman Assessment Battery for Children (K-ABC) does not take a position on the anterior-posterior or left-right debate, but rather takes as it's basis the dichotomy in processing ability that has emerged from research findings (Kaufman and Kaufman, 1983b). In general, Luria's (1970) neuropsychological theory of language and brain regions associated with simultaneous processing and sequential processing represents a very broad description of cognitive information processing ability. In this regard, Das and colleagues have formulated the PASS model and have subsequently extended Luria's (1970) cognitive processing theory to provide an understanding of how simultaneous and sequential processes develop and are related to spelling development (Naglieri & Das, 1988; Das 1992a Naglieri, Das & Jarman, 1990; Das & Naglieri 1994; Das & Naglieri, 1997).

2.2.2 Naglieri and Das's (1988) Planning Attention Simultaneous and Successive (PASS) Model

The PASS model is a cognitive-information processing model that examines how information is retained, transformed, coded, stored, retrieved and used, thus how knowledge is acquired and how learning takes place (Das, Kirby & Jarman, 1975a; Das et al., 1975b; Bournot-Trites, Jarman & Das, 1995). Naglieri and Das's (1988) simultaneous and successive

information processing model is based on Luria's (1970) neuropsychological theory and explains cognitive processing ability by looking at four types of functioning, namely: Planning, Arousal-attention, Simultaneous and Sequential (hence PASS). There are three main divisions in information processing, namely: input, processing and output. Input refers to all the information that is received by the sense organs, which can be received either in a serial or parallel manner. All this information is then categorised, analysed and made meaningful by cognitive processing strategies, which then produce an output (Naglieri & Das, 1989).

The first of the three systems *Arousal* regulates waking state and distributes cognitive energy that needs to be both selective and sustained as in attention (Eysenck & Keane, 1995). *Processing* is responsible for the acquisition, analysis, storage and retrieval of information, by using simultaneous and successive processing skills. These are viewed as two cognitive processing strategies. However no task alone requires only simultaneous processing and successive or sequential processing independently as each has a role to play, although according to the task at hand, one type may be relied upon in certain situations (Naglieri & Das, 1988; Naglieri, 1989). Sequential processing refers to the ordering of stimuli in a linear sequence or step-by-step serial order. Each separate unit is related only to the next in temporal order and are independent of one another (Naglieri and Das 1989, cited in Warrick & Naglieri, 1993). In contrast, simultaneous processing refers to the process whereby separate elements of information are integrated and synthesised into a holistic, unitary system of interrelationships (Naglieri 1989, cited in Warrick & Naglieri, 1993). The third system, *Planning*, programming and monitoring of behaviours, includes decision-making, judgement, selection, and execution of plans (Lezak, 1995). The three functional system of the PASS have been shown to be independent and distinct but interrelated (Ashman & Das, 1980; Naglieri, Prewett & Bardos 1989; Naglieri, Das & Jarman, 1990).

Das and Naglieri (1997) have proposed a measure of information processing, a *Cognitive Assessment System*, designed to tap PASS factors (CAS, 1997) as have Kaufman and Kaufman (Kaufman Assessment Battery for Children, 1985). Although Das and Naglieri (1997) present evidence to support the construct validity of the CAS, other researchers have questioned whether the test actually measures what it purports to measure (Keith & Kranzler, 1999; Telzrow, 1990). Telzrow (1990) argues that the K-ABC is a more appropriate measure as many factor analytic studies have shown that the K-ABC taps into simultaneous and

sequential processing factors, thereby providing support for the K-ABC's construct validity (Kaufman & Kaufman, 1983b; Kaufman & Kamphaus, 1984; Kaufman & MacLean, 1987; Keith, 1985; Zins & Bartlett, 1984; Naglieri & Jensen, 1987; Wilson et al., 1985; Kaufman, 1993; 2000). In addition research (Fourquean 1987; Valencia & Raikin, 1988; Flanagan, 1995) indicates that the K-ABC, is more appropriate to use with bilingual children as its subtests are largely non-verbal, and can be administered with little or no verbal instructions. This is described by Anastasi (1988) as a culturally reduced test which, according to Kaufman and Kaufman (1983) is suitable to administer to children with different linguistic backgrounds, as responses in either of the bilingual child's languages is scored correctly. By isolating the underlying cognitive abilities involved in general problem solving by breaking them down into their most basic parts the K-ABC permits an assessment at the level at which cognitive functioning is deficient or successful in order to direct remediation. Overall, Kline, Snyder and Castellanos (1996) commend the K-ABC for its clear theoretical rationale, as well as intent to assess cognitive skills relative to academic achievement. The K-ABC is discussed below, as an example of a cognitive information processing measure. In addition studies that have used the K-ABC to examine the relation between simultaneous and sequential processing and reading are discussed, as no study has addressed simultaneous processing, sequential processing and spelling.

2.2.3 Kaufman and Kaufman's (1983) K-ABC and simultaneous processing, simultaneous processing and spelling

The Kaufman Assessment Battery for Children (K-ABC) has already been the focus of extensive research and was used with over 1 million children in its first four years of distribution (Murphy & Davidshofer, 2001). The K-ABC is noteworthy for several reasons. Firstly, the K-ABC is based on a well-articulated theory of information processing that is strongly grounded in research in neuropsychology and cognitive psychology, both in the selection of information processing tasks and in the administration of the items (Coffman, 1985, Kaufman et al., 1985). This has resulted in a test that is technically excellent with extensive reliability and validity data supportive of its psychometric soundness. Secondly, the K-ABC's test scores demonstrate high reliability; internal consistency reliabilities average near .80 for the individual subtest and above .90 for the global simultaneous processing, sequential processing and mental processing composite test scores (Kaufman & Kaufman

1983b). Factor analyses indicate that the fundamental organization of mental processing tests (simultaneous processing versus sequential processing) is empirically justified, which offers evidence of construct validity (Kaufman & Kamphaus, 1984). Although factor-analytic evidence also suggests that these types of processing could be described differently (Bracken, 1985; Keith; 1985; Goldstein, Smith & Waldrep, 1986). Thirdly, the test is designed to minimise cultural bias and researchers have found this to be the case (Bracken, 1985; Chattin & Bracken, 1989). The use of sample items, teaching items, and minimal verbal emphasis placed on the administration of the simultaneous processing, sequential processing subtests all contribute to making the test culture fair (Anastasi, 1988; Cohen & Swerderlik, 2002). Finally, the test separate fluid and crystallised ability and provides diagnostic information that helps determine why children perform well on some tasks and poorly on others (Murphy et al., 2001). In addition, partly as a result of it's strong theoretical basis, the K-ABC has proven to be useful in various populations, including linguistically and culturally different children and multicultural assessment contexts (Naglieri, 1984a; Naglieri 1984b Fourquean, 1987;Valencia & Raikin, 1988; Matazow, Kamphaus, Staunton, & Reynolds, 1991; Flanagan, 1995; Das, 1992a, Das 1992b; Giordani, Boivin, Opel, Nseyila & Lauer, 1996; Kriegler & Skuy, 1996; Skuy, Taylor, 'o Carrol, Fridjhon, & Rosenthal, 2000; Greenop, 2004).

Although the K-ABC is seen as an intelligence test, it does not assess the same abilities as the Wechsler and Binet tests (Naglieri & Jensen, 1987; Kaufman & MacLean; 1987). The difference lies in the definition of intelligence, the test authors of the K-ABC define intelligence as "largely a matter of the problem-solving ability and the effectiveness of one's information-processing skills" (Cohen & Swerdlik, 2002, p.309). The K-ABC battery is divided into two mental processing scales namely: simultaneous processing and sequential processing which are designed to measure fluid intelligence and an achievement scale designed to measure crystallised or acquired knowledge. Naglieri 's (1984) study of 35 Navajo children found a significant difference between the Weschler Intelligence Scales for Children –Revised (WISC-R) Full Scale Scores and the K-ABC's mental simultaneous-sequential processing scales with the latter being a better instrument of intellectual assessment in linguistically and culturally different children. Naglieri (1984) explains this discrepancy as a result of the acquired knowledge component of the K-ABC Achievement Scale and WISC-R overall IQ as evidenced by the high correlation between these two measures(r =. 69), whilst the simultaneous processing and sequential processing scales did

not yield a correlation with the WISC-R, endorsing these K-ABC scales as a measure of a fluid and not an acquired ability.

The K-ABC intelligence scales measure two types of information-processing skills, which relate to ***how*** children solve problems rather than ***what*** type of problems they must solve (e.g. verbal or non-verbal) (Kaufman & Kaufman, 1983b). Unlike the Wechsler scales which measure "*g*" or general intelligence, the K-ABC places greater emphasis on the processing scales, elevating them so that they form the basis of interpretation, for identifying the child's processing style or cognitive strength in order to construct a remediation or teaching strategy utilising this strength (Kaufman & Kaufman, 1983b; Kamphaus, 1992). Simultaneous processing refers to the process whereby separate elements of information are integrated together and synthesised into a whole, or holistic unitary system. In contrast, sequential processing refers to the ordering of stimuli in a linear sequence or step-by-step order. Each separate unit is related to the next in temporal order and are independent of one another (Naglieri & Das, 1990). Thus, simultaneous processing tasks require the child to integrate information, often visual-spatial to solve a problem. Sequential processing tasks emphasise the temporal order or sequence of information in problem solving (Kaufman & Kaufman, 1983b).

Goldstein, Smith and Waldrep (1986) tried to establish the construct validity of the K-ABC by comparing the results on the Mental Processing Composite to results on various other tests. The K-ABC's overall simultaneous processing scale is highly related to tests of language and general ability than the overall sequential processing scale. Goldstein et al., (1986) argue that this provides evidence for the more simultaneous processing (Gestalt Closure, Matrix Analogies, Spatial Memory, Photo Series) than sequential processing (Hand Movements, Number Recall, Word Order) tasks on the K-ABC, which reflects the pattern of correlation results they found.

The relationship between simultaneous processing, sequential processing and spelling has not been addressed directly in any study. Theoretical support for a relationship between simultaneous processing and sequential processing and spelling is argued by Kaufman and Kaufman (1983b). The K-ABC provides a broad measure of information processing skills within which to conceptualise and encompass the skills necessary to spell. The present study is primarily concerned with the link between simultaneous processing and sequential

processing and learning to spell. It may be the case that simultaneous processing, and sequential processing each contribute to spelling separately, or it may be the case that simultaneous processing and sequential processing together contribute to different aspects of the spelling process. Furthermore emphases placed on these spelling strategies may vary according to the demands of the orthography the child is learning to spell in and what the spelling task emphasises. These alternatives are addressed in the present study. The next section discusses literature, which has linked the K-ABC's simultaneous processing and sequential processing to spelling abilities, as presented by Kaufman and Kaufman (1983b).

Sequential processing has been linked to spelling abilities, which require the serial ordering of components. Grapheme-phoneme correspondences require the child to match a particular letter of the alphabet to a particular sound or phoneme, and thus involve a serial ordering of letters and sounds. The sequence of letters making up the sound is held in working memory (Kaufman & Kaufman, 1983b). The ability to learn grammatical rules, and correct pronunciation of words also relies on the acquisition of sequential skills (Kaufman & Kaufman, 1983b). Simultaneous processing is influential in the following skills of spelling. Learning the shapes of letters and the spatial configuration of words, which requires the ability to integrate shape and letter forms to form meaningful wholes. This then leads to the ability to note the correspondence between patterns of letters and particular sounds such as spelling rule generalisations and applying this spelling pattern to spelling other words (Kaufman et & Kaufman, 1983). This means that once the ability to spell syllable by syllable has developed the child then begins to generalise about common occurring spelling patterns. Memory for these larger grapheme-phoneme patterns or rime units act as a cue to generate the entire word, as seen in whole-word spelling strategies, which represents a more automatized procedure for spelling associated with simultaneous processing (Kaufman and Kaufman, 1983b; Goswami, 1999).

Naglieri (1999) notes that children low in one type of processing may use another to spell, often compensating for their weakness in one area with their strength in another. However, it is important to note that these two processing scales are not hierarchical, but rather are conceptualized as equal in their contribution to reading or spelling. Kaufman and Kaufman (1983b) argue that word recognition involves both phonological decoding of unfamiliar or new words and visual spelling for familiar words, thus neither sequential nor simultaneous processing is used exclusively in spelling, but rather one type of processing may be utilised

when certain aspects of spelling are encountered. For example, when spelling a familiar word the speller may use simultaneous processing and recall a word's spelling from the visual-spatial sequence of the letters, whilst spelling a new or unfamiliar word would require the speller to use a more sequential processing approach to remember and recall the sequence of letters and sounds they hear in order for the word to be spelt (Treiman, 1993, Treiman & Bourassa, 2000).

Spelling disabilities have been linked to reading difficulties (Kaufman & Kaufman, 1983b). Problems with reading, such as in letter discrimination, or in memory are reflected in spelling. Identification of the visual and auditory dyslexic has further highlighted the link between reading, decoding and spelling. The visual dyslexic speller or decoder confuses letters or words that are similar, may show letter reversals, has difficulty with visual sequences and may have visual memory disorders, and may exhibit difficulty in relating part to whole, especially in learning words as single units, which reflects poor simultaneous processing skills (Boder, 1973; Sweeney & Rourke, 1978; Denckla, 1979; Kaufman & Kaufman, 1983b). By contrast, the auditory dyslexic speller or decoder, has auditory discrimination and perceptual disorders, may demonstrate difficulty with auditory analysis and synthesis, and has marked difficulty in auditory memory and sequencing phonemic information and recoding it, and thus poor sequential processing skills (Boder, 1973; Sweeney & Rourke, 1978; Denckla, 1979; Kaufman & Kaufman, 1983b). The language processes of spelling and reading are treated as similar, as research indicates that spelling and reading processes both draw upon and reflect a common underlying base of orthographic knowledge or lexicon (Zutell & Rasinski, 1989; Richgels, 1995; Ganske & Scharer, 1996; Ehri, 1997; Burt & Tate, 2002). However, other research has highlighted that spelling and reading represent different skills and that spelling is not just a process of reading in reverse (Bradley & Bryant, 1980) but rather a complex system of representation capable of both deeper lexico-morphemic levels of language (Ellis & Young, 1996) as well as the mapping of phonology to orthographic units. Spelling is more difficult than reading, because there are more possible graphemes for a given sound than ways of sounding out a grapheme (Frith, 1985). Nonetheless, spelling and reading co-occur and draw upon a common orthographic lexicon. Therefore, studies with reading provide an important empirical framework from which to infer the relationship between simultaneous processing, sequential processing and spelling, which no study has addressed, but is addressed in the current study.

In relation to reading ability, Hooper and Hynd's (1986) study found that normal readers performed significantly better on the K-ABC's sequential processing than dyslexic and poor readers. Dyslexic and poor readers displayed lower correlation scores between sequential processing subtests of the K-ABC and reading tasks. Das, Jarman, and Kirby's (1975) study found that this relationship is irrespective of a high or average non-verbal IQ. Similarly, Fourquean's (1987) study of Latino learning disabled children of limited English proficiency scored low on the K-ABC sequential scale, consistent with their associated reading disorders. Thus, the K-ABC sequential scale is a measure of cognitive processing as well as provides an indication of the learning difficulties or reading achievement in both first and second learners of English.

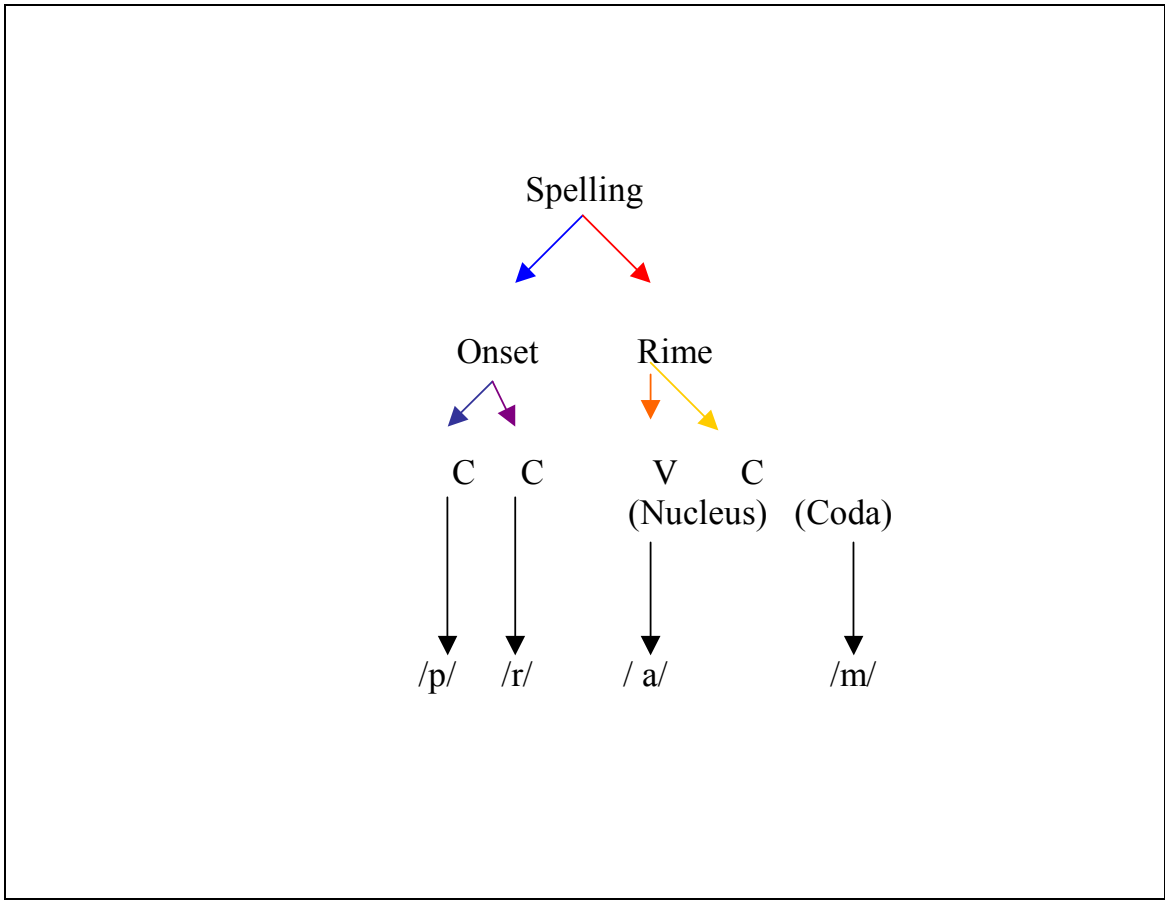
Boden and Kirby (1995) argue that sequential processing skills are vital for reading and that deficient or poor sequential processing skills are evident in dyslexic decoders, as measured in non-word reading tasks, which requires sequential processing to decode the letter sound correspondences of words not seen before, and forms the basis on which subsequent simultaneous processing skills builds upon. However, no study has directly assessed the importance of simultaneous processing and sequential processing and their relation to spelling, nor investigated this relationship in the context of bilingual spelling. It is important to assess whether the structure and orthography of a language influences the cognitive processing styles that children learn to spell in across dissimilar language orthographies (Frost et al., 1987). Consistent with research literature in phonological awareness studies, depending on the characteristics of language children may attend to different orthographic units (Caravoulas et al., 1993; Cossu et al., 1988; Durgunoğlu & Oney, 1997). For example, in languages where letter-sound correspondences are very close, sequential processing may be predominantly relied upon, whilst an opaque language may utilise simultaneous processing to a greater extent. Furthermore, this hypothesis could be extended to assess whether the nature of the orthography or language structure that children are learning to spell in influences the pattern of simultaneous processing and sequential processing skills used to spell in different language orthographies (Frost et al., 1987; Geva & Wang, 2003).

In terms of the specific subtests of the K-ABC's simultaneous processing and sequential processing scales each examines aspects and skills used to spell. A description of the subtests and their contribution to the spelling process is summarised in Appendix A. The K-ABC places greater emphasis on the processing scales, elevating them so that they form the basis

for interpretation, for identifying the child's processing style or cognitive strength in order to construct a remediation or teaching strategy utilising this strength. The general principles that govern the K-ABC's remediation strategies is summarised in Appendix B. Kaufman and Kaufman (1983b) and Naglieri (1999) outline a broad approach of how to remediate simultaneous processing and sequential processing weaknesses. With a child low in simultaneous processing, the importance of emphasising that words, letters and symbols need to be organized into patterns for a word to be spelt. With a child low in sequential processing Naglieri (1999) points out that, three things needs to be addressed: knowledge base, memory span, and application of sequencing strategies. If a child has a poor knowledge base, which interferes with their the ability to sequence letters and sounds, it is important to provide strategies to the child to give him or her this information. For example, give the child the letters /Y-L-A-P/, and then asking him/her to spell /*play*/. Memory difficulties may be addressed by teaching the child specific strategies to enhance memory. For example, recognizing spelling patterns tasks such as recognizing an entire word from presentation of some part of the word. For example presenting a word (question) in a sentence, which has *'tion'* in it as in *Can you answer the _ _ _ _ tion?* Therefore, spelling is made up of a variety of skills, each of which can affect the spelling process if it is not acquired properly or disordered (Kaufman & Kaufman, 1983). Each of these sub-skills needs to be investigated to determine, which is faulty to direct the remediation and teaching interventions (Kaufman & Kaufman, 1983b; Naglieri, 1999). Past research has established the importance of simultaneous and sequential processes as a crucial skill and predictors that enables children to read (Hooper & Hynd, 1982, Kaufman and Kaufman, 1983b; Boden & Kirby, 1995; Greenop, 2004). However, no research study has directly examined the relationship between simultaneous processing and sequential processing and spelling, which the present study addresses.

Kaufman and Kaufman (1983b) suggest that by identifying a child's processing strength, a remedial or teaching programme can be constructed based on this strength. In this information-processing framework, the authors suggest that the remediation of spelling involves teaching the child to segment the sounds in words as well as recognizing spelling patterns in multi-syllabic words, which illustrates aspects of phonological awareness (Kirby, 1988). Phonological awareness has been linked to the development of spelling skills in alphabetic languages, in which letters stand for speech sounds (Frith, 1985; Treiman 1985; 1993; Blachman, 2000). In addition training children in phonological awareness has been

found to encourage spelling development (Tangel et al, 1994). Measuring children's ability to conceptualise and manipulate spelling orthographic units assesses phonological awareness. Phonological awareness is an umbrella term for a number of spelling sub-skills such as the ability to identify and manipulate syllables, onset, rimes and phonemes (Cisero & Royer, 1995). For example, in the word /pram/, /pr/ is the onset, /am/ represents the rhyme, and /p/, /r/, /a/, /m/ the individual phonemic units that make up the word /pram/, as illustrated in Figure 2.1 below.



Note: C=consonant, V=Vowel

FIGURE 2.1: Spelling orthographic units (Fromkin & Rodman, 1998, p. 269).

Theoretical support regarding the relationship between simultaneous processing, sequential processing and phonological awareness has been proposed by Kirby (1988), and Kaufman and Kaufman (1983b). Kirby's (1988) model illustrates how simultaneous and sequential processes contribute to reading and spelling skills, as illustrated in Figure 2.2 below.

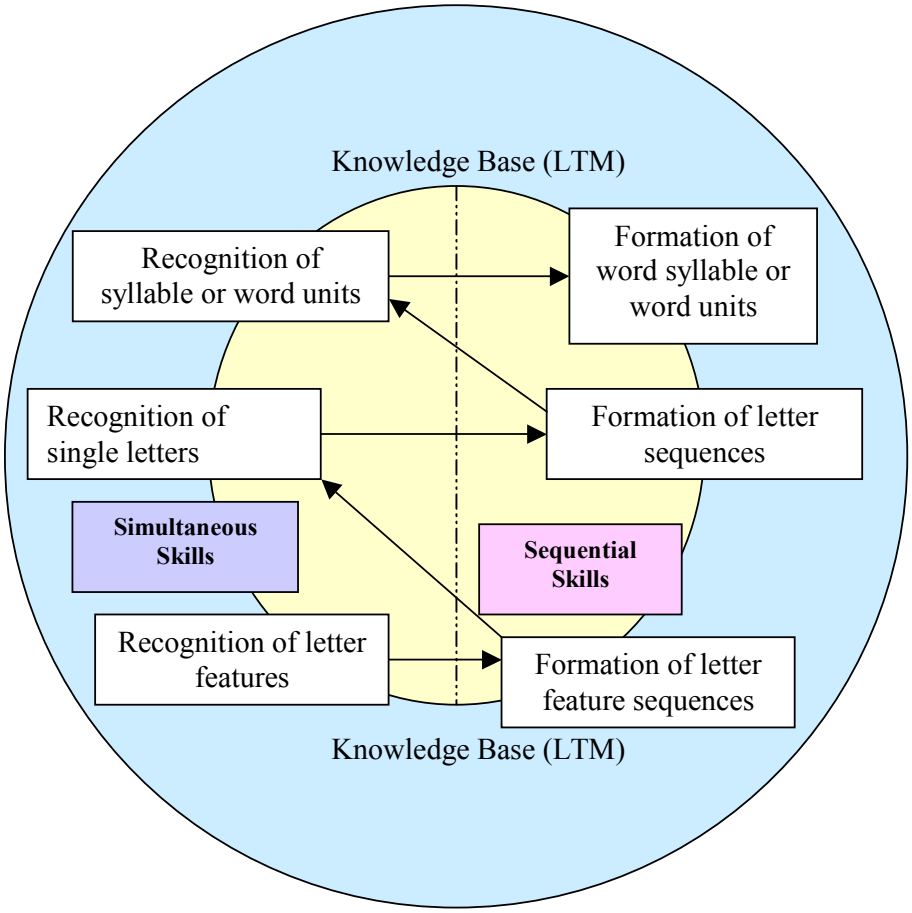


FIGURE 2.2: Kirby's model of phonological awareness, simultaneous processing and sequential processing skills in reading and spelling (adapted from Kirby, 1988, p.160).

Figure 2.2 clearly demonstrates that phonological awareness skills such as recognition of syllables, phonemes, and letters rely on simultaneous processing, while the formation of syllables, letter sequences, necessitates sequential processing. If this is the case, one may argue that this reliance on processing strategies extends to the ability to spell, which requires a child to recognise and use orthographic units such as parts of syllables and complex letter combination consisting of onset and rhyme spelling patterns to solve the spelling of unknown words, whilst phonemic analysis requires the child to distinguish the sounds that need to be represented in the order they occur and to remember what letter the sounds represents and how to write them down recognisably and in sequence. Thus, learning to spell does not rely only on one type of processing. The child may utilise simultaneous processing or sequential processing to spell, depending on his/her strength (Kaufman & Kaufman, 1983b).

Spellers use their knowledge of syllables patterns to segment the spoken sounds into individual sounds. The phonemic significance of these sounds is then identified and the phonemes represented by letters. Finally the individual lettes are integrated to produce the written word. The spelling process thus relies on simultaneous processing skills to arrange the speech stream into syllable orthographic units, as well as sequential processing skills to pronounce the word that is to be spelt (Frith, 1985; Treiman, 1985, 1993; Kirby, 1988; Adams, 1990). The acquisition of syllable awareness is easy and present in pre-spellers, as the syllable represents a clear distinctive speech sound unit (Adams, 1990). Words consist of onsets and rimes, with the onset referring to the beginning consonant or consonant cluster, whilst the rime refers to the remaining vowel (nucleus of the syllable) and the remaining consonant (Fromkin & Rodman, 1988). Spellers use onset and rhyme orthographic units to spell by recognising spelling patterns and groups of letters that share the same sound, which relies on simultaneous processing skills, although some sequential processing may be needed to attach a sound to a letters they represent (Goswami, 1988; Adams, 1990). Phonemes represent the individual sounds that make up a word, and requires explicit instruction in the alphabetic principle, that is to distinguish that letters represents sounds. Thus, awareness of phonemes is a prerequisite to learning to spell, and may require sequential processing in order to decode the correspondence between letters and sounds in order to spell a word (Frith 1985, Adams, 1990). An extensive body of research has shown that learning to read and spell requires mastering the system that print encodes oral languages (Adams, 1990).

Research indicates that phonological awareness follows a developmental path from syllable awareness, which is then followed by rhyme and onset awareness. The final form of phonological awareness to develop with the help of alphabetic instruction is the awareness of individual phonemes (Bryant et al., 1990; Cisero & Royer, 1995). In addition, there is consensus among researchers, that over time the development of phonological awareness is best understood as an interaction between biological maturation and the importance of alphabetic instruction, and that the relationship between phonemic analysis and reading as well as spelling is mutually enhancing (Frith, 1985; Treiman, 1985; Goswami & Bryant, 1990). Deficits in representation, retrieval or analysis of phonological information are associated with persistent problems in decoding skills (Adam, 1990; Siegel and Lennox, 1999; Schayal, 2001). Only one study has addressed the relationship between phonological awareness and simultaneous processing and sequential processing. Greenop's (2004) study examined the relationship between phonological awareness and simultaneous processing and

sequential processing in 119 10-year-old English, Sotho and Zulu South African children. Greenop's (2004) results indicated that simultaneous processing, sequential processing, and phonological awareness tasks, demonstrated shared variance. Therefore, phonological awareness and simultaneous processing and sequential processing measure the same broad underlying processing abilities involving decoding sounds, manipulating and holding sounds in memory in order for a word to be spelt (Burns & Richgels. 1989; Liberman, Rubin, Duques & Carlisle, 1985; Mann, Tobin, & Wilson, 1987; Elliot et al., 1990; Tangel & Blanchman 1992; 1995; Treiman, 1993; Treiman & Bourassa, 2000).

Spelling errors can be categorised broadly into those showing reliance on visual whole-word or simultaneous strategies and those showing reliance on auditory sequential phonetic strategies (Elliot, Smith & McCullough, 1990). Good spellers are able to use both types of strategies, thus a balance of both types of strategies is needed to decode print because of the nature of the English orthography where some words cannot be decoded using letter sound correspondences alone (Elliot, et al., 1990). Knowledge of phonetic rules enables unfamiliar words to be decomposed and analysed. But for fast spelling, memory for whole-syllable and whole-orthographic patterns is used (Elliot et al., 1990). Similarly, Kaufman and Kaufman (1983b) argue that poor spellers often have problems with one or both types of strategies. Children with auditory sequential processing difficulties may have consistent difficulties in using phonetic strategies in spelling. On the other hand, children with visual simultaneous processing difficulties may have difficulties in accurate visual simultaneous recall of whole words or whole syllables, thus placing an undue reliance on phonetic strategies (Boder, 1973; Sweeney & Rourke, 1978; Denckla, 1979; Kaufman & Kaufman, 1983b; Read 1985; Liberman, Rubin, Duques & Carlisle, 1985; Mann, Tobin, & Wilson, 1987; Burns & Richgels, 1989; Tangel & Blachman 1992; 1995; Treiman, 1993; Treiman & Bourassa, 2000). Thus, as research in spelling error analyses and Kirby's (1998) model illustrates spelling does not rely on one type or processing but each contribute to different aspects of the spelling processes and children may use either strategy to spell, depending on his/her strength or habitual processing style, but spelling success is dependent on adequate development of skills in both modes of processing as illustrated in Figure 2.2 (Kaufman & Kaufman, 1983b; Elliot et al., 1990). Thus, an investigation that focuses on developing processing strategies may be complemented by an analysis of spelling errors. Frith (1985) and Treiman and Bourassa (2000) suggest that examining children's spelling errors and strategies can provide insight into the types of perceptual units engaged in during spelling. The way in which a

child spells a word provides insight into the type of orthographic knowledge he or she is using to perceive and understand a word during the process of spelling. Therefore, the argument presented suggests that simultaneous processing, sequential processing and phonological awareness are linked and that an examination of spelling error analyses may provide important information about what level of phonological awareness the child is using as a guide to spell and whether he/she utilises a simultaneous processing or sequential processing approach to spell.

Therefore, in terms of the K-ABC, Kaufman & Kaufman (1983b) argue that sequential processing is important for remembering a word's pronunciation and the order of graphemes in a word. In contrast, the ability to remember a word's general configuration or 'picture' it in one's mind as a whole, as well as recall the visual-spatial arrangement of individual letters, requires simultaneous processing (Kaufman & Kaufman, 1983b, p.268). Sequential processing is important for spelling in English where letters represent sounds, despite the fact that English is only a partially phonetic language, where there is often not a complete match of grapheme to phoneme. In such a language system reliance on the memory of phonemic order and matching individual phonemes with graphemes is not always the most productive strategy. The spelling of some English words needs to be made solely on the basis of memory of sequential order of the letters that make up the word, which relies on simultaneous processing (Kaufman & Kaufman, 1983b).

The K-ABC, represents a theoretically driven, construct valid, relatively culture reduced and arguably a suitable measure of simultaneous processing and sequential processing in South African children (see the Method chapter), and it does not differ from other measures where language is an important variable for a child (Kamphaus, 1992). The K-ABC, has been theoretically linked to spelling, measures processing styles, which a cognitive tasks such as spelling utilises. Research in spelling error analyses indicates that spelling strategies are used to decode print, as well as rely on a common relationship between simultaneous processing, sequential processing and phonological awareness. Qualitative error analyses of children's spelling errors provides evidence that children go through qualitatively different stages during the course of learning to spell and that children's spelling errors reveal varying levels and types of knowledge that are masked when spelling are only scored as correct or incorrect. Therefore, spelling is made up of various sub-skills as measured by spelling error analyses which may complement an analyses of the K-ABC's simultaneous and sequential processing

scales scores, and their respective sub-tests scores which can be used to direct spelling instruction and remediation (Kaufman & Kaufman, 1983b). Most research has focused on the relationship between simultaneous processing, sequential processing and reading, (Hooper & Hynd, 1982; Das et al., 1975; Boden & Kirby, 1995) whilst no study has examined the relationship between simultaneous processing, sequential processing and spelling which the current study addressed. The K-ABC has been linked to specific aspects of spelling such as decoding and whole word spelling. The next section discusses the models of spelling that address the development of these componential skills of spelling and highlights their implicit relationship to sequential and simultaneous processing.

2.3 MODELS OF SPELLING:

Various models of spelling have implicitly proposed the importance of simultaneous processing and sequential processing as necessary spelling skills, which are described in various models of spelling as being either, phonological or whole-word spelling strategies. In addition various models of spelling have examined the nature and process of spelling familiar and unknown words. The dual route model of spelling (Ellis & Young, 1996) and Frith's (1985) developmental model as well as Seymour, Bunce and Evan's (1992) dual-foundation developmental spelling model will be discussed below.

2.3.1 Dual-Route Model of Spelling

Spelling written words essentially consists of transcribing the phonological code into an orthographic one (Frith, 1985; Ellis & Young, 1996; Cunningham, 2005). The mental lexicon is the mental dictionary that comprises an individual's intuitive knowledge of words, their meaning, phonology of words previously spelt by the individual (pronunciation of the sounds of language), and spelling strategies (Pinker, 1994). Ellis and Young's (1996) model proposes that spelling consists of being able to use two strategies to gain access to the mental lexicon. This model of spelling was developed to explain spelling English words and non-words, and postulates a two-route model of spelling, namely a whole-word direct route (lexical route) and a phonological, indirect (non-lexical route), as illustrated in Figure 2.3 below.

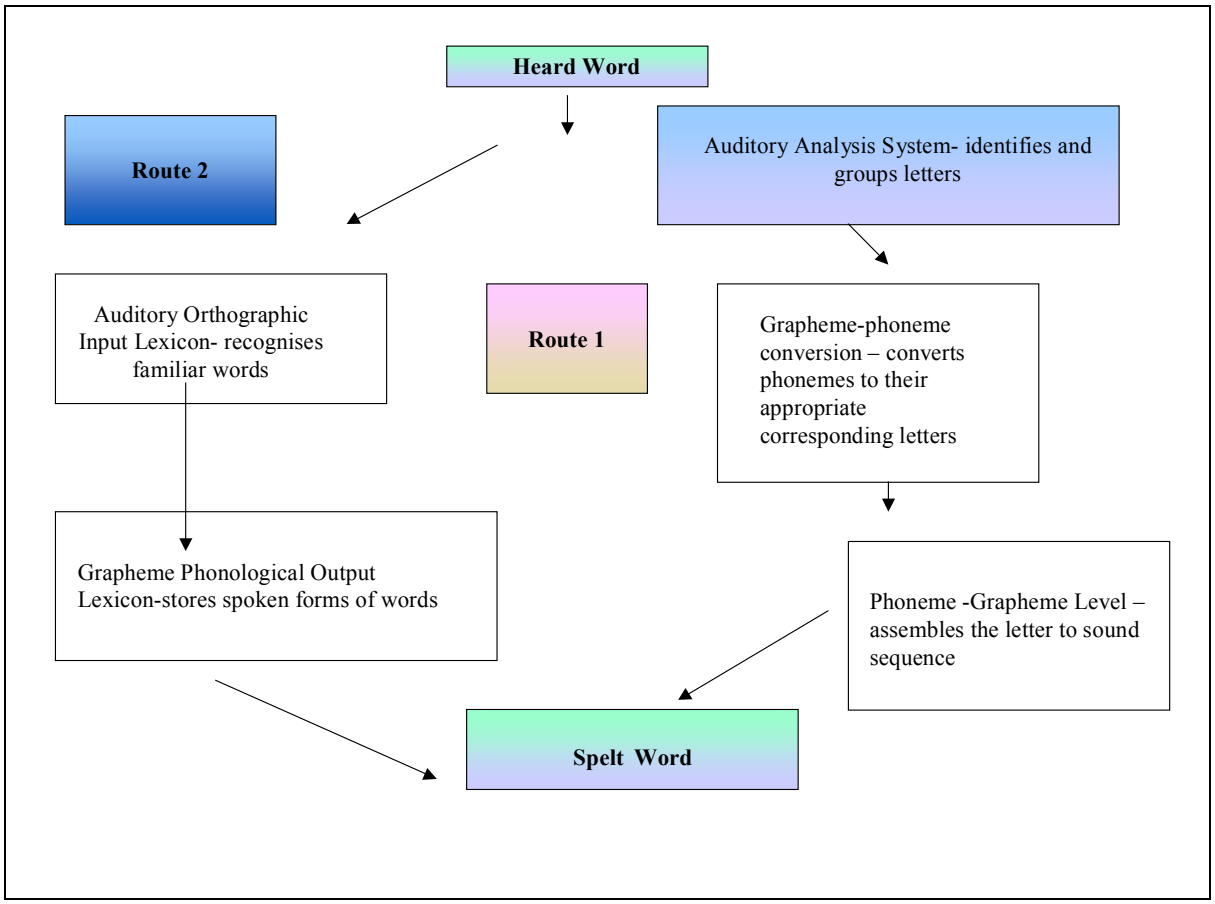


FIGURE 2.3: Dual Route Model of Spelling (Ellis & Young, 1996 p.50)

Route 1 is the approach used by beginning spellers and comprises a phonological indirect non-lexical route to spelling, which is used to spell words never seen before or legal non-words. This route involves breaking down the heard word into it's constitute phonemes by the auditory analysis system. Subsequently grapheme-phoneme conversion occurs, which then converts phonemes to their corresponding letters and then at the grapheme level matches each phoneme to their corresponding grapheme(s) are integrates these to form a spelt word. Individuals who utilise phonological strategies to spell should be able to spell words with regular letter sound correspondences, and should be able to spell regular non-words (Ellis & Young, 1996). Thus, this route enables one to spell unfamiliar words and legal non-words by using grapheme-phoneme-rules, which requires sounding out the letter sound units of words and sequential processing (Kaufman & Kaufamn, 1983), but irregular words cannot be decoded with grapheme-phoneme rules. To accommodate this Ellis and Young (1996) postulate that there is a second route. Route 2 is the approach to spelling used by skilled

adult spellers and corresponds to a visual or whole word direct lexical route to spelling, which is used to spell regular familiar word seen before. According to this route, when a word is heard, the auditory orthographic input lexicon recognises the familiar word, which in turn activates the grapheme phonological output lexicon that contains a store of recognised familiar written words, and contains the description of the letter sequences which are then outputted as spelling. Individuals who utilise this visual or whole word strategy to spell should be able to spell familiar words but not spelling unfamiliar words or non-words (Ellis & Young, 1996). Thus, by using a whole word strategy the individual is able to identify the word as a whole, which involves simultaneous processing (Kaufman & Kaufamn, 1983b) rather than pronouncing and identifying the individual letter sound units or sequential aspects of the word. The whole-word strategy is used to spell familiar and regular words (Ellis & Young, 1996). However, Bradshaw and Mattingley, (1995) suggest that there are certain types of spelling strategies that have been omitted in Ellis and Young's (1996) model, which also make use of this second lexical route. Spellers can either activate whole words phonologically (which may be guided by a combination of simultaneous processing in recognising words, and to a greater extent sequential processing in pronouncing the sounds of the words) and spelling unfamiliar words using an analogy (Goswami, 1999) to a known word (simultaneous processing, and to a lesser extent sequential processing).

Although Ellis and Young's (1996) model postulates that we use both routes to spell, research by Burt and Tate (2002) suggests that the extent to which each route is used depends on a number of features, such as the frequency the word is encountered, and how much experience one has in reading, which is associated with an individuals' learning history with a word's orthography. However, one could imagine that, teaching strategies and different orthographies could lead to differences in spelling strategies, orthographic representation and access to these spelling strategies during writing. Therefore, while the routes to spelling are generally agreed upon, as involving sequential analyses, phonological decoding and whole-word simultaneous synthesis, or a combination of these two approaches (analogy spelling), Burt and Tate (2002) note that further study is needed to determine more precisely the effect of an individual's learning history on a word's orthography and the processes used to spell in different language orthographies.

The validity of Ellis and Young's (1996) model is strengthened by neuropsychological studies of patients who show double dissociations, such as cases in which there is selective

damage to either the lexical or non-lexical processing areas of the brain associated with this spelling strategy and as a result renders one spelling route inoperative while leaving the other functional (Coltheart, 1982; Shallice, 1979). For example, after brain injury some patients are able to spell words, but not non-words as they have damage or impaired access to the non-lexical route. In addition, there is research that demonstrates that there are patients who are able to spell non-words but not exception words (Ellis & Young, 1996; Lezak; 1998). Although Ellis and Young's (1996) model clearly demonstrates that spelling comes about through the two routes proposed, mostly adult neuropsychological cases have been used to support its validity. Perry, Ziegler and Coltheart (2002) argue that research involving adult spellers is not comparable to children's spelling because adults make fewer errors due to their increased phonology and orthographic knowledge of language. The phonemic system of young children has been found to differ fundamentally from that of the literate adult (Treiman, 1993; 2000; Geva & Wang, 2003). Furthermore, Ellis and Young's (1993) model implies that skilled spellers are able to translate every letter in a given word to sound, and do this while spelling at any given time. Research has demonstrated that skilled speller have access to the words they spell, and well developed knowledge of the relationship between letters and the words they represent, which over time becomes over-learnt, resulting in spelling becoming an automatic process (Perry et al., 2002). When this occurs, the individual processes that comprise the act of spelling become less apparent (Luria, 1970). Treiman and Bourassa (2000) argue that although Ellis and Young's (1996) model may explain skilled adult spelling, it does not explain the development of the strategies used in the spelling process early spellers' use.

Analysis of children's 'invented' spelling by Tunmer and Hoover (1992) indicates that children have a level of knowledge about print, spelling rules and strategies, which they use when attempting to spell familiar or unknown words. Similarly, Read's (1975), Tunmer and Hoover's (1992) and Treiman's (1985, 1993,) studies have analysed children's spelling errors and have found that these reflect children's conceptualisation of the phonemic structure of language. For example, if a child is asked to spell the word "*was"* and he or she spells it as *"wuz"*. This misspelling represents a phonological error because if read aloud it sounds like the target word, which indicates that the child is using phonological rules and a sequential approach to spell. Alternatively the error may resemble the word visually, for example when the child is asked to spell "*play*" and spells the word "*plag*" instead, which indicates that the child is using information about the visual-spatial configuration of letters, their sequence and

overall shape of the word as a guide to spell the dictated word. In this case, the child is said to have made a visual error and is thus relying primarily on a simultaneous approach to spell. Treiman's (1993) pivotal study of the qualitative errors analysis of children's spelling, differed from Read's (1975) findings as the sample in the latter study had begun to read and write before starting schooling, which may have been a factor in the types of errors they exhibited. Nonetheless, Treiman's (1993) findings supported Read's (1975) conclusion that children create spellings for words based on their ability to organise sounds into larger units such as syllables, onsets and rimes, which is guided by simultaneous and sequential processing to a lesser degree, and use grapheme-phoneme correspondences, which utilises sequential processing. Therefore children's spelling skills unlike adults is still developing and as a result provides important clues with respect to the cognitive processes involved in spelling and how it is acquired (Treiman, 1985, Kirby, 1988; Perry et al., 2002).

This developmental approach to children's spelling, permitted renewed interest in spelling research by aiming to understand how spelling is acquired and the implicit role simultaneous and sequential processing may play in facilitating the development of writing ability. Furthermore, Treiman's (1993, 1998) research and that others (Read, 1975; Tunmer & Hoover, 1992) serves to highlight a crucial theoretical and dynamic view that emphasises that learning to spell is a complex cognitive skill, with layers and levels of complexity, and involves more than just a simple serial learning skill (Jensen, 1962; Kooi, Schultz & Baker, 1965) whereby letters follow each other and need to be memorized in order for a word to be spelt. In addition the qualitative error analyses studies such as those of Read (1975) and Treiman's (1985; 1993, Treiman & Bourassa, 2000) emphasise that children are strategic learners; actively searching for meaning and structure in the words they spell. Therefore, spelling is a creative, cognitive-linguistic and developmental process in which children are active participants in learning to spell by using, either phonological or visual-orthographic spelling strategies to spell familiar and unknown words.

Research on the emergent spelling skills of school-aged children (Henderson & Beers, 1980; Read, 1975; Treiman, 1993) has revealed large differences in young children's spelling ability, and provides evidence that children go though a series of qualitatively different stages during the course of learning to spell. However, other researchers question the concept of developmental stages, while acknowledging that existing stage theorists may provide a rough overall picture of spelling development (Rittle-Johnson & Siegler, 1999; Treiman & Cassar,

1997). Although the debate is sill ongoing, it is clear that children's spelling errors reveal varying levels, types of knowledge and spelling strategies. These differences are masked if spellings are only scored as correct or incorrect (Gentry, 1982; Frith, 1985; Ehri, 1988; Treiman & Bourassa, 2000). Children in contrast to adults, are learning to spell in a developmental manner and an analysis of spelling helps illustrate the emergence of different spelling strategies and their role in learning to spell, and the other side of the coin, the cognitive consequences of becoming an avid speller (Cunningham, 2005). However, to get to this point the child needs to be able to understand and use the rough association between letters (graphemes) and sounds (phonemes). These grapheme-phoneme correspondences form the basis of spelling all words and children who master this are on their way to becoming skilled spellers (Kaufman and Kaufman, 1983b; Frith, 1985; Adams, 1990). However, a feature lacking in the dual-route model at present is its ability to offer an account of how spelling skills are acquired, rather than simply presenting a static picture of a mature spelling system (Coltheart, Curtis & Atkins, 1992). Ignoring the important question of acquisition can lead an investigator to make incorrect assumptions. For example, one would have to believe that the skills that are seen are components of the end-stage of spelling mastery and have always been there (Frith, 1985). Thus, it is necessary to consider what the development factors of spelling acquisition are, and how they interact with basic cognitive processes. One of the most well known developmental models of spelling is Frith's (1985) model of spelling acquisition, which is outlined below.

2.3.2 Frith's (1985) Developmental Stages in Spelling

Frith's (1985) model of spelling acquisition postulates that spelling acquisition occurs through a succession of three stages or strategies which children use in learning to spell.

1. Logographic Stage: In this stage the child ignores the letter order and concentrates on the salient features of the whole word, and thereby utilises a logographic strategy of direct recognition of entire words. In effect, the child treats words as complete units, with one feature to recognise them with (such as the first letter). At this stage the child is spelling visually and is unable to read new or unfamiliar words, as they are unable to decode words. He/she is only able to spell words encountered before, such as "*coca-cola*" or spell "*cat*" by using only the letter "*c*". Errors in spelling at this stage are termed rudimentary (Gentry, 1984) or pre-spelling (Elliot, Smith & McCulloch, 1990). For example, if the child is asked to spell the word" *the"* and

he/she spells it as "*orh"*, this type of error illustrates that the spelling bears no relationship to the sounds in the intended word. This type of error indicates that the child is unable to analyse sounds within words and has little knowledge of grapheme-phoneme correspondences (sequential processing) but is instead using a simultaneous whole-word strategy to spell (Elliot et al., 1990).

2. Alphabetic Stage: This stage often starts as children begin formal literacy instruction at school. Usually, this stage is described as reflecting an understanding of the alphabetic system, whereby the child has learnt and begun to use grapheme-phoneme conversion rules or letter-to-sound correspondences as a guide to spelling words (Frith, 1985). At this stage the child is able to decode new words by sounding them out and understands the notion that spoken and written words needs to be analysed into their component parts (sounds and letters respectively) in order to spell them accurately. Errors at this stage are what Gentry (1984) termed semi-phonetic or basic phonetic. Semi-phonetic spelling errors indicate that spelt word represent some of the phonemes in the target word (e.g. "*l*" for elephant). Basic phonetic spelling (Gentry, 1984; Ehri, 1986; Elliot et al., 1990) errors provide a more complete representation and may capture certain features of the pronunciation that are ignored in conventional English spelling (e.g. "*f*"-"*ph*" as in "*elefut*" for "elephant", "*ch*"-"*tr*" for "*chran*" for "train"). The processing style seems to be more sequential during this spelling stage.

3. Orthographic Stage: This is Frith's (1985) last stage and occurs when the conventions of the orthography (English in the case of Frith) have been mastered and can be used in an integrated manner. Spellings of familiar, known words are memorised visually. Moreover, by this stage, children have a visual store of alternative graphemic representations of phonemes which is related to their knowledge of word families and which is used to spell unknown words. Errors made at this stage are termed plausible phonetic alternatives (Gentry, 1984) or morphemic (Ehri, 1986) which indicates that children are increasingly relying on the visual and morphological information in words as a guide to spelling dictated words (e.g. spelling "*eighty*" as "*eightee*" instead of the phonetic "*ate*"). Adult spelling follows this format, unless an unfamiliar word is encountered, at which point the individual may revert to the earlier alphabetic strategy to decode the word, thereby illustrating both a simultaneous and sequential processing style (Frith, 1985).

Criticisms of Frith's (1985) model include Seymour's (1990) argument that, in effect it provides no explanation of why the prior adoption of the logographic stage (simultaneous processing style) is necessary for the subsequent adoption of an alphabetic one (sequential processing style). In addition, the orthographic stage is viewed as a merging of alphabetic and logographic strategies, yet Frith (1985) does not elaborate how this occurs. Further criticism of this model comes from Stuart and Coltheart's (1988) who argue that these spelling stages may not proceed in the invariant order that Frith (1985) assumes. Rather, these researchers have formulated a model of spelling that questions the necessity of the logographic stage. In their longitudinal study of young spellers (4 through 5 years) Stuart and Coltheart (1988) found that some children started to spell from an alphabetic level, while others relied on logographic processes. Stuart and Coltheart (1988), thus argue that if phonological skills required for proficiency in the alphabetic strategy are not present, the child will rely on the logographic visual strategies to learn to spell. However, if these skills are present, then the child is able to bypass the logographic stage and concern him/herself with the construction of the orthographic system utilising his/her knowledge of the alphabetic strategy.

In terms of the dual-route model of spelling, this demonstrates that some children are able to use the non-lexical route from the onset of spelling, while others first use the lexical route and then develop the sub-lexical route. Frith's (1985) developmental stages of spelling was developed and largely based on monolingual English children, as a result its universal applicability has been questioned, by Stuart and Coltheart (1988). In effect, Stuart and Coltheart's (1988) argument is relevant to the current study as it implies that bilingual children learning to spell in dissimilar orthographies may rely on different strategies implied by different stages of Frith's (1985) theory. On the other hand, Seymour, Bunce and Evans (1992) agree with Frith's (1985) conceptualisation of the logographic, alphabetic and orthographic stages, but differ from Frith's, as they propose that logographic and alphabetic processes emerge in parallel, both of which provide the basis for orthographic processes to emerge. Seymour, Bunce and Evan's (1992) model is discussed below.

2.3.3 Seymour, Bunce and Evan's (1992) "dual- foundation model"

Seymour, Bunce and Evans (1992) proposed a developmental model of reading and/or spelling that has a logographic, alphabetic and orthographic level, however these levels are not invariant and the child may be in one or more of these stages at the same time as shown below in Figure 2-4.

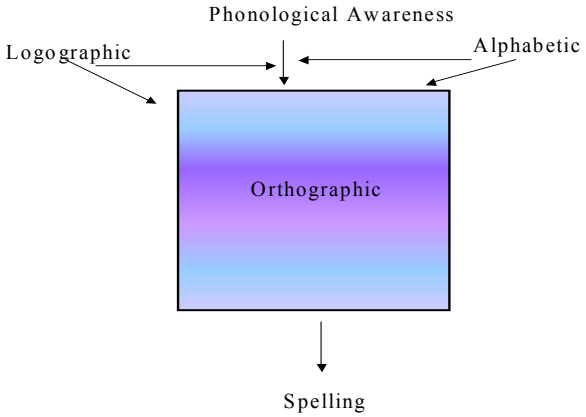


FIGURE 2.4: Seymour, Bunce and Evan's (adapted, 1992, p.118) dual foundation model of orthographic development.

Seymour, Bunce and Evan's (1992) model takes into account the different rate of development that exists in children reading and or spelling in different orthographies. Seymour et al's (1992) model takes into account research indicating that children may learn to read and/or spell alphabetically without necessarily passing through a logographic stage (Stuart & Coltheart, 1980; Wimmer et al., 1990). Seymour et al's (1992) model argues that the establishment of both the logographic and alphabetic lexicons are necessary but not sufficient for the development of the orthographic lexicon by which skilled reading and /or spelling proceeds. The acquisition of these processes is proposed as concurrent rather than successive and that both these processes are needed for skilled spelling (Seymour, 1990) especially in a language such as English, which has a high proportion of words that do not conform to the rules of grapheme-phoneme correspondences (Wijk, 1966; Venesky, 1970).

Despite many advances, there are controversies that remain with regards to the organisation of the cognitive systems used for processing written language, in particular the spelling processes used to spell in orthographies beside English (Hanon, 1995; Geva & Wang, 2003). The present study seeks to contribute research on the cognitive processes and strategies that bilingual children use and how these differ or resemble those of monolingual children's. A comparison of the spelling skills in monolingual English and bilingual Afrikaans-English children, also makes it possible to investigate further the relationship between simultaneous processing and sequential processing and spelling skills and orthographic transparency (Frost et al., 1987). The next section explores the relationship between phonological awareness and spelling as a means of inferring whether simultaneous processing, and sequential processing precede or develop alongside spelling instruction or are mutually enhancing.

2.4 THE RELATIONSHIP BETWEEN SIMULTANEOUS AND SEQUENTIAL PROCESSING AND SPELLING DEVELOPMENT

Frith's (1985) model of spelling suggests that the development of phonological awareness in the form of phonetic decoding strategies and whole-word strategies leads to better spelling. However, other researchers have noted that exposure to the alphabetic principle and spelling instruction also leads to better spelling, thus suggesting that there is a bi-directional reciprocal relationship between phonological awareness, simultaneous processing, sequential processing and spelling (Das, Naglieri & Kirby, 1994). There is reasonable agreement that over time the relationship between phonological awareness is mutually enhancing (Goswami and Bryant, 1990). In effect the argument presented in terms of phonological awareness may be expanded to simultaneous and sequential processing skills. In particular, whether simultaneous processing, sequential processing are influential in early spelling development and develop together with spelling instruction.

Bradley et al's (1990), study examined the importance of nursery rhymes in children's reading and spelling and found that there is a strong relation between early knowledge of nursery rhymes and later progression in spelling, (even after controlling for IQ, social background and initial phonological skills). This led these authors to conclude that nursery rhymes enhance children's sensitivity to rime units, which in turn is beneficial in learning to spell. MacLean, Bradley and Bryant (1987) have shown that children as young as three years

of age are able to detect whether two words rhyme and to a lesser extent whether they start with the same sound (onsets). Thus, the implicit implication for cognitive processing skills is that some aspects of phonological awareness such as rime and onset awareness, which requires simultaneous processing to recognise the groupings of letters in space (Kirby, 1988; Kaufman & Kaufman, 1983) may precede spelling, and affect its later success.

Kirtley, Bryant, MacLean and Bradley (1989) suggest that sensitivity to rhyme may help in learning to spell. The orthography of English is less predictable at the level of every single letter than at the level of groups of letters, seen for example in rhyming words, which are often spelt in the same way. This observation led Goswami and Bryant (1990) to suggest that the predictability in spelling rhyming words may be an economical method of learning that groups of letters share the same spelling pattern. Goswami's (1988) lexical analogy model of spelling hypothesises that skilled spellers spell words by synthesising the word's phonological information from orthographically similar words already in existence in their mental lexicon. Evidence for this, according to Goswami (1988), comes from the early influence that early rhyming skills have on spelling development, which in turn allows children to become sensitive to the same spelling patterns in words. In addition Goswami's (1993) study found that as children progressed in spelling ability, alongside spelling instruction they were able to break up the rhyme into its constituent phonemes. Thus, the argument presented suggests that awareness of phonemes is a prerequisite for learning to spell, and would rely on sequential processing to decode the correspondence between letters and sounds (Adams, 1990). Aspects of phonological awareness (rime and onset awareness) and implicitly cognitive processing skills, (Kirby, 1988; Greenop, 2004) in the form simultaneous processing skills are needed to recognise and group the onsets and rimes that contain strings of commons letters, precedes spelling and is most untaught, and leads to future spelling success. A more difficult skill like phoneme awareness, which utilises sequential processing, only emerges as children start to learn to spell and with explicit alphabetic instruction (Kirby, 1988; Greenop, 2004).

Das's (1992b) research on the effect schooling has on simultaneous processing and sequential processing; found that sequential processing seems to increase as a result of age and school experience. Both simultaneous processing and sequential processing styles emerged in schooled and non-schooled children. When pre-school children were compared with children in Grade 2, the children in Grade 2 were better at simultaneous processing and sequential

processing, while the pre-school children exhibited only simultaneous processing ability. In a comparison between 6 through 8-year-old schooled and 10 thorough 12-year-old non-schooled children, the schooled children were superior on sequential processing tasks, but almost similar on simultaneous processing tasks. Therefore, the development of simultaneous processing and sequential processing and phonological processing spelling skills may influence each other reciprocally, and both increase as an effect of age and formal alphabetic instruction. The pattern of simultaneous processing and sequential processing development reflects the way children are taught to write and spell. At school, children learn the alphabet, as well as learn to write the letters and words, which require analysis of the letters and reproduction of these letters which requires simultaneous processing, which if not developed properly could result in reversing /p/ for /q/ (Das, Naglieri, Kirby, 1994). Gradually, the simultaneous processing of letters and words form a temporal order, which requires sequential processing. Sequential processing is also important for decoding new or unknown words. Therefore, schooling in the form of literacy practices, which utilise simultaneous processing and sequential processing skills result in schooled children developing higher levels of cognitive processing skills than non-schooled children (Das, 1992b).

However, all studies thus far have examined the relationship between simultaneous processing, sequential processing and reading (Das, Bisanz & Mancini, 1984; Das, Mishra & Kirby, 1994) or a related relationship that of the relationship between phonological awareness and reading (Bradley et al., 1990; Goswami & Bryant, 1990) as well as the relationship between phonological awareness and spelling (Frith, 1985, Treiman, 1993). Therefore it is important to establish whether cognitive processing ability impacts on spelling skills and vice versa. In addition most of the current research has been carried out with monolingual English children. The impact of bilingualism, or learning to spell in another language besides English, might affect the rate and pattern of simultaneous processing and sequential processing as related to spelling development in speakers and spellers of different languages that differ in orthographic transparency (Frost et al., 1987).

The next section presents research that has been carried out cross-linguistically into the spelling process of children learning to spell in dissimilar orthographies.

2.5 SPELLING CROSS-LINGUISTICALLY

Alphabetic languages differ in their phonological characteristics (oral and written), which is termed the ***Orthographic Depth Hypothesis*** (Frost et al., 1987). According to this hypothesis, there are differences among alphabetic orthographies in terms of how regularly spelling and phonology can be mapped. In shallow orthographies such as German, Spanish, Dutch and Italian, there is a relatively 1:1 correspondence between letters and sounds and graphemes in these systems generally represent only one phoneme. Conversely in deep orthographies such as English and French, there is a more complex or opaque relation between letters and sounds. This means that individual graphemes represent a number of different phonemes in different words and that there are many exceptions to grapheme-phoneme correspondences rules. As a consequence, the English orthography contains irregular or exceptions words such as " shoe"," have" and "one". In a transparent orthography, the mappings from letters to sounds are much more consistent and there are very few irregular words. Therefore, the demands of language orthography may influence the acquisition of spelling skills, such as simultaneous processing and sequential cognitive processing skills which have been shown to be important for spelling success (Kirby, 1988; Kaufman & Kaufman, 1983b). It is important to discover whether the transparency of language's orthography has an effect on the way in which children learn to spell in different languages. This has not been addressed directly in a bilingual South African context.

Although the orthographic framework is mainly used in research with phonological awareness, theoretical support for the link between phonological awareness, simultaneous processing and sequential processing is proposed by Kirby (1988) and Kaufman and Kaufman (1983b). In addition there is as empirical support, from Greenop's (2004) study that phonological awareness and simultaneous processing and sequential processing share variance, which suggests that all these constructs are tapping processing ability. It is thereby plausible to extend this framework and trends in phonological awareness research to examine how the relationship between simultaneous processing, sequential processing and spelling varies across language orthographies. There are two main questions for this situation. The first is whether children can learn to spell in a transparent orthography more quickly than they can learn to spell in an opaque orthography (Cossu et al., 1988). The second concerns the qualitative nature of spelling development. Do children adopt different strategies when faced with an opaque orthography compared to a transparent orthography? If so, are different

simultaneous processing and sequential processing strategies required in learning to spell in transparent orthography than in a more opaque orthography? (Wimmer & Hummer, 1990; Goswami al., 1998; Landerl, 2000).

Investigations of children learning to read and write in transparent orthographies such as Turkish (Oney & Durgunoĝlu, 1997), Finnish (Holopaeinen, Ahonene, Heikki Lyytinene, 2001) German (Wimmer & Hummer, 1990), Italian (Cossu, et al., 1995) Portuguese (Pollo, Kessler, Treiman, 2005) Spanish (Goswami, et al., 1998) have shown that reading and spelling skills develops very rapidly at school, with children making relatively few errors by the end of the first year of formal instruction. For example, Durgunoĝlu and Oney (1999) found that even children with relatively limited phonological decoding skills at the start of the first year of schooling in Turkey are able to spell with high levels of accuracy by the end of the first grade. These results were interpreted as reflecting the consistent nature of the mappings between graphemes and phonemes in the Turkish orthography. Thus, the argument as applied to cognitive processing suggests that in transparent orthographies aspects of sequential processing may be relied upon to a greater extent than simultaneous processing due to the unambiguous letter sound relation, which permits most words to be spelt using this strategy.

Goswami et al., 's (1998) study found superior non-word spelling in Spanish children relative to French and English children. In addition word and non-word spelling was highly correlated, (but not highly correlated in the English children), due to transparency of the language permitting an alphabetic strategy to be an effective strategy to decode both Spanish words and non-words. Goswami et al., (1998) argue that the Spanish children were better able to exploit the regularity of the spelling sound correspondence in Spanish than the English orthography permitted the English children to do the same. Landerl (2000) extended these findings by showing that the non-word spelling skills of English children were poorer than those of their German counterparts even when they were being taught via a phonics approach. In addition, Wimmer et al.,'s (1990) study found that most of the erroneous responses to spelling words made by children learning to spell German were nonsense words. In marked contrast, errors made by children learning to spell in English were frequently (the wrong) real words. Thus, cross-linguistic spelling research suggests that children become competent spellers of transparent orthographies, such as German, Italian and Turkish within a year of formal spelling instruction. There is also cross-linguistic spelling research evidence

that suggests that their spelling non-word skills is superior to that of English children even when spelling age is matched, and that the errors they make are qualitatively different. Furthermore, cross-linguistic spelling research evidence suggests that phonological decoding skills or alphabetic skills may be superior in children learning to spell in a shallow or transparent orthography than in an opaque one (Cossu et al., 1988, Wimmer & Hummer, 1990; Treiman et al., 2005). In terms of cognitive processing skills, the implication is that although both simultaneous processing and sequential processing may emerge in different orthographies, one may expect that simultaneous processing and sequential processing may also mirror this orthographic transparency trend.

Frith's (1985) developmental model of spelling does not seem to take bilingualism, or learning to spell in a language that differs in orthographic transparency to English into account. This model assumes a naturalness and universality of the logographic stage as a starting point of spelling development. Wimmer and Hummer (1990) suggest that the presence of the logographic stage may be due to American and British teaching methods (initially 'whole-word') that are more suited to an opaque orthography such as English, which does not easily allow for direct-grapheme correspondences to be made. Thus, these authors argue that the logographic stage is not found in a phonologically more transparent language orthography typified by German, as both normal progressing and delayed German beginning spellers are found to be able to utilise the alphabetic strategy from the start of spelling instruction.

In a further study of the differential effects of language's orthography exerts. Wimmer and Goswami's (1994) study compared English and German beginning readers on reading words and non-words derived from the number of words that the children in this study were asked to spell. Analyses of the result indicated that German children had little difficulty reading the non-words; in contrast the English children struggled to read non-words. The authors concluded that German children initially rely on word recognition via an assembled sequential processing strategy (alphabetic), moving onto direct word recognition for frequently occurring words, while the English children rely on a visual recognition simultaneous processing approach (logographic) from the start. Wimmer and Goswami (1994) attribute this difference to the degree of transparency the different orthographies display, together with the resulting different instructional approaches. Wimmer et al's., (1994) study examined reading, although other researchers have also argued and found that

the orthographic transparency that children learn to spell also influences spelling acquisition. (Frith, 1985; Treiman 1993; Geva & Wang, 2003). Therefore, the argument suggests that it may be the case that simultaneous processing and/or sequential processing is shaped to some extent by the phonological inputs (syllable structure in oral language) and by the nature of the written orthography of the specific language that a child is learning to spell in. In addition the relationship between simultaneous processing and sequential processing may vary as a function of the language orthography that a child is learning to spell in.

Wimmer, Landerl, and Schneider (1994) noting the importance of the relationship between phonological awareness and reading in English, investigated this relationship in German. These researchers found that rhyme or logographic processes were only minimally predictive of reading ability at the end of Grade one, but gained in predictive power at the ends of Grade three and four. Phoneme or alphabetic processes displayed no such predictive power. These results were attributed to German children first using an alphabetic approach to spell and then progressing on to a more direct and faster method of spelling, where logographic processes become beneficial in recognising the sub-lexical units that make up a word. Therefore, Wimmer et al., (1994) concluded that logographic strategies are important for English and German spellers, yet at different stages of reading development. Thus, the implication suggests that in terms of spelling the degree to which a language has an opaque or transparent orthography affects the phonological units children use to spell. In terms of cognitive processing, this suggests that the nature of the orthography that children are learning to spell in may influence the extent to which children adopt a sequential processing and/or simultaneous processing strategy to spell.

Spenser and Hanley's (2003) have noted that the method of reading or spelling instruction may affect the level of phonological awareness and implicitly the extent to which simultaneous processing and sequential processing develops and is relied upon to spell. For example, in a language with very regular phoneme-grapheme correspondences, it is reasonable to emphasise an alphabetic strategy, whereas in English where no clear differentiation between the grapheme-phoneme correspondences exists and as a result a whole-word logographic strategy is, more appropriate. In a study that controlled for method of instruction Greenop's (2004) study investigated the simultaneous processing, sequential processing as measured by the K-ABC 's and reading words and non-words in 10 year old English, Sotho and Zulu speaking children learning to read in English as a second language.

These children were learning to spell in English, Sotho and Zulu, at the same school, so any differences found could not be attributed to varying teaching strategies. Greenop' s (2004) study found that first language English speakers relied on both simultaneous processing and sequential processing to a relative equal degree, whilst second language bilingual readers of English with a first transparent language relied more on sequential processing than simultaneous processing approach to read. However, Greenop's (2004) study investigated the relationship between simultaneous processing and sequential processing and reading and the question remains whether these findings will apply to spelling.

Recently, researchers have noted that theory development in spelling is limited by the lack of information on the nature and acquisition of orthographic representation (Treiman & Bourassa, 2000; Burt & Tate, 2002). No research study has been done on the processes that bilingual children use to spell within an simultaneous processing and sequential processing framework and written language skills proposed by Kirby (1988) and Kaufman and Kaufman's (1983b) spelling models. In addition, the trend in spelling research recently advocates for an incorporation of both quantitative test scores as well as an assessment of qualitative differences present in children's spelling as important facets to consider when investigating spelling development (Treiman & Bourassa, 2000).

Differences in the availability and utilisation of orthographic information may appear in the development of learning to spell in diverse orthographies, as is the case in permitted in bilingual children who are learning to spell in first (L1) and second language (L2) that differs in orthographic transparency. This issue is important not only for spelling research but also for educators who wish to promote optimal learning of literacy skills in children who are acquiring literacy skills in more than one language and in particular in dissimilar orthographies, which is addressed in the present study. Bilingual children may display different simultaneous processing and sequential processing styles and associated relationship between simultaneous processing and sequential processing and spelling in their L1 and L2.

As Bialystok (2002, p.159) notes bilingualism affects children's development of literacy, as literacy skills are acquired differently from monolinguals, but "its effects are neither unitary nor simple".

Very few studies have examined the role of bilingualism on cognitive processing style and spelling development of young bilingual children, and those that have have tended to focus on reading, whilst the present study focuses on a related skill in the form of spelling. Reading and spelling have been found to rely on the same orthographic system (Zutell & Rasinski, 1989; Richgels, 1995; Ganske & Scharer, 1996; Ehri, 1997; Burt & Tate, 2002), whilst other researchers have argued that reading and spelling may entail different developmental trends as spelling is different to reading, because there are more possible graphemes for a given sound than ways of sounding out a grapheme (Frith, 1985). An investigation into bilingual children's spelling skills in comparison to monolingual children's may provide information about language-specific and universal aspects of written language processing (Vaid & Genesee, 1980).

2.6 BILINGUALISM AND THE TRANSFER OF SPELLING STRATEGIES

In South Africa, bilingualism is a reality for many school-aged children, and as a result many of these children are learning to spell in more than one language (Buthelezi, 2003). Bilingualism is defined as the ability to speak two languages (Baker, 2000). However, the reality of this may be more complex as the two languages may not be spoken to the same degree of proficiency, one may dominate over the another, and the language of spelling may not be the individual's first. Baker (2000) suggests that the brain has the capacity to learn and retain many languages. Obler's (1983, cited in Baker, 1993) review of research on bilingual aphasia, localisation, laterality and split brain studies suggests that the differences between monolinguals and bilinguals are the exception rather than the rule and that bilinguals do not vary from monolinguals in relation to their neuropsychological processes, as the lateralisation of language is relatively similar in both groups. However, two neuropsychological papers by Mägiste and Hoosain (1991, cited in Harris, 1992) both deal with cerebral lateralisation. Mägiste (1991, cited in Harris, 1992) suggests that language in a bilingual individual is less lateralised in the left hemisphere than it is in the monolingual individual, whilst Hoosain (1991, cited in Harris, 1992) argues that there is more right-hemisphere involvement in bilingual individual's than in monolingual individual's language functioning. Baker (1993) notes that the present state of knowledge of cellular organisation, brain structure and neuropsychological functioning makes generalisations unsafe but an area in which future research may hold some promise. Thus, although the brain structures

involved may differ, the cognitive processes that are used to spell in different language varying as a function of language orthography is generally agreed upon (Frost et al., 1987; Durgunoĝlu & Oney, 1999; Geva & Wang, 2003). Paradis (1998, cited in Yelland, Pollard & Mercuri, 1999) suggests that if one considers "degree" as an index of the difference between languages that bilingual children are exposed to and learn then, orthographic differences become important to research. This has important implications for teaching children learning to spell in different orthographies, in particular when one is transparent (Afrikaans) and the other opaque (English). As Grosjean (1998, p.131) points out, bilinguals function in two languages differently from monolinguals and thus cannot be "treated as two monolinguals in one." Furthermore Grosjean (1998, p.131) ardently defends a 'holistic' view of bilingualism, which holds that bilinguals exploit two languages in a unique way to achieve their communicative intentions. It is thus, important to examine whether spelling strategies learnt in a bilingual child's first language transfers to spelling in a second language, the direction of this transfer, and the effect of oral language in comparison to written language, on bilingual children's spelling development. Cross-language transfer has important theoretical and practical implications for models of bilingual spelling (Durgunoĝlu, 2002).

Durgunoĝlu (2002) argues that cross-language transfer can be used as a potential diagnostic tool, to distinguish between spelling problems stemming from low levels of oral language proficiency versus a more general spelling or learning difficulty. Literacy components that reflect language-independent meta-cognitive processes show similarities across languages. If bilingual children have had enough exposure and instruction in the first language (L1), these cognitive processing skills can be assessed and expected to transfer to their second language (L2). However, if bilingual children are not able to transfer these cognitive processing skills to their second language this could indicate a delay due to limited L2 oral language proficiency and not because of a spelling disability or difficulty. Therefore, bilingual children who just need more exposure to the language-specific concepts of their L2 can be distinguished from those bilingual spellers who truly have special educational needs (Durgunoĝlu 2002).

Fitzgerald's (1995) review of English second language readers and spellers, which is in agreement with the views of many other researchers, argues that oral skills and literacy in one language is often transferred to a second language such as English. This is termed the ***Common Underlying Proficiency (CUP) model*** of the relationship between the bilingual

child's two languages (Cummins, 1981, cited in Fitzgerald, 1995). The CUP model assumes that there are important common features in all languages such as: conceptual knowledge, subject-matter knowledge, higher-order thinking skills, and spelling strategies. Furthermore, the CUP model highlight's Cummins (1981, cited in Fitzgerald, 1995) ***developmental interdependence hypotheses***, which states that the ability to develop a second language depends on the development of the first language.

Models of bilingualism such as Bialystok's (2002) highlights that knowledge and well-practised skills acquired in the bilingual child's first language transfers to a second when the bilingual child learns to spell in his/her new language. Opponents of this view argue that no transfer occurs but that one learns the new language utilising the same processes necessary to learn to spell in the first language. However, the current approach and understanding of transfer (Geva & Wang, 2003) argues that some transfer does exist between the first and second language, although it may not be automatic nor assumed and when it does happen the consequences may not always be beneficial (Durgunoglu & Verhoeven; 1998; Bialystok, 2002; Geva & Wang, 2003).

Bialystok (2002) presents a diagram (see Figure 2.5) of the factors that affect bilingualism and the relation between first (L1) and second language (L2) spelling acquisition.

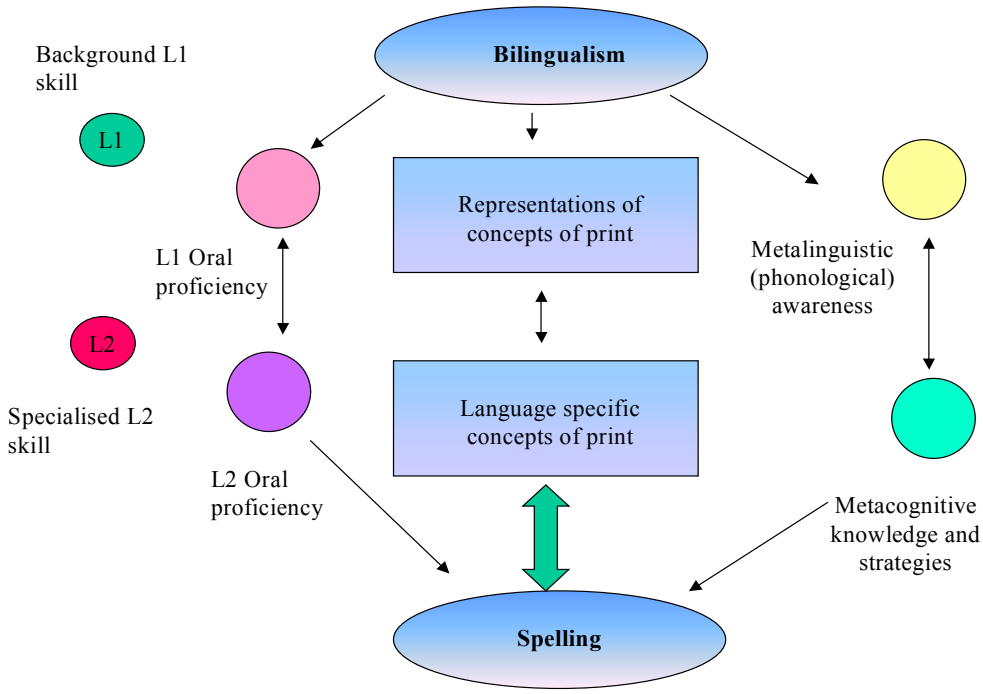


FIGURE 2.5: Relation between first and second language spelling development (adapted from Bialystok, 2002, p.26).

Figure 2.5 illustrates spelling acquisition in a first language and the additional relations that second language speakers have. First language speakers need to develop oral proficiency in their first language in order to aid spelling, whilst bilingual speakers need to be proficient in their first and second language in order to be able to spell competently in both of their languages (Cummins, 1981; Baker, 1993; Bialystok, 2002). Monolingual learners develop grapheme-phoneme rules, while the bilingual children need to learn language-specific grapheme-phoneme representations used in their second language in addition to their first. Additionally, monolingual learners learn about phonological representations in their language, while bilingual learners need to learn the phonological skills used in both their fist and second language. The bi-directional arrows indicate that there is a relationship between the two levels for the bilingual child, because he/she has to master the sounds of their first language, as well as a second language. Bialystok's (2002) model presents an explanation of bilingual spelling, and provides a framework for the present study to research how the strategies that bilingual children use to spell may be similar or different to monolingual English-speaking children, as well as the manner in which they are used and whether their

place in spelling development varies as a function of spelling in dissimilar orthographies. This provides insight into the role bilingualism has on cognition and spelling development.

Comeau et al's., (1999) study investigated French children taught to read and write English in a French immersion school and found that these children were no different in terms of literacy measures from an English only class. Comeau et al., (1999) found that bilingual French-English children in Grade one, were poorer than monolingual English children, the gap narrowed in Grade two, and by Grade three and four there were no significant differences. These resulted are attributed by Comeau et al., (1999) to learning to spell in English as a second language and the positive transfer of spelling skills learnt in one language to another. This result is predicted by the orthographic framework as both French and English are opaque orthographies, and would both rely on lexical strategies to a greater degree than non-lexical strategies for success, thus one would expect that bilingual children fluent in their L1 and some L2 oral proficiency would be able to transfer strategies to reading across these two language orthographies. This results is supported by Geva and Wang's (2003) finding that bilingual Chinese-English children learning to spell in a orthographically similar first and second language permitted these children to benefit from spelling instruction in both their languages as these children were able to transfer their L1 visual-orthographic strategies to spelling in their L2, a spelling strategy that is successful for spelling in their L1 and L2, because in both cases most English and Chinese words cannot be decoded using sound alone.

Very few studies have examined the transfer of spelling strategies, and most studies have tended to focus on reading (Durgunoğlu, 1993; Cisero & Royer, 1995; Durgunoglu & Verhoueven; 1998; Comeau et al., 1999) and the question remains whether these findings apply to spelling, which the is addressed in the present study. In terms of reading, Durgunoğlu, Nagy and Hancin-Blatt (1993) found that word decoding and phonological awareness skills in Spanish are highly correlated with word and non-word decoding in English. All these studies have examined transfer in the context of phonological awareness and reading or phonological awareness and spelling. However this hypothesis could be extended to examining whether a bilingual child learning to spell in both his/her first and second language may transfer simultaneous processing and sequential processing skills learnt in a first language to learning to spell in a second language.

Debate has been raised regarding the cognitive benefits of learning two or more languages simultaneously, which is typified by dual-medium or parallel-immersion schools (Cummins, 1981; Baker, 1993; Jared and Kroll, 2003). The concern is that by becoming fluent in spelling in a second language this would have a negative impact on the child's spelling skills in their first language. For some time researchers have tried to determine whether the bilingual child can activate both of their languages simultaneously when producing written language or whether they can selectively activate their knowledge of just one language. If knowledge of both languages is activated simultaneously, then there is the possibility that they could interfere with one another and slow processing (Jared & Kroll, 2001). Jared and Kroll (2001) suggest that second language spelling may be slightly hampered because of interference from knowledge of spelling-sound correspondences of the first language, particularly when the bilingual child's two languages share many word bodies (spelling phonological-orthographic units) that are pronounced differently in the two languages. Jared and Kroll (2003) argue that the bilingual child is able to access and activate both languages or illustrate ***code-switching patterns***, due to the interaction between his or her two languages, which occurs when he or she is asked to spell a word in either language. This aspect is related to how a bilingual child's two language are stored mentally, namely a separate storage and a single-storage hypothesis. The separate storage view maintains that the bilingual child's two languages are represented in two language-specific spelling systems, whilst the shared storage view holds that spelling knowledge is represented in a single, integrated language-independent system (Baker, 2000). In the present study the bilingual Afrikaans-English children are required to spell English and Afrikaans words and non-words, thus one would expect to see activation of both languages as well as inhibition of words in one language when processing words in the other as a response to the spelling materials presented. Arnsberg and Arnsberg's (1991, cited in Harris, 1992) study investigated the question of how and when bilinguals manage to separate their two languages. These authors describe a bilingual awareness task, and show that bilingual children who show awareness of their two languages mix them to a lesser extent than bilingual children who are less aware of their two languages. This means that these children code switch-less, and suggests that language separation results from language awareness, and as a result bilingual children that have a higher level of linguistic awareness may be in an advantageous position (as compared to monolinguals) when learning a new language. Jared and Kroll's (2001) results in combination with Bialystok (1997, Bialystok & Shilpi, 1998; McLeary, 2004) have found that bilingual children derive cognitive benefits from their bilingualism provided that, they

have sufficient practise spelling in their first language and language-specific features of their second language. Other studies have demonstrated that bilingual children in comparison to their monolingual peers, score higher on tasks that assess cognitive ability, cognitive flexibility, analytical reasoning, selective attention and metalinguistic awareness (McLeary, 2004). Bialystok (1992) explains that the bilingual child is able to focus attention on the more relevant features of a task rather than on the perceptually striking features. Bialystok (1999) has found that bilingual children perform well in solving tasks that require high levels of analysis and attention. Indeed, bilinguals have been found to be more divergent thinkers and more creative-problem solvers than monolinguals, as well more sensitive to the sounds in language and that different words in different languages can refer to the same concept, which is termed meta-linguistic awareness (Karmiloff-Smith, Grant, Sims, Jones & Cuckle, 1996; Bialystok, 1999; Yelland, 1999). Thus, the idea that to be bilingual bestows thinking and cognitive skills beyond the average monolingual is an appealing one, one that warrants further study in relation to the cognitive processes that bilingual children use to spell. Furthermore, bilingualism may not affect language development but cognitive development may be influenced.

2.7 THE SOUTH AFRICAN SITUATION: ENGLISH AND AFRIKAANS ORTHOGRAPHIES

English and Afrikaans are two phonetically dissimilar alphabetic South African languages, which may differentially rely on certain spelling skills in the spelling process. Both English and Afrikaans belong to the Indo-European, specifically West Germanic language family (Botha, Ponelis, Combrink, Odendal, 1989; Fromkin & Rodman, 1998; Campbell, 1995) but they differ with regard to grapheme phoneme correspondence patterns, and thus remain phonetically dissimilar languages. The results of this relation between English and Afrikaans can be seen in the many shared words which have the same spelling but different pronunciations, such as '*arm*', '*junior*', and '*argument*', and the overlapping words with the same meaning but different spellings, such as 'constable/*constable*', 'palace/ *paleis*' and republic/*republiek*' (Botha & Van Aardt, 1981). Afrikaans developed into its present form from 17th century Dutch, and is the youngest Germanic language in Africa (Campbell, 1995). There are three main varieties, Eastern Cape Afrikaans (*Oosgrens Afrikaans*, which became Standard Afrikaans), Cape Afrikaans (*Kaapse Afrikaans*) and Orange River Afrikaans

(*Oranjerivier Afrikaans*). At present, Afrikaans is distinct from Dutch and has a standardised language status, which refers to an established uniform linguistic norm which is used in education and teaching (Van Rensburg & Jordaan, 1989; Deumert, 1999, cited in Mesthrie, Swann, Deumert & Leap, 2000). Afrikaans is spoken throughout the South Africa although the largest concentrations of Afrikaans speakers are in the provinces of the Western Cape (39.8%), the Eastern Cape, (10.3%) the Northern Cape (9.9%), and Gauteng (20.9%) as seen in Figure 2.6 (Census, 1996). Afrikaans originated in the Cape Province; and the language spread as its speakers moved further into the interior of the country. The most important movement was the Great Trek in the 1830s and 1840s. The discovery of gold on the Witwatersrand in 1886 and the subsequent industrial development of the Pretoria, Witwatersrand and Vereeniging areas (currently the province of Gauteng), resulted in urbanisation, which explains the large concentration of speakers in this province (UNESCO, 2000).

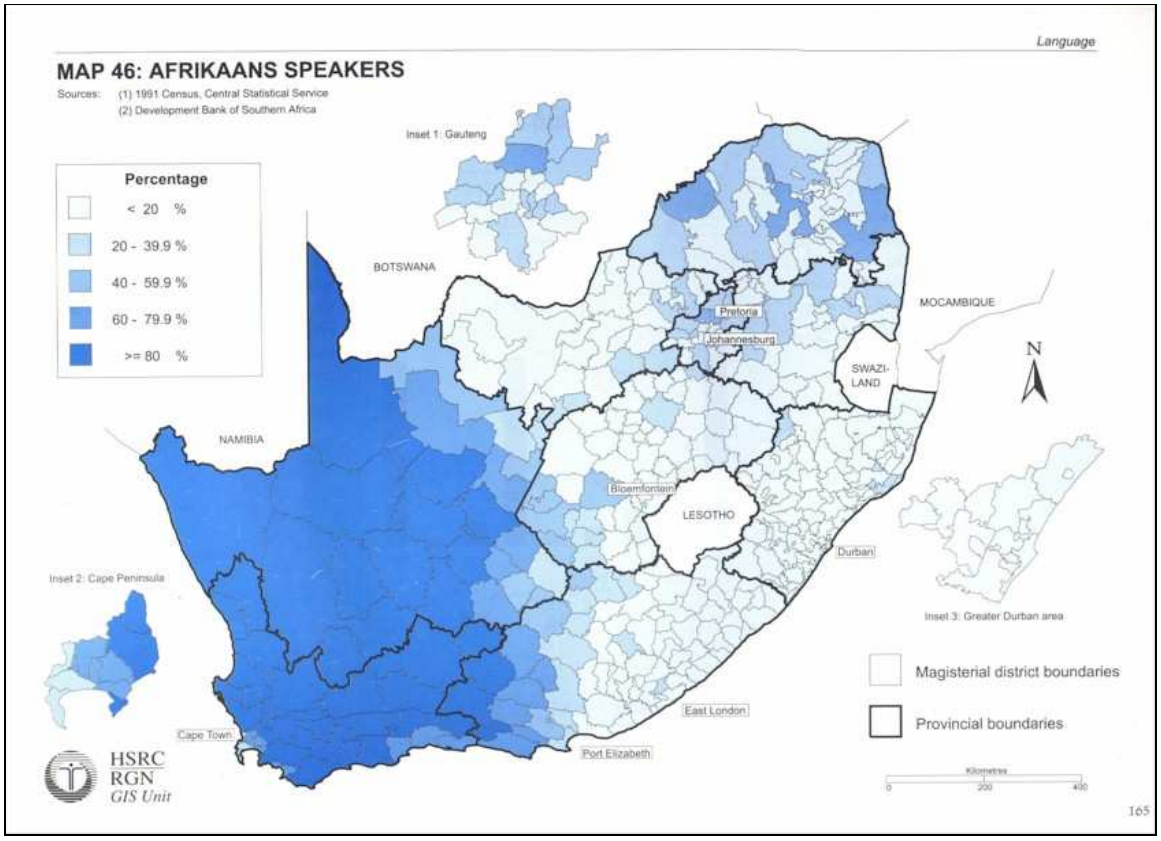


FIGURE 2.6: Map of Afrikaans Speakers in South Africa (HSRC, 1996, cited in UNESCO Report p.165)

English is spoken throughout South Africa and the according to the Census 1996 the distribution of English across the nine province in South Africa was as follows: Eastern Cape (6.7%), Free State (1.0%), Gauteng (27.4%), KwaZulu-Natal (39.1%), Mpumalanga (1.6%), Northern Cape (0.6%), North West (1.0%), and Western Cape (23.0%) (Census, 1996), see Figure 2.7 below. In addition English is spoken as first language in approximately 3771645 individuals and as second language in 3009840 individuals across all the South African provinces (Census, 1996, cited in UNESCO, 2000).

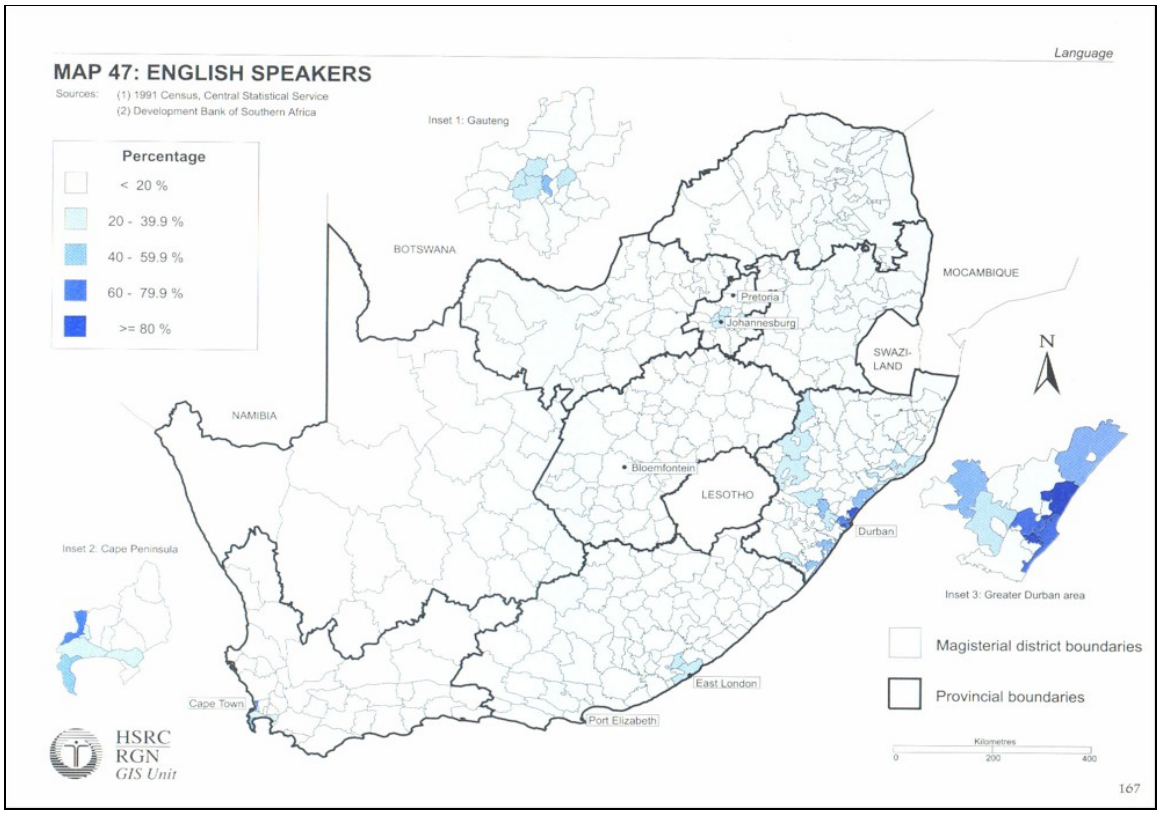


FIGURE 2.7: Map of English speakers in South Africa (HSRC, 1996, cited in UNESCO Report, p.6)

According to the most recent Census in 2001 the language trends from the 1996 percentages in English and Afrikaans have remained relatively similar for Afrikaans (14.30% in 1996 versus. 13.30% in 2001) and for English (8.2% in 1996 versus 8.7% in 2001), as seen in Figure 2.8. Therefore, both English and Afrikaans are alphabetic orthographies that are well established and recognised written languages frequently spoken and used in South Africa (UNESCO, 2000; Census, 1996; Census; 2001; Statistics South Africa, 2004).

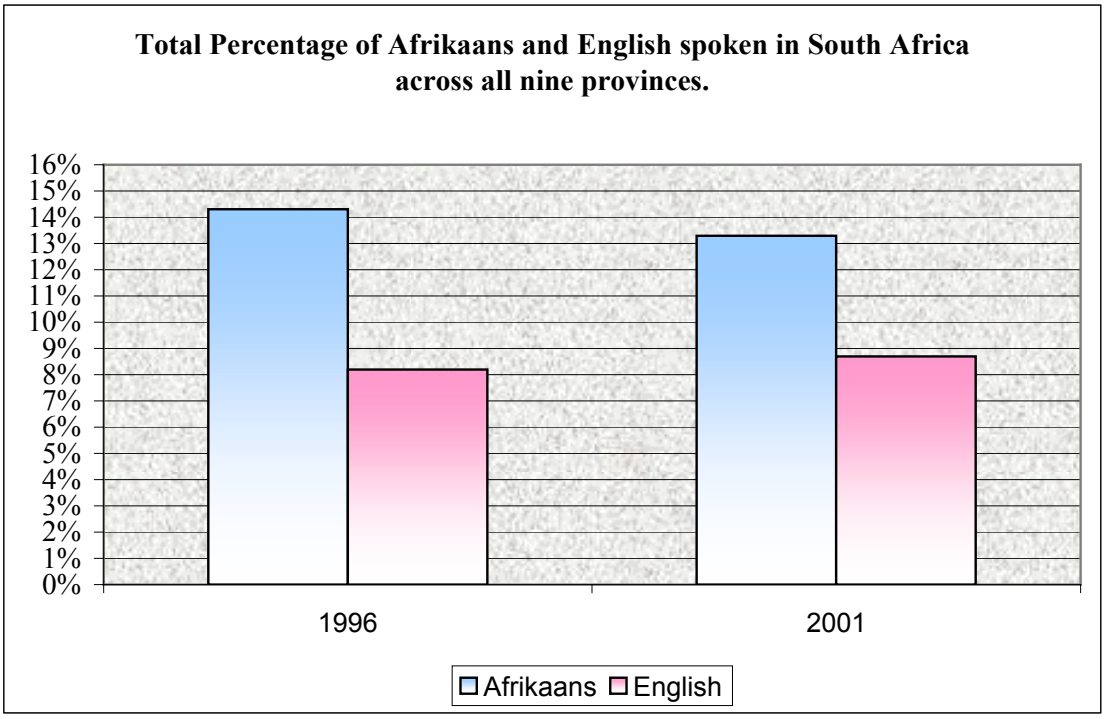


FIGURE 2.8: Percentage of Afrikaans and English spoken in South Africa across all nine provinces (Statistics South Africa, 2004, p.2).

Although English and Afrikaans are seen as belonging to the same language family, one of the main differences between them is the depth of orthography (Botha et al, 1989). English has an irregular and opaque orthography, as can be seen in the English letter 'a' which in different contexts can represent the vowels in 'h<u>a</u>t', 'b<u>a</u>th', and 'pl<u>a</u>te'. In addition, many words occur in English, which cannot be spelt phonologically, such as 'laugh' or 'yacht'. Coetzee (1985) argues that Afrikaans can be written as it is spoken, its orthography is relatively transparent in comparison to English. Afrikaans orthography in this regard is relatively similar to German, with a generally clear, unambiguous correspondence between letters and sounds. This difference between English and Afrikaans is made more apparent in a comparison between the numbers of sounds each language derives from an alphabet of 26 letters. Afrikaans has approximately 58 sounds compared to roughly 104 in English (see Table 2.1 below). English sounds map onto more syllables and consonant clusters that appear before and after a vowel, and thus has a more complex and opaque relationship for the purposes of spelling. In contrast, in Afrikaans there is a closer relationship between graphemes than in English, resulting in Afrikaans being relatively transparent for the purposes of spelling (Doctor, Ahmed, Ainslee, Cronje, Klein, Knight, 1987).

TABLE 2.1: Number of different speech sounds and symbols in English and Afrikaans (Coetzee, 1985)

Speech Sounds & Symbols	English	Afrikaans
Vowel sounds	25	30
Vowel symbols	60	27
Consonant symbols	25	27
Consonant symbols	44	31
Total number of sounds	50	57
Total number of symbols	104	58

Therefore it is possible that differences in the Afrikaans and English orthographies may produce noticeable differences in strategies and processing styles that children use in learning to spell. This has implications for teaching, spelling and remediation. In addition this would impact on bilingual children, or the child whose first language differs from the language of instruction at school, particularly if one is opaque and the other is transparent. Further, different cognitive processes and spelling strategies may be utilised in learning to spell in different language orthographies. If certain of these skills transfer to spelling in another orthography then this has important theoretical implication for models of bilingual spelling, spelling instruction and remediation. This is vital to assess in a country like South Africa, which adopts an additive model of bilingualism, which has had little research attributed to it (Buthelezi, 2003).

2.8 RESEARCH RATIONALE

Most research on spelling has studied English, with the consequence that most understanding is of the cognitive processes of spelling and its development in English. Cross-linguistic studies of different writing systems have shown that the effects of language orthography are important to consider in spelling in different languages (Wimmer & Hummer, 1990; Bialystok, 2002; Geva & Wang, 2003). In light of the diverse orthographic differences between English and Afrikaans, which has been shown to influence children's spelling acquisition, it would be helpful to identify whether monolingual English and bilingual Afrikaans-English children exhibit significantly different cognitive processing style strengths and weaknesses. This information would be valuable to teachers on how to teach children to spell by taking into consideration the processing skills that monolingual English and bilingual Afrikaans-English children may excel at, and using this strength to build their interest in spelling, as well as help them with their weaker spelling skills. Examining the qualitative

spelling errors that monolingual English and bilingual Afrikaans-English children make, would provide information about the spelling skills and strategies that are important to spell in an opaque orthography in comparison to a transparent orthography, which would inform teachers of how to help bilingual Afrikaans-English children deal with learning to spell in a second language. By examining cross-language transfer, information about the cognitive and language capacities of bilingual Afrikaans-English children can be gleaned, as this provides information about what is common in both English and Afrikaans, and would possibly generalise across languages in spelling instruction and remediation, and those aspects that are language-specific, and would require specific instruction or remedial focus for each language (Vaid & Genesee, 1980). Research on bilingual children's spelling has been less researched and is lacking in South Africa, a country characterised by multilingual literacy instruction as decreed by legislature (Buthelezi, 2003). Research involving bilingual children presents an opportunity to investigate whether exposure to two different language's spelling system reveals unique cognitive processing strengths and weaknesses, different spelling strategies and cognitive skills associated with learning two languages, and a possible transfer of spelling strategies from one language to another.

2.9 RESEARCH AIMS

The aims of the present study seeks to address the role of bilingualism, in the form of how learning to spell in dissimilar orthographies (English which has an opaque and Afrikaans a transparent orthography), makes different demands on the early speller, especially with reference to simultaneous processing and sequential cognitive processing, spelling skills and the associated concurrent and predictive relationship between simultaneous processing and sequential processing and spelling. Scores on the K-ABC's simultaneous processing and sequential processing subtests and overall simultaneous processing, sequential processing, mental processing composite scaled scales are expected to differ, as are the spelling abilities of English and Afrikaans words and non-words in the monolingual English and bilingual Afrikaans-English children. The differences in scores on these literacy measures and the qualitative nature of spelling errors will reflect the extent to which monolingual English and bilingual Afrikaans-English children use simultaneous (logographic) and sequential (alphabetic) cognitive processing styles in learning to spell and the spelling strategies they use to spell. In addition the study, examines bilingual children learning to spell in both their first language (Afrikaans) and in their second language (English) and whether there is

evidence of transfer of spelling strategies cross-linguistically. If transfer is evident between the languages, this provides important implications for bilingual instruction, and the effects of learning to spell in more than one language simultaneously.

2.10 RESEARCH QUESTIONS

The research questions that guided the present study are exploratory in nature due to the limited amount of information on the role of bilingualism, or learning to spell in another language besides English. The central research issues concerns whether orthographic differences influence the relationship between simultaneous processing, sequential processing and spelling ability in the monolingual English and in the bilingual Afrikaans-English children. In order to investigate this research issue, four research questions were formulated and used to guide the present study, namely:

1. Is there a difference in simultaneous processing and sequential processing between monolingual English and bilingual Afrikaans-English children?
2. Is there a difference in spelling ability between the monolingual English and the bilingual Afrikaans-English children?
3. Is spelling ability in Afrikaans associated with spelling ability in English and vice versa?
4. Is there a difference in the relationship between simultaneous processing, sequential processing and spelling ability in the monolingual English and in the bilingual Afrikaans-English children?

2.11 CHAPTER SUMMARY

The present chapter has reviewed the theoretical and empirical literature central to the research issue. Specifically, whether monolingual English and bilingual Afrikaans-English children might display different cognitive processing styles and spelling skills and associated relationship between simultaneous processing and sequential processing and spelling varies as a function of language orthography. This chapter has also presented the research rationale and aims of the present study. The next chapter presents a description of the design, sample, instruments and data analysis techniques utilised in the present study to answer the four research questions presented in this chapter.

CHAPTER 3: METHOD

3.1 DESIGN

The present study utilised a non-experimental (ex post facto) cross-sectional, mixed subject's two independent samples research design. The independent variable being language instruction in English as a mother-tongue (monolingual English children) and dual-medium instruction (bilingual Afrikaans-English children), which was not manipulated as it was pre-existing and thus no control was possible (Kerlinger, 1973, cited in Terre Blanche and Durrheim, 2002; Rosnow & Rosenthal, 1999; Coolican, 2004). The dependent variables were cognitive processing as measured by the K-ABC's simultaneous processing and sequential processing scales (Kaufman & Kaufman, 1983b) and spelling as measured by Klein's (1993) spelling tests of English and Afrikaans words and non-words.

The design was cross-sectional, thereby comparing the reciprocal relationship between simultaneous processing and sequential processing and learning to spell at one point in time, in the monolingual English and bilingual Afrikaans-English children.

3.2 PARTICIPANTS

A total of 60 children agreed to participate in the present study from two primary schools within the same demographic area in Johannesburg. Thus, the sample in the present study was a purposive, convenience sample obtained using a non-probability sampling strategy. The sample consisted of 30 monolingual English and 30 bilingual-Afrikaans-English children. English and Afrikaans were chosen because they reflect current demographic trends in Gauteng (Census, 2001) and represent different language orthographies (Venesky, 1970; Coetzee, 1995). Grade was held constant and both the monolingual English and bilingual Afrikaans-English children were of a similar age.

The bilingual Afrikaans-English children had Afrikaans as their first language, or at home at least one parent was an Afrikaans speaker and these children were learning to spell in Afrikaans and English at a dual-instruction (parallel-medium) school. An important part of the study is that bilingual Afrikaans-English teachers provide spelling instruction in English

and Afrikaans to the bilingual Afrikaans-English children. This is an ideal population for studying the interplay in language processing, which is of interest to the analysis of bilingual processing. The monolingual English children were first language speakers of English and were learning to spell in English at an English medium school.

The method of spelling instruction, whether whole-word or phonics, has been shown to have an effect on the cognitive processes used in learning to spell (Adams, 1990; Duncan & Seymour, 2000; Spenser & Hanley, 2003;). A phonics teaching approach stresses the basic rules for translating written patterns into sound, whilst a whole-word approach stresses that children should be presented with learning materials in their complete form, such as stories whole words and poems. Therefore, Grade three teachers in both respective schools were interviewed to obtain information on the teaching method employed. Both the schools sampled in this study made use of the whole-word and phonics approach to teach the monolingual English and bilingual Afrikaans-English children to spell. Biographical data, including home language, sex and date of birth were obtained from school records. Children who had no language, neurological or sensory disorders were included in the study. Table 3.1 below summarises the descriptive characteristics of the sample in the present study.

TABLE 3.1: Descriptive summary of gender and age of monolingual English and Bilingual Afrikaans-English children

Total Sample (*n* =60)	**Monolingual English (*n* =30)**	**Bilingual Afrikaans-English (*n* =30)**
Gender	30 (10 Male, 20 Female)	30 (16 Male, 14 Female)
Mean Age	9.years.08 months	9 years. 09 month
Mean Age Range	(9.0-9.08)	(9.1-9.09)

The overall sample had slightly more girls (n=35) than boys (n=30), necessitating the need for a two-independent sample *t*-test to be conducted to determine whether there were gender differences on the measures of simultaneous processing, sequential processing and spelling English and Afrikaans words and non-words in the monolingual English and bilingual Afrikaans-English children. The results of the t-test indicated that there were no significant gender differences $t\ (58) = (p > .05)$ on any of the measures (see Results chapter).

3.3 INSTRUMENTS

Two measures were administered: the K-ABC's (1983a) simultaneous processing and sequential processing scales and Klein's (1993) Spelling Tests of English and Afrikaans words and non-words. A description of the instruments used in the present study is discussed below.

3.3.1 Kaufman Assessment Battery for Children (K-ABC)

The K-ABC is a measure of information processing that was developed in the 1980's and designed to assess the way children process information. It is based on Luria's (1970) simultaneous/sequential information-processing theory, thereby emphasising the child's fluid cognitive processing ability and de-emphasises the acquisition of acquired knowledge (crystallised ability). In general, although the K-ABC is seen as an intelligence test, it does not assess the same abilities as the Weschler and Binet tests (Naglieri & Jensen, 1987; Kaufman & MacLean; 1987). The difference lies in the definition of intelligence. The test authors of the K-ABC define intelligence as "largely a matter of the problem-solving ability and the effectiveness of one's information-processing skills "(Cohen & Swerdlik, 2002, p.309). The K-ABC seems to take this into account by offering different measures of mental ability, which may influence different types of cognitive skills. Anastasi (1988) argues that the K-ABC is an innovative, cognitive assessment battery, that assesses cognitive processing, preferred learning style and whose development meets high standards of technical psychometric quality. Norms were developed to reflect the general population including ethnic and bilingual minorities from the United States. Anastasi (1988) and Murphy and Davidshofer (2001) note that many studies have evidenced that the K-ABC is less prone to cultural, linguistic bias and gender bias (Wilson, Nolan, & Reynolds, 1989) in diverse samples and populations (Valencia, 1984; Naglieri, 1984, 1989; Valencia & Raikin, 1986; Fourquean, 1987; Matazow et al., 1991; Flanagan, 1995; Das, 1992a, Das 1992b; Giordani et al., 1996; Kriegler & Skuy, 1996; Skuy et al., 2000;Greenop, 2004) largely due to it's content and organisation.

The K-ABC items are mostly non-verbal, and were designed to be as culturally fair as possible. Oral instructions from the examiner and verbal responses from the examinees are minimal, and whenever a verbal response is required the K-ABC manual contains special instructions for test administration to bilingual children (Kaufman & Kaufman, 1983a). In

particular, the simultaneous processing and sequential processing tests contain sample items, which ensures that the child understands the type of response expected. When administrating the sample item, it is permissible to use a different language if the child is bilingual. In addition the child is given credit for a response whether in English or in another language. This is particular relevant to the present study as the bilingual Afrikaans-English children were permitted to respond in English or Afrikaans. As the K-ABC utilises many pictures and games, it is appropriate to assess the cognitive processing styles of children from diverse cultural and linguistic backgrounds and past studies in the South African context (Kriegler & Skuy, 1996; Skuy et al., 1998; Greenop, 2004) have found this to be the case. In addition both Fourquean's (1987) and Flanagan's (1995) studies highlight that the K-ABC represents an improved measure of identifying the cognitive processes associated with decoding achievement and difficulties than the WISC-R in second language learners of English.

The K-ABC battery is divided into simultaneous processing and sequential processing scales, which when combined form an overall mental processing scale designed to measure fluid intelligence, and an achievement scale designed to measure crystallised or acquired knowledge. The test authors regard the simultaneous and sequential mental processing scales as the best measures of fluid intelligence (Kaufman & Kaufman, 1983a), as they minimize the dependency on knowledge or facts, or crystallised intelligence, and tap basic information processing abilities. Naglieri's (1984) study of 35 Navajo children showed a significant difference between the Weschler Intelligence Scales for Children –Revised (WISC-R) Full Scale Scores, the K-ABC's achievement scale and the K-ABC's mental processing scales, in favour of the latter suggesting that the K-ABC's mental processing scales were a better instrument of intellectual assessment in linguistically and culturally different children. Naglieri (1984) explains this discrepancy as a result of the acquired knowledge component of the K-ABC's achievement scale and WISC-R overall IQ as evidenced by the high significant correlation between these two measures (r =. 69). The simultaneous processing and sequential mental processing scales did not yield a correlation with the WISC-R or K-ABC Achievement Scale endorsing these scales as measures of fluid and not acquired knowledge The K-ABC is assumed to affect all areas of cognition, which can be translated into teaching skills and strategies that can be used to help children learn literacy skills that are crucial for success in today's society (Kaufman and Kaufman, 1983a; Kriegler & Skuy, 1996; Pandor, 2004; Cunningham, 2005).

Various factor analytic studies provide evidence of the construct, predictive, concurrent validity and utility of simultaneous processing and sequential processing for Black, Hispanic and White populations in the United States (Anastasi, 1988; Cohen & Swerderlik, 2002) and few studies in South Africa have shown this also to be the case in (Skuy et al., 2000; Greenop, 2004). The K-ABC has a split half reliability of between .89-.97, with most of the individual subtest in the .80's. Kaufman and Kaufman (1983a) report satisfactory reliable estimates of test-re-test reliability ranging from .77 to .97 for children aged 2½, to 12½, tested at two intervals of two to four weeks. This last result demonstrates that the K-ABC test items scores remain consistent over time (Kamphaus, 1992). The aims of the simultaneous processing and sequential processing abilities of the K-ABC provide an excellent fit to the present research as they aim to "provide an indication of a child's potential in a wide range of mental and academic-problem-solving activities" (Kaufman and Kaufman, 1983b, p.8).

In the present study, only the simultaneous processing and sequential processing K-ABC sub-tests were used as the focus was on simultaneous processing, sequential processing and their relation to spelling development. Spelling is a dynamic fluid entity rather than a static entity as implied in the K-ABC achievement scales' similarity to the WISC-R. (Naglieri, 1989; Treiman & Bourassa, 2000) The K-ABC's achievement scale was not used to avoid the confounding variable of different knowledge bases and biased American content that is inappropriate for South African children (Bracken, 1985; Das & Naglieri, 1989; Greenop, 2004). A summary of the subtests that make up the simultaneous processing and sequential processing scales administered in the present study and their description is presented in Table 3.2.

TABLE 3.2: Description of sequential processing and sequential processing

Subtests of the Sequential Processing Scale	
Hand Movements	Performing a series of hand movements in the same sequence as the examiner.
Number Recall	Repeating a number of digits in the same sequence spoken by the examiner.
Word Order	Touching a series of silhouettes of common objects named orally by the examiner.
Subtests of the Simultaneous Processing Scale	
Gestalt Closure	Naming an object or scene pictured in a partially completed inkblot drawing.
Triangles	Assembling several identical triangles into an abstract pattern that matches a model.
Matrix Analogies	Selecting the picture or abstract design that best completes a visual analogy.
Spatial Memory	Recalling the placement of pictures on a page that are exposed briefly.
Photo Series	Placing Pictures of an event in a chronological order.

The sequential processing scale assesses a child's ability to solve problems by arranging and ordering a series of images or ideas. The ability to order information is seen in scholastic skills that require memorisation of a number of facts or lists of spelling words and of the association between letters and their corresponding sounds (Kaufman & Kaufman, 1983b). The overall sequential processing scale consists of the Hand Movements, Number Recall, and Word Order subtests. Sequential processing tasks all emphasise that the order of a problem's stimuli forms a chain-like progression, where each item is related only to the preceding one (Kaufman & Kaufman, 1983a). In contrast, simultaneous processing tasks all emphasise the ability to think about visual patterns and stimuli, and to mentally rotate objects in space. The ability to solve problems that are spatial or organisational in nature involves integration and synthesis of information and is seen in the scholastic skills associated with learning the shapes of letters and words (Kaufman & Kaufman, 1983b). The simultaneous processing scale consists of the Gestalt Closure, Triangles, Matrix Analogies, Spatial Memory, and Photo Series subtests and assesses a child's ability to examine, integrate and synthesize various items or parts into a group or whole to solve a problem (Kaufman & Kaufman, 1983a).

The K-ABC subtests are scored correct (1 point) or incorrect (0 points), and the K-ABC (1983b) manual provides explicit directions and criteria for administering and scoring the test. Scores on the individual simultaneous processing and sequential processing subtests items are tallied to yield raw scores for each of the subtests. Tables in the manual are then used to convert each of the raw scores obtained on each of the simultaneous processing and sequential processing subtests into standard scores, with a mean (*M*) of 10 and a standard deviation (*SD*) of 3. From these standard scores, an overall simultaneous processing, an overall sequential processing and an overall mental processing composite scores is tallied and derived by using the tables in the manual to convert these scores to scaled scores with a mean (*M*) of 100, and a standard deviation (*SD*) of 15 (Kaufman & Kaufman, 1983b).

3.3.2 Klein's (1993) Spelling English and Afrikaans Words and Non-Words

Klein's (1993) spelling test consists of 10 English and 10 Afrikaans words and 10 English and 10 Afrikaans non-words. The English and Afrikaans words were matched for frequency and word length so that the two represent equivalent tests (Klein, 1993). The non-words were constructed by changing the initial letter of each word such that the non-words all remained orthographically legal, that is they conformed to the phonological rules of English or Afrikaans.

Stimuli in both languages were checked to ensure that none constituted real English or Afrikaans words. For the construction of the English version of the spelling test stimulus words were chosen from the spelling literature (Coltheart, 1978). The construction and development of the Afrikaans spelling versions of the test was based on direct translation of the English words, but took into account specific characteristics of the Afrikaans orthography. Klein's (1993) English and Afrikaans word and non-word spelling tests are based on detailed analysis of the English and Afrikaans languages and permit an in-depth assessment of the cognitive processes of spelling in monolingual English and bilingual Afrikaans-English children (Klein, 1993). For example, spelling non-words correctly points to a phonics or alphabetic strategy, while spelling irregular words points to a whole-word or logographic approach to spelling (Frith, 1985). Words and non-words are interspersed. In the present study children were encouraged to attempt to spell all the words, as some children may not attempt to spell words that are not "real".

In terms of scoring a spelt word is scored correct (1 point) or incorrect (0 points). A possible score out of 10 can be achieved for each of the English and Afrikaans words and non-words respectively in addition to the qualitative analyses of errors. Klein (1993) reports no reliability co-efficient for the English and Afrikaans spelling tests. Cronbach's co-efficient alpha (α) was thus computed in the present study, for each of the spelling tests. Table 3.3 contains these results.

TABLE 3.3: Reliability analyses of spelling measures used in the present sample

Measure	Monolingual English (n =30)	Bilingual Afrikaans-English (n =30)
Spelling English words	.96	.94
Spelling English non-words	.86	.84
Spelling Afrikaans words	*	.95
Spelling Afrikaans non-words	*	.94

Note: * indicate not applicable.

The results in Table 3.3 indicate that Klein's (1993) English and Afrikaans word and non-word spelling tests were highly reliable and appropriate to use to measure spelling ability of English and Afrikaans children. These reliability scores have important implications for future research using these measures.

3.4 PROCEDURE

The K-ABC's simultaneous processing and sequential processing subtests were administered by the researcher on an individual basis to the monolingual English and bilingual Afrikaans-English children over a short period of two months, (from July to September 2004). The simultaneous processing and sequential processing tasks took about 40-45 minutes per child to administer over two sessions. Testing sessions took place in the morning at a time convenient to the teacher and pupils. A quiet classroom as agreed upon by the child's teacher and principal of each school was chosen as the venue for the administration of the simultaneous processing and sequential processing tasks to the children. The spelling tests were administered as group tests by the researcher. The monolingual English children were asked to spell English words and non-words, whilst the bilingual Afrikaans-English children were asked to spell English as well as Afrikaans words and non-words. Appendix C and Appendix D illustrates the procedures for the K-ABC (1985) and Klein's (1993) tests respectively.

3.5 ETHICAL CONSIDERATIONS

As the present study involved sampling monolingual English and bilingual Afrikaans-English children in two governmental schools, permission was sought and obtained form the Gauteng Provisional Government as well as from the principals from each school (Appendix E). In addition an ethical clearance certificate was obtained from the University of the Witwatersrand Ethics Committee (Appendix F). Informed consent was obtained from the children's parents and the children gave their assent to participate in the study (Appendix G). The children were told that the study involved building and solving puzzles. This involves no deception, yet was helpful to explain to the child what the study was about. The children's names were co-indexed with a number to ensure confidentiality.

3.6 DATA ANALYSES

The present study utilised both quantitative statistical tests of significance, *t*-tests, correlation and stepwise regression analyses, as well as qualitative error analyses. This permitted the present study to investigate the quantitative cognitive processing and spelling differences, as well as contribute research on the qualitative distinction between monolingual English and bilingual Afrikaans-English children's spelling processes (Treiman & Bourassa, 2000; Hanley & Spenser, 2003).

3.6.1 Quantitative Statistical Analyses

Language of teaching and orthography was the independent variable. Simultaneous processing, sequential processing and spelling were the dependent variables. The statistical analyses consists of descriptive statistics, and inferential statistics, such as two independent sample *t*-tests, a dependent sample *t*-test, Pearson's correlation analyses, and a series of stepwise regression analyses. The dependent variables were interval scale measures, but before significant differences were calculated, normality was checked using the Kolmogorov-Smirnov "goodness of fit "(*D*) test. The results of the Kolmogorov-Smirnov "goodness of fit "test indicated that the data was normally distributed for all the measures in the study (see Table H1 in Appendix H). For the two languages of teaching and orthography *t*-tests, correlation and regression analyses comparisons, the homogeneity of variance was checked, using Levene's (*W)* homogeneity of variance test. The results indicated that the variances in the monolingual English and bilingual Afrikaans-English children were equal as the two

sample variances were not significantly different (see Table H2 in Appendix H). Parametric statistics were chosen due to normality and homogeneity of variance assumptions being met. A short rationale for the inclusion of each statistical technique used in the present study to explore the research questions is outlined below.

A *two-independent sample t-test* was used to compare and calculate the ***significant differences*** between the monolingual English and bilingual Afrikaans-English children's performance on the simultaneous processing scale, sequential processing scale, mental processing composite scales and on the simultaneous processing and sequential processing subtests that made up the simultaneous processing and sequential processing scales respectively, as well as spelling English and Afrikaans words and non-words.

According to Howell (2002) a two-independent sample *t*-test is used to compare the mean scores of two independent samples to determine that the two groups differ in some amount, and whether this difference is large enough to justify the conclusion that the differences found are due to genuine reasons and not chance. A two-independent sample *t*-test requires interval data, a normal distribution and homogeneity of variances parametric assumption to be met in order to analyse data using this statistical technique.

A dependent sample t-test was used to calculate and compare the ***significant differences*** between spelling in English words and non-words in the monolingual English children. In addition, *a dependent sample t-test* was also used to calculate and compare the ***significant differences*** between spelling words and non-words in a first (L1) and in a second language (L2) in the bilingual Afrikaans-English children. According to Howell (2002) a dependent sample *t*-test is used when the same participants respond on two occasions, for example two measures from the same participant on a measure to determine whether the difference between the two means scores on the two occasions is large enough to justify the conclusion that the differences found are due to genuine reasons and not chance. A dependent sample *t*-test requires interval data, a normal distribution and homogeneity of variances parametric assumption to be met in order to analyse data using this statistical technique.

A *Pearson's correlation analysis* (*r*) was used to calculate and examine the ***significant relationships*** between spelling English and Afrikaans words and non-words and between simultaneous processing, sequential processing and spelling in monolingual English and

between simultaneous processing, sequential processing and spelling in the bilingual Afrikaans-English children. According to Howell (2002) a Pearson's product-moment correlation co-efficient is based on the variance in the two sets of scores, and is used to determine the degree of the relationship between two variables. The correlation co-efficient is itself a measure of effect size. Cohen (1988, cited in Coolican, 2004) provides an accepted set of guidelines for interpreting correlation results and proposes that a *r* of .1 is considered a small effect size, a *r* of .3 is considered a medium effect size, and a *r* of .5 and above is considered a large effect size.

A series of *stepwise regression analyses* were carried out to determine the ***extent*** to which the simultaneous processing and sequential processing subtests were ***significant predictors*** of spelling English words and non-words in the monolingual English and spelling English and Afrikaans words and non-words in the bilingual Afrikaans-English children. "Stepwise regression is used in the prediction of criterion variables from a particular set of predictor variables. It gives the best prediction possible of a criterion variable from this set of predictors" (Coolican, 2004, p.427). According to Howell (2002) a stepwise regression analysis examines the variable at each stage of the regression and as each new variable is added checks that a variable added earlier on should now be retained or removed before another variable is added. This means that a stepwise regression examines each variable in the regression model as though it were the latest variable added, removing the non-significant ones. This process is repeated until the addition of further variables produces no significant improvement (Draper & Smith, 1966; Howell, 2002; Coolican, 2004).

3.6.2 Qualitative Error Analyses

Qualitative error analyses were used to determine the spelling strategies used by the bilingual Afrikaans-English children to spell words and non-words in English and Afrikaans and how these differed from monolingual English children spelling English words and non-words. In line with Frith's (1985) and Seymour's, Bunce and Evan's (1992) stage models of spelling who argue that children progress through different qualitative stages in spelling development (Treiman & Bourassa, 2000). Spelling errors analysis can reveal whether the qualitative nature of spelling strategies in English is the same or different to the spelling strategies used in other languages (Spenser et al., 2003). The next section presents the approach to errors analysis that is used in the present study.

Spelling strategies fall into two main types:

- Visual whole-word or whole-syllable non-phonetic strategies; and
- Auditory sequential phonetic strategies.

Spellers use both types of strategies. Known words are recalled visually. Unknown words or legal non-words may de decoded using a combination of phonetic rules and through analogy, and visual memory for letter combinations in related words. A balance of both types of strategies is usual in normal spellers of English due to the nature of the opaque orthography, as most English words cannot be decoded by letter sound correspondences alone (Kaufman & Kaufman, 1983; Frith, 1985). Poor spellers may have problems with one or both types of strategies. Spelling errors can be categorised into those relying on phonetic strategies and those showing reliance on visual strategies. An analysis of spelling errors can suggest that although reliance is being placed upon one particular type of strategy, this strategy on its own is not entirely effective (Elliot et al., 1990).

The naturalistic spelling data of the monolingual English and bilingual Afrikaans-English children was analyzed qualitatively into two broad error categories namely:

- Phonetic errors; and
- Visual errors.

Phonetic errors reveal reliance on phonetic strategies to spell, and provide evidence that the child understands that letters represents sounds and uses these to solve the spelling of words. The child is able to carry out sequential phonemic analysis and able to distinguish that sounds need to be represented in the order they occur, and able to remember which letters represent which sounds and to write them recognizable and in sequence. However, predominate reliance on phonetic strategies may indicate that the child may have difficulty in visual recall of whole words, and may thus place an undue reliance on phonetic strategies for irregularly spelt words. In addition the child may be dependent on phonics strategies even for relatively easy words, and may have a relatively small core vocabulary of irregularly spelt words (Elliot et al., 1990).

Visual errors reveal a reliance on visual strategies to spell and provide evidence that the child has developed a store of syllable patterns and irregular spelling patterns of particular phonemes and uses these to solve the spelling of words. The child is able to use visual or whole-word analogies to solve the spelling of unknown words. However, predominate reliance on visual strategies may indicate that the child has difficulties with sequential processing of letter sound correspondences or phonemic awareness, with the child being unable to identify the sounds within words or lack knowledge of sound-letter correspondences or a combination of both (Frith, 1985; Elliot et al., 1990).

In line with Bialystok's (2002) model of bilingual spelling, qualitative error analyses was used in the present study to investigate whether the bilingual Afrikaans-English children were able to transfer and share spelling strategies cross-linguistically from learning to spell in their first to learning to spell in a second language.

3.7 CHAPTER SUMMARY:

This chapter has presented and discussed the design, participants and measures utilised in the present study in terms of psychometric credibility, applicability as well as the rationale for their inclusion in the present study. In addition the statistical analyses used to explore the research questions were mentioned, and the qualitative error analysis approach used to classify the monolingual English and bilingual Afrikaans-English children's spelling data. The next chapter presents the results of the quantitative statistical data analyses and the qualitative error analyses used in the present study in relation to the research questions that guided the present study.

CHAPTER 4: RESULTS

This chapter presents the results of the quantitative data analyses and compares the performance of the monolingual English children learning to spell in English and the bilingual Afrikaans-English children learning to spell in English and Afrikaans on the K-ABC's (1983b) simultaneous and sequential cognitive-processing subtests and scales, and Klein's (1993) spelling English and Afrikaans word and non-word tests. In addition the results of the qualitative spelling errors analyses are presented in this chapter. Firstly the descriptive statistics comprising the means and standard deviations for each of the research variables will be presented and then the inferential statistical analysis will be presented as they relate to the research questions that guide the present study.

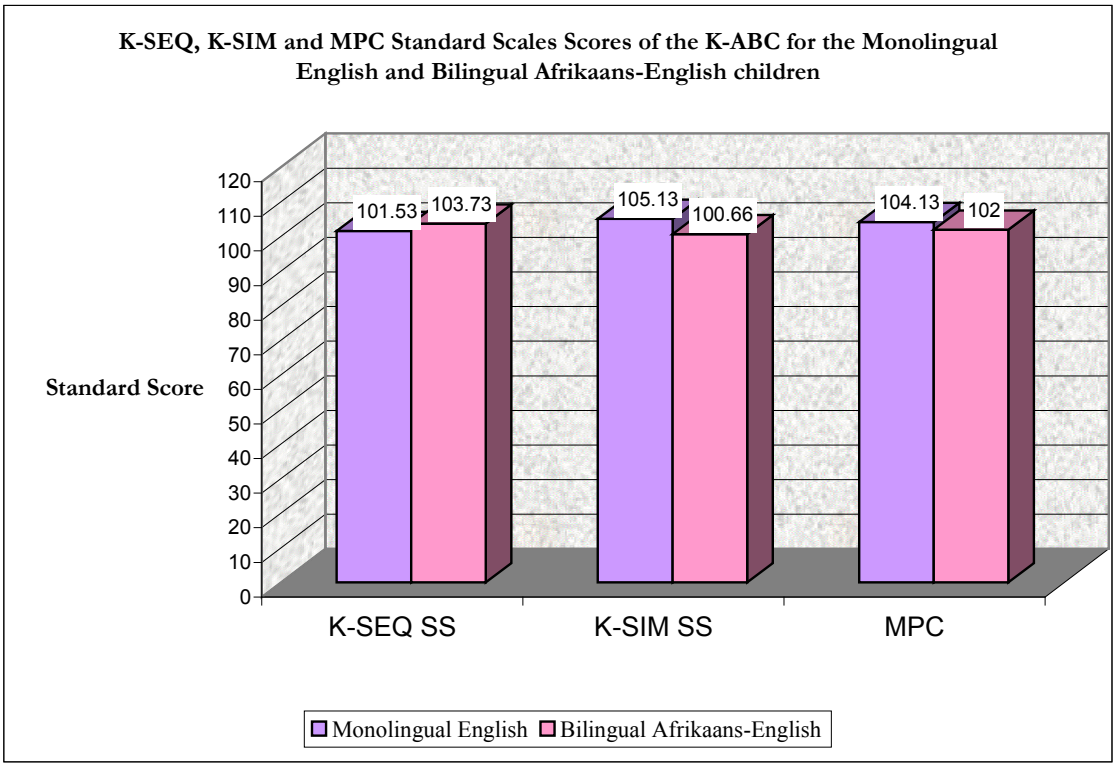
4.1 DESCRIPTIVE STATISTICS

The overall simultaneous processing, sequential processing and mental processing composite scaled scores were analysed in terms of mean and standard deviations for the monolingual English and bilingual Afrikaans English children (see Table 4.1 below).

TABLE 4.1: Overall simultaneous processing and sequential processing Mean (*M*) and Standard Deviations (*SD*) scores in the monolingual English and bilingual Afrikaans-English children

Grade Three				
Dependent Variable	**Monolingual English (*n* =30)**		**Bilingual Afrikaans-English (*n* =30)**	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
K-ABC Simultaneous Processing Scale Score	105.13	9.22	100.66	11.10
K-ABC Sequential Processing Scale Score	101.53	9.34	103.73	9.67
Mental Processing Scale Score	104.13	9.00	102.00	9.69

Table 4.1 contains the means and standard deviations for the overall simultaneous processing, sequential processing and mental processing composite scaled scores for the monolingual English and bilingual Afrikaans-English children respectively. Figure 4.1 below illustrates the monolingual English and bilingual Afrikaans-English children's performance on these measures.



Note: K-SIM SS= K-ABC simultaneous global scale standard score; K-SEQ-SS sequential global scale standard score, MPC = Mental Processing Composite global scale standard score.

FIGURE 4.1: Overall simultaneous processing, sequential processing and mental processing composite scaled scores in the monolingual English and bilingual Afrikaans-English children.

The monolingual English children's mean score was higher on the simultaneous scale (*M* =105.13, *SD* =9.22) in comparison to the bilingual Afrikaans-English children, (*M*= 100.66, *SD* =11.10). In contrast the bilingual Afrikaans-English children, obtained a higher mean score on the sequential processing scale, (*M* =103.73, *SD* =9.67) in comparison to the monolingual English children, (*M* =101.53, *SD* = 9.34). Overall, the monolingual English children displayed a slightly higher mental processing composite (MPC) mean score than the bilingual Afrikaans-English children (*M* =104.13, *SD* =9.00) versus (*M* =102.00, *SD* =9.69) respectively.

The individual subtest standard scores on the subtests that make up the simultaneous processing and sequential processing scales were analysed in terms of mean and standard deviations are summarised in Table 4.2 below.

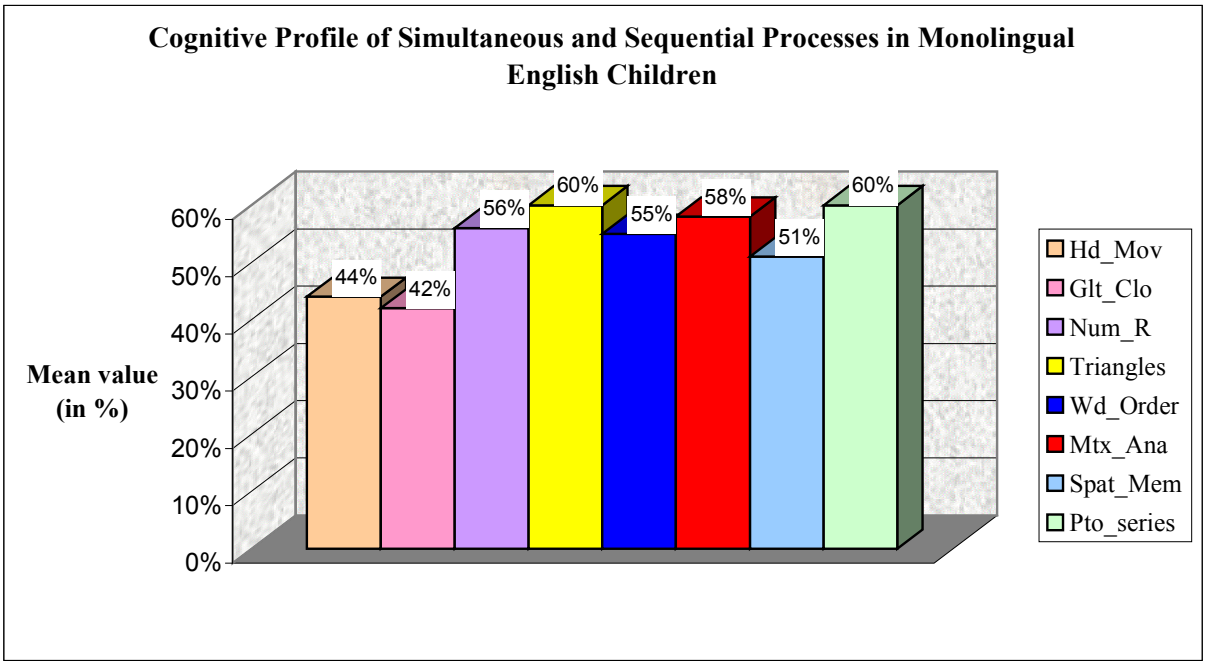
TABLE 4.2: Mean (*M*) and Standard Deviations (*SD*) on K-ABC's processing subtests standard scores for the monolingual English and the bilingual Afrikaans-English children.

Grade Three					
		Monolingual English (*n*=30)		Bilingual Afrikaans-English (*n*=30)	
Dependent variable	Maximum Test Total	Mean	Standard Deviation	Mean	Standard Deviation
Hand Movements	21	9.20	2.12	11.00	1.91
Gestalt Closure	25	10.56	2.82	9.76	2.15
Number Recall	19	10.66	2.40	10.13	2.27
Triangles	18	10.80	1.99	10.30	2.36
Word Order	20	10.96	1.63	10.83	1.87
Matrix Analogies	20	11.56	2.50	10.33	1.66
Spatial Memory	21	10.76	1.63	10.73	2.36
Photo Series	17	10.20	2.01	9.56	1.94

According to Kaufman and Kaufman (1983b), the standard scores of the simultaneous processing and sequential processing subtest have a metric mean of 10 and standard deviation of 3. The above results show that none of the measures are in the poor range (below 7 points). Matrix Analogies from the simultaneous processing scale is in the above average range for the monolingual English children. Hand Movements from the sequential processing scales is in the above average range for the bilingual Afrikaans-English children.

In terms of the individual subtests, no standard deviations reached 3 for the monolingual English and bilingual Afrikaans-English children. The mean scores for the simultaneous processing and sequential cognitive processing variables as measured by the K-ABC (1985) revealed a noticeable consistent difference in means between the monolingual English and bilingual Afrikaans-English children; with the monolingual English children achieving consistently higher scores on the K-ABC subtests with the exception of the Hand Movements mean score which favoured the bilingual Afrikaans-English children. (see Table 4.2).

Figures 4.2 and 4.3 below graphically illustrate the monolingual English and bilingual Afrikaans-English children's performance on the simultaneous processing and sequential processing subtests.



Note: Hd_Mov= Hand Movements, Glt_Clo= Gestalt Closure, Num_R= Number Recall, Triangles =Triangles, Wd_Order = Word Order, Mtx_Ana= Matrix Analogies, Spat_Mem=Spatial Memory, Pto_Series= Photo Series.

FIGURE 4.2: Simultaneous processing and sequential processing in the monolingual English children.

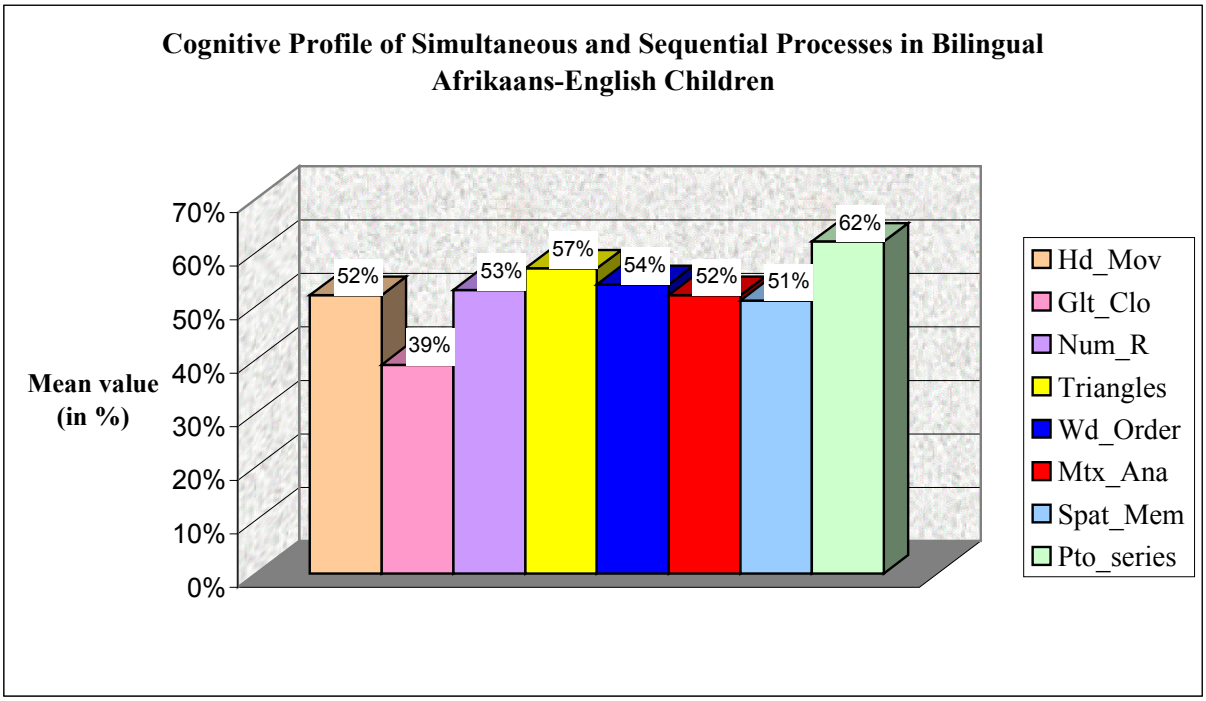


FIGURE 4.3: Simultaneous processing and sequential processing in the bilingual Afrikaans-English children.

TABLE 4.3: Spelling words and non-words in monolingual English and bilingual Afrikaans-English children

Grade Three					
		Monolingual English (*n* =30)		Bilingual Afrikaans-English (*n* =30)	
Dependent variable	**Test Total**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Spelling Afrikaans Words	10			6.23	1.65
Spelling Afrikaans Non-Words	10			5.06	1.36
Spelling English Words	10	8.70	1.31	2.93	1.04
Spelling English Non-Words	10	4.10	1.44	2.06	1.11

Note: SpellEW= Spelling English Words, Spell ENW= Spelling English Non-Words, SpellAE = Spelling Afrikaans Words and SpellAnw = Spelling Afrikaans Non-Words

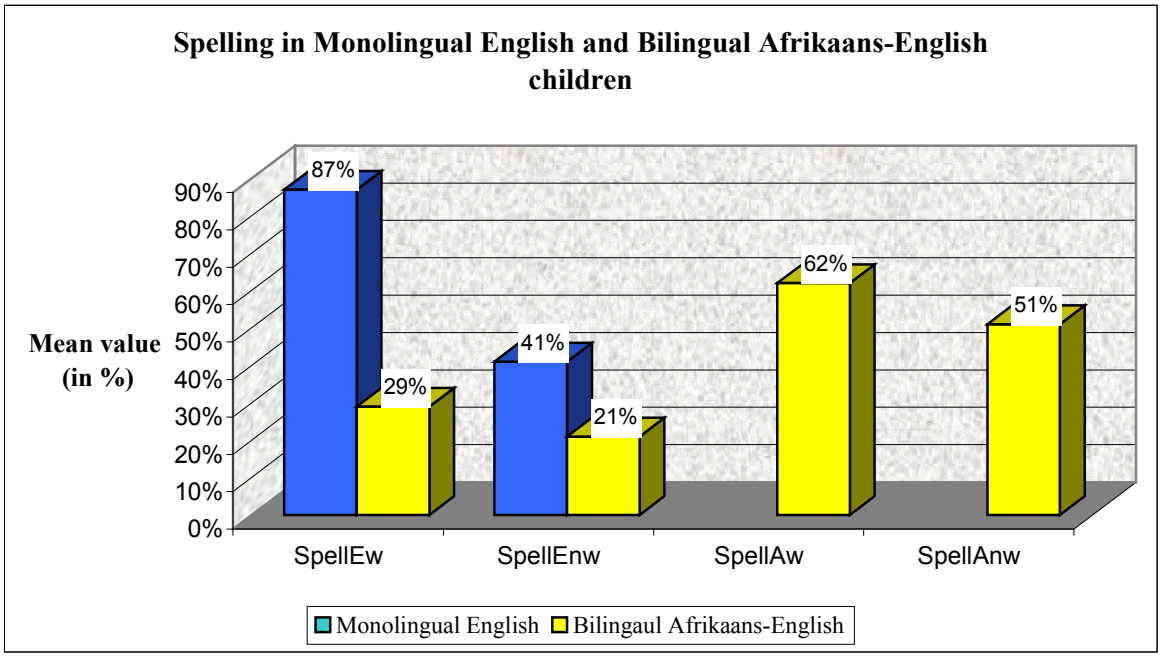


FIGURE 4.4: Overall spelling ability profile of monolingual English and bilingual Afrikaans-English Children.

Table 4.3 summarises the mean and standard deviation scores for spelling words and non-words. Figure 4.4 illustrates the monolingual English and bilingual Afrikaans-English children's performance on the spelling measures used in the present study. The monolingual English children achieved higher mean scores on spelling English words, (*M* =8.70, *SD* =1.31), and non-words, (*M* =4.10, *SD* =1.44), compared to the bilingual Afrikaans-English children,

(*M* =2.93, *SD* =1.04) for spelling English words, (*M* =2.06, *SD* =1.11), for spelling English non-words respectively. However, the bilingual Afrikaans-English children displayed higher means scores in spelling Afrikaans words and non-words than English words and non-words. Specifically, the bilingual Afrikaans-English children achieved a mean score of (*M*=6.23, *SD* =1.65) for spelling Afrikaans words than for spelling Afrikaans non-words (*M*=5.06, *SD* =1.36).

As the present sample contained unequal numbers of boys, *n* = 26 (43 %) and girls, *n* = 34 (57%), it is vital that gender differences are examined. Children's cognitive development is often argued to be gender related, as some research findings suggest that boys or girls may outperform one another on particular literacy tasks (Warrick & Naglieri, 1993). A two-independent sample *t*-test was run to see if there were gender differences on the cognitive processing and spelling measures used in the present study. The following table lists the mean and standard deviation scores of the male and female participants in the present study (Table 4.4).

The results indicate that there were no significant gender differences on the global scale scores of the K-ABC, nor in the simultaneous processing, sequential processing subtest scores or in any of the spelling measures used in the present study (see Table 4.5).

TABLE 4.4: Results of two-independent sample *t*-test for gender differences on the K-ABC global scale scores

Grade Three						
			Female		Male	
Variable	**DF**	***t* Value**	**Mean**	**SD**	**Mean**	**SD**
K-SEQ scale	58	.42 (n.s, p >.68)	102.20	9.79	103.24	9.22
K-SIM scale	58	.79 (n.s, *p*>.43)	102.00	10.22	104.16	10.64
MPC SS scale	58	.85 (n.s, *p*>.39)	102.20	9.17	104.28	9.61

Note: K-SEQ= sequential standard scale score; K-SIM= simultaneous standard scale score, MPC= mental processing composite standard scale score, n.s = not significant at p<. 05

Similarly, the results indicated that there were no significant gender differences on the individual subtest that make up the simultaneous processing, sequential processing scales and spelling measures used in the present study (see Table 4.5). .

TABLE 4.5: Results of two-independent sample t-test for gender differences on the K-ABC processing subtests for females and males

Grade Three						
			Female		Male	
Variable	**DF**	***t* Value**	**Mean**	**SD**	**Mean**	**SD**
Hd_Mov	58	1.26 (n.s, *p*>.21)	9.80	2.05	9.54	2.36
Glt_Clo	58	.33 (n.s, *p*>.22)	10.05	3.13	10.32	2.85
Num_R	58	.22 (n.s, *p*>.74)	10.34	2.46	10.48	2.18
Triangles	58	1.61 (n.s, *p*>.11)	10.17	2.07	11.08	2.25
Wd_Order	58	.67 (n.s, *p*>.58)	11.02	1.80	10.72	1.67
Mtx_Ana	58	.27 (n.s, *p*>.79)	10.09	2.29	10.14	2.09
Spat_Mem	58	.42 (n.s, *p*>.67)	10.65	2.19	10.88	1.76
Pto_series	58	.12 (n.s, *p*>.91)	9.85	1.81	9.92	2.21
SpellEw	58	1.75 (n.s, *p*>.08)	6.42	3.19	4.96	3.23
SpellEnw	58	.92 (n.s, *p*>.36)	3.25	1.73	2.84	1.72
SpellAw	58	1.74 (n.s, *p*>.10)	2.51	3.18	3.76	3.15
SpellAnw	58	1.66 (n.s, *p*>.10)	2.05	2.62	3.20	2.64

Note: Hd_Mov= Hand Movements, Glt_Clo= Gestalt Closure, Num_R= Number Recall, Triangles =Triangles, Wd_Order = Word Order, Mtx_Ana= Matrix Analogies, Spat_Mem=Spatial Memory, Pto_Series= Photo Series, SpellEw = spelling English words, SpellEnw = spelling English non-words, SpellAw=spelling Afrikaans words, Spell Anw=spelling Afrikaans non-words,

Note: n.s = not significant at p>.05

4.2 INFERENTIAL STATISTICS

In this section the inferential statistics of the data are presented. Each analysis will be presented as it relates to the research questions that guided the present study.

4.2.1 Simultaneous and Sequential Cognitive processing

In order to determine whether there were statistically significant differences on the overall simultaneous processing, sequential processing and mental processing composite scales mean scores a two-independent sample t-test was used. Table 4.6 indicates the results of the two independent sample *t*-test.

TABLE 4.6: Results of two-independent sample t-test of significance of means between the monolingual English and the bilingual Afrikaans-English children

Grade Three					
Dependent Variable	***Df***	***n***	***t-statistic***	**Mean of monolingual English children**	**Mean of bilingual Afrikaans English children**
K-SIM scale	58	60	1.69 n.s	105.13	100.66
K-SEQ scale	58	60	0.90 n.s	101.53	103.73
MPC scale	58	60	0.88 n.s	104.13	102.00

Note: K-SIM-scale = simultaneous standard scale score, K-SEQ scale = sequential standard scale score; and MPC = mental processing composite standard scale score
Note: Df = Degrees of Freedom
Note: *significant at $p < .05$; ** significant at $p < .01$; ***significant at $p < .001$. n.s = not significant at $p < .05$

The results in Table 4.6 indicate that there were no significant differences on the overall simultaneous processing, sequential processing and mental processing composite scaled scores between the monolingual English and bilingual Afrikaans-English children.

According to Kaufman and Kaufman (1985), for the age range (5.0-12.5) a significant difference between the simultaneous and sequential processing scales of 12 points is significant at the .05 level of significance, whilst a difference of 16 is significant at the .01 level of significance and both of these differences can be used to determine one's cognitive processing strength and preferred learning style.

In terms of the monolingual English children the difference between the simultaneous and sequential processing scales was 3.60, which demonstrated no clear dominant cognitive processing style for processing information or preferred learning style, and indicates that the monolingual English children rely upon both simultaneous and sequential processing styles to solve cognitive tasks. Similarly, the difference between the simultaneous and sequential processing scales in the bilingual Afrikaans-English children was 3.07, which is not significant although the mean score suggest that the bilingual Afrikaans-English children relied slightly more on a sequential processing than on simultaneous processing style to solve cognitive tasks.

In order to determine whether there were statistically significant differences between the monolingual English and bilingual Afrikaans-English children on the individual subtests of the simultaneous processing and sequential processing mean scores respectively a two-independent sample *t*-test was used (see Table 4.7).

TABLE 4.7: Results of a two-independent sample t-test of significance between the monolingual English and the bilingual Afrikaans-English children

Grade Three					
Dependent Variable	***Df***	***n***	***t-statistic***	**Mean of monolingual English children**	**Mean of bilingual Afrikaans English children**
Hand Movements	58	60	3.45***	9.20	11.00
Gestalt Closure	58	60	1.03	10.56	9.76
Number Recall	58	60	0.88	10.66	10.13
Triangles	58	60	0.88	10.8	10.3
Word Order	58	60	0.87	10.96	10.83
Matrix Analogies	58	60	2.25*	11.56	10.33
Spatial Memory	58	60	-	10.73	10.73
Photo Series	58	60	1.25	10.20	9.56

Note: Df = Degrees of Freedom
Note: * significant at p < .05; ** significant at p < .01; ***significant at p< .001**;** - = too small to calculate.

The results indicate that the monolingual English and bilingual Afrikaans-English children obtained significantly differently mean scores on the Hand Movements t (58) =3.45, p <. 001, and Matrix Analogies, t (58) =2.25, p <. 05, subtests. Examining the mean scores, the bilingual Afrikaans-English children performed better on the Hand Movement's subtest of

the sequential processing scale, (M =11, SD =1.91), in comparison to the monolingual English children, (M = 9.20, SD =2.12). In contrast, the monolingual English children performed significantly better on the Matrix Analogies subtest of the simultaneous processing scale, (M =11.56, SD =2.50), in comparison to the bilingual Afrikaans-English children, (M=10.33, SD =1.66). Overall, with the exception of Hand Movements and Matrix Analogies the subtests analyses reveals small differences between the monolingual English and bilingual Afrikaans-English children

4.2.2 Spelling Words and Non-Words

In order to determine whether there were statistical significant differences in spelling English words and non-words in the monolingual English and in the bilingual Afrikaans-English children, a two-independent sample *t*-test was used. The results appear in Table 4.8 below.

TABLE 4.8: Results of a between two-independent sample *t*-test of significance between the monolingual English and the bilingual Afrikaans-English children

Grade Three					
Dependent Variable	***Df***	***n***	***t-statistic***	**Mean of monolingual English children**	**Mean of bilingual Afrikaans-English children**
Spelling English Words	58	60	14.90***	8.70	2.93
Spelling English Non-Words	58	60	5.60***	4.10	2.06

Note: Df = Degrees of Freedom
Note: * significant at p < .05; ** significant at p < .01; ***significant at p< .001

The results of the two independent sample *t*-test (see Table 4.8) indicate that there were significant difference between spelling English words t (58)=14.90, (p <. 001) and non-words t (58)=5.60, (p<. 001) for the monolingual English and the bilingual Afrikaans-English children. Examining the mean scores the monolingual English children significantly outperformed the bilingual Afrikaans-English children on spelling English words (87 % vs. 29%). Similarly, the monolingual English children outperformed the bilingual Afrikaans-English children in spelling English non-words, (41 % vs. 21 %).

In order to determine whether there were significant differences between spelling English words and non-words in the monolingual English children a dependent sample *t*-test was used. The results of the dependent sample t-test is summarised in Table 4.9 below.

TABLE 4.9: Results of dependent sample t-test of spelling English words and non-words in the monolingual English children

Grade Three				
Dependent Variable	***Df***	***n***	***t-statistic***	**Mean of monolingual English children**
Spelling English Words	29	30	18.60***	8.70
Spelling English Non-Words				4.10

Note: Df = Degrees of Freedom
Note: * significant at $p < .05$; ** significant at $p < .01$; ***significant at $p < .001$

The results of the dependent sample t-test indicated that spelling English words and non-words were statistically significant $t\ (29) = 4.71$, $p<.001$ in the monolingual English children. Qualitative errors analyses also (see Appendix I-1 and I-2) revealed important differences in the spelling strategies of the monolingual English and bilingual Afrikaans-English children. These are discussed below.

- ***Qualitative Error Analyses***

In the monolingual English children an incorrect spelling usually resulted from an error in a vowel or consonant digraph (for example, *meony* for *money*), or an incorrect use of a letter combination that would be appropriate in some words but not in others (for example, *fiyer* for *fire*) which is consistent with a visual approach to spelling. An alphabetic approach to spelling was noted to a lesser degree (see Table I-1 in Appendix I). Similarly, in spelling English non-words the monolingual English children exhibited errors in a vowel or consonant digraph (for example, *sherch* for *shurch*), or an incorrect use of a letter combination that would be appropriate in somes word but not in others (for example, *steeld* for *stild*) which is consistent with a visual approach to spelling, whilst an alphabetic approach to spelling was noted to a lesser degree (see Table I-2 in Appendix I). These errors demonstrate a predominant reliance on visual whole word strategies. However, the errors also suggest that the monolingual English children still have to develop an ability to analyse the sounds within words and use letter to sound correspondences to a lesser degree (Elliot et al., 1990).

In order to determine whether there were statistically significant differences between spelling ability in Afrikaans as a first language and English as a second language, a dependent sample *t*-test was performed on the spelling English and Afrikaans words and non-words scores of the bilingual Afrikaans-English children, as depicted in Table 4.10 below.

4.2.3 Spelling skills in a first and second language compared in bilingual Afrikaans English children

TABLE 4.10: Results of a dependent *t*-test of significance in the bilingual Afrikaans-English children

Grade three				
Dependent Variable	***Df***	***n***	***t-statistic***	**Mean of bilingual Afrikaans-English children**
Spelling Afrikaans Words and Afrikaans Non-Words	29	30	4.96***	6.23 5.06
Spelling Afrikaans Words and English Words	29	30	14.06***	6.23 2.93
Spelling Afrikaans Non-Words English Non-Words	29	30	9.27***	5.06 2.06
Spelling English Words and English Non-Words	29	30	4.71***	2.93 2.06

Note: Df = Degrees of Freedom
Note: * significant at $p < .05$; ** significant at $p < .01$; ***significant at $p < .001$

The results of the dependent sample *t*-test between spelling English and Afrikaans words and non-words for the bilingual Afrikaans-English children are summarised in Table 4.10. Spelling Afrikaans words, t (29)=4.96 ($p <. 001$) was significantly different from spelling Afrikaans non-words. Similarly spelling English words, t (29)=4.71 ($p <. 001$) was significantly different from spelling English non-words, t (29)=8.31, ($p <. 001$).

Overall, the bilingual Afrikaans-English children demonstrated significantly better spelling ability of Afrikaans words and non-words than English words and non-words.

- ***Qualitative Error Analyses***

Qualitative error analyses (see Tables I-3, I-4, I-5, I-6 in Appendix I) revealed that the bilingual Afrikaans-English children were using similar strategies for spelling English and Afrikaans words and non-words, with a greater emphasis on letter sound correspondences than logographic spelling strategies. In spelling English words and non-words the bilingual Afrikaans-English children's predominance of phonetic errors are consistent with an alphabetic phonetic approach to spelling, for example '*haus*' for '*house*', '*tjurs*' for '*church*' with visual spelling strategy being relied upon to a lesser degree, as seen in'*docter*' for '*doctor*', and '*huis*' for '*house*'. Phonetic errors indicate that the bilingual Afrikaans-English children are using grapheme-phoneme correspondence rules as a guide to spelling.

Additionally the errors found capture certain features of the pronunciation that ignore conventional spelling. For example, "v" for "f". The errors exhibited in spelling Afrikaans words and non-words, would give the correct pronunciation of the target word if read aloud by regular phonics rules, the error is a homophone of the target, with a visual spelling strategy being relied upon to a lesser degree. Spelling errors revealing reliance on phonetic strategies provide evidence that the bilingual children have grasped the essence of the alphabetic principle that letters represents sounds. In addition phonetic errors indicate that the bilingual Afrikaans-English children are able to carry out phonemic analysis; as well as able to distinguish that sounds need to be represented in the order they occur, additionally to remembering which letters represent which sounds and are able to write these down recognisable and in sequence. The predominant reliance on a phonetic strategy further suggests that the bilingual Afrikaans-English children rely on a lesser extent on spelling rules or analogies or alternative graphemic representations of sounds such as word families as a guide to spelling (Elliot et al., 1990).

In order to assess whether simultaneous processing and sequential processing were related and the nature of the relationship to spelling ability, two Pearson's correlational analyses using Pearson's product moment correlation co-efficient (*r*) were performed: one for monolingual English (see Table 4.11) and one for bilingual Afrikaans-English children (see Table 4.12) respectively.

4.2.4 Relationship between Simultaneous processing and Sequential processing and Spelling Scores.

4.2.4.1 Relationship between Simultaneous processing and Sequential processing and Spelling in monolingual English children

TABLE 4.11: Pearson's correlation matrix between simultaneous processing, sequential processing and spelling in monolingual English children

	HM	GC	NR	TR	WO	MA	SM	PS	SEQ	SIM	MPC	SEW	SNW
HM													
GC	.02												
NR	.32	.04											
TR	.19	.03	.36										
WO	.30	.10	.23	**.44****									
MA	.30	.05	.02	**.35***	.23								
SM	.26	.27	.04	.23	.04	.008							
PS	.24	-.10	.15	**.39***	**.39***	**.41***	.26						
K-SEQ	**.75*****	.12	**.77*****	**.45****	**.63*****	.24	.17	**.35***					
K-SIM	**.33**	**.41***	.21	**.64*****	**.41***	**.64*****	**.53****	**.63*****	**.43****				
MPC	**.58*****	.31	**.50****	**.67*****	**.59*****	**.56*****	**.45****	**.61*****	**.77*****	**.90*****			
SEW	.17	.22	.24	.24	**.44***	**.35***	.29	.27	**.36***	.23	.34		
SENW	**.51****	.50	.29	.14	**.51****	**.38***	.04	.14	**.57*****	.26	**.46****	**.52****	

Note: HM=Hand Movements, GC=Gestalt Closure, NR=Number Recall, TR=Triangles, WO=Word Order, MA=Matrix Analogies, SM=Spatial Memory, PS=Photo Series, K-SEQ=overall sequential processing scale score of the K-ABC, K-SIM=overall simultaneous processing sale of the K-ABC, MPC=overall mental processing composite scale of the K-ABC, SEW= Spelling English Words, SENW=Spelling English Non-Words.

Note: *correlation significant at p < .05; **correlation significant at p < .01; ***correlation significant at p< .001**;**

Table 4.11 illustrates the results of the Pearson's correlation co-efficient obtained in the monolingual English children. ***Word Order*** was significantly correlated with spelling English words, with a moderate positive correlation of r (28)=. 44, p <. 05. Similarly, ***Matrix Analogies*** demonstrated a significant positive strong correlation of r (28) = .35, p <. 05. The ***overall sequential processing scale*** demonstrated a significant moderate correlation of r (28)=. 36, p<. 05) with spelling English words. ***Hand Movements*** was significantly correlated with spelling English non-words, with a strong significant positive correlation of r (28)= .51, p <. 01. Similarly ***Word Order***, displayed a strong significant positive correlation of r (28) =. 51, p <. 01. Furthermore, ***Matrix Analogies*** displayed a moderate positive correlation of r (28) =. 38, p <. 05, with spelling English non-words. The ***overall sequential processing scale*** demonstrated a significant moderate positive correlation of

r (28) =. 57, *p*<. 001, with spelling English non-words. Similarly the ***overall mental processing scale*** demonstrated a significant moderate correlation of (*r* =. 46, *p* <. 01) with spelling English non-words. Spelling English words demonstrated a significant strong positive correlation of *r* (28) =. 52, *p*<. 01, with spelling English non-words. Overall, the results of the correlation analyses indicated that there was a significant relationship between simultaneous processing and sequential processing and spelling in the monolingual English children. In addition, the monolingual English children demonstrated fewer correlations with simultaneous processing and sequential processing subtests than the bilingual Afrikaans-English children. Table 4.12 below contains the correlation matrix for the bilingual Afrikaans-English children.

4.2.4.2 Relationship between Simultaneous processing and Sequential processing and Spelling in bilingual Afrikaans-English children

TABLE 4.12: Pearson's correlation matrix between simultaneous processing, sequential processing and spelling in the bilingual Afrikaans-English children

	HM	GC	NR	TR	WO	MA	SM	PS	SEQ	SIM	MPC	SEW	SENW	SAW	SANW
HM															
GC	-.07														
NR	.19	.22													
TR	-.1	.31	.24												
WO	.18	**.51****	**.49****	.27											
MA	.21	.19	.27	.28	**.64*****										
SM	.12	.34	-.23	**.48****	.23	.27									
PS	-.18	**.43****	-.08	.26	**.54*****	**.47****	**.57****								
K-SEQ	**.60*****	.29	**.80*****	.15	**.76*****	**.55****	.83	**.07**							
K-SIM	-.09	**.73*****	.11	**.67*****	**.62****	**.50****	**.76*****	**.73*****	.26						
MPC	.18	**.70*****	**.44****	**.61*****	**.81*****	**.65*****	**.56*****	**.62*****	**.64*****	**.90*****					
SEW	-.06	.32	.05	.18	**.44****	**.44****	.39	**.57*****	.19	**.53****	**49****				
SENW	.14	.34	.16	.19	**.47****	**.38***	.33	**.44****	**.34***	**.48****	**.52****	**.79*****			
SAW	.12	.08	.17	.13	**.28***	.27	.13	.19	.17	.21	.22	**.62*****	**.59*****		
SANW	.16	-.15	.16	-.11	**.22***	.19	.02	.11	.07	.09	-.03	.07	.24	**.30***	

Note: HM=Hand Movements, GC=Gestalt Closure, NR=Number Recall, TR=Triangles, WO=Word Order, MA=Matrix Analogies, SM=Spatial Memory, PS=Photo Series, SEQ = K-SEQ=overall sequential processing scale score of the K-ABC, K-SIM=overall simultaneous processing sale of the K-ABC, MPC=overall mental processing composite scale of the K-ABC, SEW= Spelling English Words, SENW=Spelling English Non-Words, SAW=Spelling Afrikaans Words, SANW = Spelling Afrikaans Non-Words.

Note: *correlation significant at p < .05; **correlation significant at p < .01; ***correlation significant at p< .001

Table 4.12 illustrates the results of the Pearson's correlation co-efficient analyse obtained in the bilingual Afrikaans-English children. ***Word Order*** was significantly correlated with spelling English words, with a moderate significant positive correlation of r (28) = .44, p < .01. Similarly ***Matrix Analogies*** demonstrated a moderate significant positive correlation of r (28) = .44, p <.01 with spelling English words. ***Spatial Memory*** demonstrated a significant moderate correlation of r (28) = .39, p < .05 with spelling English words. ***Photo Series*** demonstrated a strong significant positive correlation of r (28) = .57, p<. 001 with spelling English words. Spelling English words demonstrated a strong significant correlation with the total score of the ***overall sequential scale*** r (28) = .53, p <. 01) in the bilingual Afrikaans-English children. Similarly ***the mental processing composite*** demonstrated a significant moderate correlation of r (28) =. 49, p <. 01 with spelling English words.

Word Order was significantly correlated with spelling English non-words, with a moderate significant correlation of r (28) =. 47, p <. 01). ***Matrix Analogies***, also demonstrated a moderate significant positive correlation, r (28) =. 38, p<. 05 with spelling English non-words. Furthermore, ***Photo Series*** demonstrated a moderate significant positive correlation of r (28) =.44, p <.01 with spelling English non-words. Spelling English non-words also demonstrated a moderate significant correlation with the ***overall sequential scale***, r (28) = .34, p < .05) and a moderate significant correlation with the ***overall simultaneous scale*** r (28) =. 48, p <. 01 in the bilingual Afrikaans-English children. Similarly the ***overall mental processing scale*** demonstrated a significant strong positive correlation of r (28) =. 52, p <. 001) with spelling English non-words. Spelling English words and spelling English non-words demonstrated a strong significant correlation of r (28) = .79, p <. 001. ***Word Order,*** demonstrated a weak positive significant correlated with spelling Afrikaans words, r (28) =. 28, p<. 05. Interestingly, ***Word Order*** also demonstrated a weak significant positive correlation with spelling Afrikaans non-word, r (28)=. 22, p <. 05. Spelling Afrikaans words and spelling Afrikaans non-words demonstrated a weak significant positive correlation of r (28) =. 30, p<. 05. It was interesting to note that in the bilingual Afrikaans-English children simultaneous processing and sequential processing demonstrated significant correlations with spelling Afrikaans words and non-words. However, the correlations were positive but weak and just reached the .05 level of significance, in contrast to the highly significant moderate to strong correlations seen for simultaneous processing, sequential processing and spelling English words and non-words. Overall, the results indicate that there was a significant

relationship between simultaneous processing, sequential processing and spelling English and Afrikaans words and non-words in the bilingual Afrikaans-English children.

In order to assess which simultaneous and sequential variables of the K-ABC predicted concurrent spelling ability of English and Afrikaans words and non-words, a series of stepwise regression analyses were performed. A stepwise regression model was chosen as it allows for all the variables to be entered all at once and of these only the significant ones constitute the final regression model (Draper & Smith, 1966; Howell, 2002; Coolican, 2004). Thus, a series of stepwise regression analyses were used to further analyse the relationship between simultaneous processing and sequential processing and spelling. In particular, the extent the extent to which simultaneous processing and sequential processing predicted concurrent English and Afrikaans spelling ability in monolingual English and bilingual Afrikaans-English children. Table 4.13 below contains the results.

TABLE 4.13: Simultaneous processing and sequential cognitive processing predictors of spelling English, and Afrikaans words and non-words.

Grade Three						
Dependent Variable	**Predictor Variable**	**F-statistic**	**R 2**	**Predictor Variable**	**F-statistic**	**R 2**
	Monolingual English (*n* = 30)			**Bilingual Afrikaans-English children (*n* = 30)**		
Spelling English words	Word Order	*F* (1;28)=6.92**	.20	Photo Series	*F*(1;28)=13.74***	.33
	Matrix Analogies	*F* (1;28)=3.74*	.36			
Spelling Afrikaans words				Word Order	*F* (1;28)=2.49**	.08
Spelling English Non-Words	Word Order	*F* (1;28)=10.03**	.27	Word Order	*F* (1;28)=8.22***	.23
	Hand Movements	*F* (1;28)=6.26**	.41			
Spelling Afrikaans non-words				Word Order	*F* (1;28)=2.52**	.08

Note: $R^{2=}$ the proportion of variance explained by predictor variable, and strength of the relationship between predictor and criterion variables. **F-statistics** refers to the significance of the regression model.

Note: *significant at $p < .05$; ** significant at $p < .01$; ***significant at $p < .001$.

The results of regression above (Table 4.13) indicate that for the monolingual English children, ***Word Order*** of the simultaneous processing scale, F (1; 28) = 6.92, (p <. 01,) was the highest significant predictor of spelling English followed by ***Matrix Analogies*** of the sequential processing scale, F (1; 28) = 2.74, (p <. 05). These two variables together could explain a reasonable 36% of the proportion of the variance of spelling English words, which indicated a good overall predictive power in predicting spelling English words. Word Order predicts 20% of the variance with the addition of Matrix Analogies the amount of variance increases to 36 %, illustrating good overall predictive power. Thus, both simultaneous processing and sequential cognitive processing is important for spelling English words in the monolingual English children. In contrast in the bilingual Afrikaans-English children, ***Photo Series*** F (1; 28) =13.74, (p <. 001,) was the only significant predictor of spelling English words and could explain 33% of the proportion of variance, and thus illustrates good overall predictive power in predicting spelling English words. Thus, for the bilingual Afrikaans-English children simultaneous processing is important for spelling English words.

The result of the regression above further indicated that for the monolingual English children, ***Word Order*** of the sequential processing scale F (1; 28) =10.03, (p <. 01) and ***Hand Movements*** of the sequential processing scale F (1; 28) = 6.26, (p <. 01), were significant predictors of spelling English non-words. These two variables were predicted to explain 41 % of variance, thereby illustrating good overall predictive power in predicting spelling English non-words. Word Order predicted 27% of the variance and with the addition of Hand Movements the amount of variance increases to 41% of proportion of variance explained, thus illustrating good overall predictive power in predicting spelling English non-words. Thus, for the monolingual English children the sequential processing scale is important to spell English non-words. In the bilingual Afrikaans-English children, ***Word Order*** F (1; 28)= 8. 22, (p <. 001) was the only significant predictor of spelling English non-words and was predicted to explain 23% of the proportion of variation, thus illustrating good overall predictive power in predicting spelling English non-words. Thus, for the bilingual Afrikaans-English children sequential processing is important for spelling English non-words.

The results of the regression indicate that for the bilingual Afrikaans-English children, ***Word Order*** F (1; 28)=2.49, (p <. 01), of the sequential processing scale was the only significant predictor of spelling Afrikaans words and could explain only 8% of the variance, thus illustrating weak predictive power in predicting spelling Afrikaans words. Thus, for the bilingual Afrikaans-English children sequential processing contributes little to spelling Afrikaans words. Furthermore, the results of the stepwise regression indicate that for the bilingual Afrikaans-English children ***Word Order*** of the sequential processing scale was the only significant predictor of spelling Afrikaans non-words, F (1; 28)= 2.49, (p <. 01) and was predicted to explain 8% of the proportion of variance which is indicative of an overall weak predictive power in predicting spelling Afrikaans and non-words. Thus, for the bilingual Afrikaans-English children, sequential processing is important for spelling Afrikaans non-words. Overall, simultaneous processing and sequential processing were found to be predictors of spelling English and Afrikaans words, although the amount of variance and predictive strength of the relationship between simultaneous processing and sequential processing subtests differed across English and Afrikaans spelling.

4.5 SUMMARY OF RESULTS

In summary, the results indicated that there were significant differences between the monolingual English and the bilingual Afrikaans-English children that emerged when the simultaneous processing and sequential processing subtests, spelling abilities, spelling strategies, type of spelling errors, the relationships between simultaneous and sequential processing and spelling English and Afrikaans words and non-words and the predictors of spelling in English and Afrikaans were calculated and compared. These differences may be triggered by the key orthographic features distinguishing the English and Afrikaans orthography, in particular the differences in the consistency of grapheme-phoneme relations for spelling words and non-words in relation to simultaneous processing and sequential cognitive processing spelling skills and spelling strategies needed to spell in these dissimilar languages. In chapter 5, the results and findings in this chapter as they relate to previous research will be discussed. Chapter 5 also presents the conclusions reached and an overall review of the strengths and weaknesses of the present study.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

Learning to spell is understood as a complex developmental process that is interconnected with simultaneous -sequential cognitive processing skills and spelling instruction, as both provide important information about the orthographic system that underlies the ability to spell (Kaufman & Kaufman, 1983b). Many researchers have demonstrated the importance of simultaneous processing and sequential processing for reading (for example Luria, 1975; Frith, 1980; Das, et al., 1975 Greenop, 2004). Research into the processes of reading development has been extensive (Adams, 1990; Aro et al., 2003, Delfior et al., 2002; Seymour et al., 2003) and research in spelling has received relatively less research (Frith, 1985; Treiman, 1993, Treiman et al., 2000). Theoretical support for the relationship between simultaneous processing, sequential processing and spelling is highlighted in the work of Kaufman and Kaufman (1983b) and Kirby (1988) but no study has directly addressed this relationship, which the present study sought to address.

Sequential processing is important for remembering the word's pronunciation and the order of graphemes and phonemes in a word, whilst simultaneous processing refers to the ability to "picture it in one's mind as a whole" or being able to remember the visual-spatial arrangements of the letters that make up a word (Kaufman & Kaufman 1983b, p. 268). Sequential processing is important for spelling in English (a partially phonemic language system) even though at times there is no complete match of phoneme to grapheme. In such a spelling system, reliance on the memory of phonemic order and matching of individual phonemes with graphemes is not always a completely productive strategy. The spelling of some English words has to be made solely on the basis of memory of the sequential letter order and memory of large phonological/orthographic units that then act as a stimulus for generating the spelling for the entire word, which involves simultaneous processing skills to a greater extent than sequential processing skills (Kaufman & Kaufman 1983b). The assumption implicit in this theoretical perspective is that the nature and structure of a language's orthography may shape the extent to which logographic or whole-word simultaneous strategies and alphabetic or non-lexical sequential strategies are used to spell in different orthographies (Kaufman & Kaufman, 1983b; Frost et al., 1987;Elliot et al., 1990) Research on the influence of orthographic transparency on spelling strategies in various alphabetic languages (Cossu, et al., 1988; Wimmer & Hummer, 1990, 1994; Goswami, et al., 1998; Oney & Durgunoĝlu, 1997; Holopaeinen et al., 2001; Pollo, Kessler, Treiman et al.,

2005) provides an important research framework to the present study. In particular how the reciprocal relationship between simultaneous processing and sequential processing and spelling instruction may vary as a function of language orthography (Kaufman & Kaufman, 1983b).

Depending on the characteristics of languages children start to attend to different phonological/orthographic units, which is broadly related to sequential processing and simultaneous processing skills (Kirby, 1988; Kaufman & Kaufman, 1983b; Greenop, 2004). Goswami et al., (1998) found that children learning to spell in English rely on familiarity with phonological and/or orthographic units when they were asked to read or spell pseudowords such as "*daik*" or "*dake*", than when they were asked to spell a non-word such as "*ricop*", where they could not rely on large-unit analogies with real words to read or spell this non-word. Goswami et al., (1998) concluded that children learning to read and spell in English are more sensitive to analogy and processing large orthographic units and use this as a strategy to spell other words and non-words. These researchers also noted that Spanish-speaking children also rely on analogy. However, because of the transparent nature of the Spanish orthography reliance on a letter-by-letter decoding is the most efficient strategy to achieve spelling success as Spanish- speaking in contrast to English-speaking children master grapheme-phoneme correspondences more quickly and easily due to the transparent nature of the Spanish orthography permitting them early access to phonemic decoding spelling strategies which are needed to spell in a phonemic language such as Spanish. English speaking children in contrast, first use rime analogy strategies to spell as English has an opaque orthography, which is less predictable at the level of single letters than at the level of groups of letters, seen for example in rhyming word that are often spelt the same way (Goswami, 1988, Frith et al., 1997; Goswami et al., 1998,). This difference between the English and Spanish orthography is mirrored in the difference between the English and Afrikaans orthographies, in the emphasis each places on rime or logographic spelling strategies and awareness of letter-sound or grapheme-phoneme correspondences or phonetic strategies to achieve spelling success (Venesky, 1970; Coetzee, 1985, Frith, 1985; Elliot et al., 1990; Campbell, 1998). English has an opaque orthography, which is unpredictable at the level of the phoneme but more predictable at the level of rime or groups of letters, whilst Afrikaans is relatively transparent and largely predictable at the grapheme-phoneme level (Coetzee, 1985, Doctor et al., 1987; Campbell, 1998).

As there are eleven official language in South Africa, English and Afrikaans were chosen in the present study as these demonstrate demographic trends, in the total percentage that these languages are spoken in the Johannesburg area (Census, 1996, HSRC, 1996; UNESCO report, 2000; Census, 2001) from which both the monolingual English and bilingual Afrikaans-English children's primary schools were sampled in the present study, in addition to representing different South African orthographies in terms of their spoken and written forms. Afrikaans is a shallow orthography and is more phonemic and transparent in nature and utilises a more phonemic approach, whereby a phonologically mediated process is largely sufficient as logographic strategies are less needed to spell due to consistent letter sound correspondence rules which ensure correct spelling (Goswami et al., 1998; Seymour et al., 1992, 2003). In contrast English has an opaque orthography, and displays a more ambiguous letter sound relationship that is complex and has a morphophonemic phonological structure that utilises predominately a visual-orthographic and to a lesser extent a phonetic spelling strategy to spell most word. Spelling in English requires dual (logographic +alphabetic) spelling skills to be used in parallel to ensure correct spelling (Seymour et al., 1992; Seymour et al., 2003). While research has pointed to alphabetic and orthographic differences between languages little research exists on cognitive processing. The present study investigated whether the significance of simultaneous and sequential processing in relation to spelling was alike in two structurally dissimilar orthographies. In the study monolingual English children learning to spell in English were compared to bilingual Afrikaans-English children, who were learning to spell in Afrikaans and English simultaneously at a dual-medium school. Learning to spell in English and Afrikaans was compared to establish what aspects of cognitive processing were seen in the spelling skills and strategies that monolingual English and bilingual Afrikaans-English speaking children adopted in spelling words and non-words.

This chapter presents a discussion of the results, and conclusions reached concerning the research questions investigated in the present study, which were exploratory in nature. In addition, implications of the findings for teaching and assessment will be noted along with a broad critique of the strengths and weaknesses of the present study and suggestions for future research emanating from the findings of the present study.

5.1 SIMULTANEOUS AND SEQUENTIAL PROCESSING IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN

The monolingual and bilingual children demonstrated similar scores on the simultaneous processing, sequential processing and mental processing composite scales (see Table 4.1 and Figure 4.1). According to Kaufman and Kaufman's (1983b) interpretive guidelines of a metric mean of 100 and a standard deviation of 15, the results indicate that both groups of children's simultaneous processing and sequential processing scale scores were in the normal range. The results of the two-independent sample *t*-tests (see Table 4.6) indicate that on the overall simultaneous processing, sequential processing and mental processing scales, there were no significant differences between the mean scores of the monolingual and the bilingual children. This result suggests that both the monolingual and the bilingual children demonstrate the same cognitive processing ability, which further implies that language orthography does not impact on the availability and development of overall cognitive processing skills in monolingual and bilingual children.

This result suggests that the K-ABC's simultaneous processing and sequential processing scales do not appear to be biased against any particular linguistic or cultural group and represents a culturally sensitive measure appropriate to use with monolingual and bilingual children. This result further supports previous studies that have used the K-ABC in South Africa (Skuy et al., 2000; Greenop, 2004) as a valid instrument to assess cognitive processing skills and extends this to using the K-ABC as a measure of cognitive processing ability with bilingual children. In addition, the results indicate that there were no gender differences on the K-ABC's simultaneous processing, sequential processing, and overall mental processing composite scales or individual subtests (see Table 4.4 and Table 4.5 respectively). This result supports Wilson et al.,'s (1989) findings that the K-ABC is a useful estimate of cognitive processing styles for both boys and girls from different linguistic and cultural backgrounds in the United States and extends this finding to monolingual and bilingual children in the South African context. These results also reiterate earlier findings (Kaufman & Kaufman 1983b; Naglieri 1985a, 1985b, Naglieri, 1989; Das, 1992b) that the simultaneous-sequential processing dichotomy may offer a better theoretical understanding than IQ for viewing cognitive processes underlying cognitive tasks, and extends this finding to monolingual and bilingual children's cognitive processing skills in the South African context. However, more research is needed to ascertain the long term and short-term predictive validity of these

results on the K-ABC, within a larger sample size using factor analytic data analysis methods, to ascertain the recurrence of simultaneous processing and sequential processing factors across various grades to ascertain whether these processing skills may offer an alternative to traditional models of hierarchical cognitive development (Das & Molloy, 1984; Das, 1992a; Das & Abbot, 1995).

Das's (1992b) research on the effects of schooling on simultaneous processing and sequential processing skills suggests that simultaneous processing is apparent in pre-scholars, with sequential processing developing with formal instruction. According to Kamphaus and Reynolds (1987) before school children tend to rely on simultaneous processing. At the same age Frith (1985) and Seymour et al., (1992, 2003) describe a logographic approach to spelling, whereby words are recognised as visual wholes. Simultaneous processing involves meaningful wholes as does logographic awareness thus this spelling strategy may require simultaneous processing. When children enter the school environment sequential processing develops, which is mirrored in the alphabetic principle that spoken and written words need to be analysed into their component parts (sounds and letters respectively) in order for them to be spelt accurately (Frith, 1985; Elliot et al., 1990). This pattern of simultaneous processing and sequential processing reflects how children learn to spell (Kamphaus & Reynolds, 1987). At school children learn the alphabet, as well as learn to write letters and words, which requires the ability to remember the visual shape and configuration of individual letters in addition to motor co-ordination to be able to write the individual letters symbols, which utilises simultaneous processing. Gradually, the simultaneous processing of letters and words results in children learning that letters and words form a temporal order, which requires sequential processing to match the phonemic pattern with the graphemic pattern. Therefore, formal literacy instruction, which requires simultaneous processing and sequential processing results in schooled children developing higher levels of these processing skills than pre-school children.

No significant differences were found between the two orthographies on the simultaneous processing and sequential processing scales. This suggests that orthography does not influence different developmental trajectories of simultaneous processing and sequential processing skills in monolingual or bilingual children. An interesting educational implications lies in the finding that there were no difference between the processing scales, which indicates no clear processing strength for either the monolingual or the bilingual

children, as the difference between the two scales was not significant, 3.60 and 3.07 respectively. Thus both groups of children may be taught using a combination of both simultaneous and sequential teaching methods as illustrated in Appendix B (Kaufman & Kaufman, 1983). Nonetheless, the slight mean differences found in the present study may be enhanced by investigating monolingual Afrikaans children, in addition to monolingual English children at different grade levels to see if there are significant orthographic differences in the development of simultaneous processing and sequential processing abilities.

Table 4.2 and Figures 4.2 and 4.3 illustrate the K-ABC subtest performance of the monolingual English and the bilingual Afrikaans-English children. On the whole, both groups' subtest performance was in the normal range as no subtest measure was below 7 and no subtest had a standard deviation that reached 3 (Kaufman & Kaufamn, 1983b). However, according to the results of the two-independent sample *t*-test (see Table 4.7), the monolingual and the bilingual children performed significantly differently on the Matrix Analogies, t (58) =2.25, $p<.05$, and Hand Movements, t (58)=9.20, $p<.001$, subtests of the K-ABC. Examining the mean scores in Table 4.2 indicates that the monolingual children significantly outperformed the bilingual children on the Matrix Analogies subtest, which requires the ability to utilise abstract analogies by separating elements of information and integrating these simultaneously into a synthesised whole. In contrast, the bilingual children significantly outperformed the monolingual children on the Hand Movements task, which requires good attention and concentration to remember the right sequence of movements by ordering stimuli in a linear sequence or step-by-step problem as summarised in Appendix A. These results suggest that the transparency of the orthography influences the development of particular cognitive processing skills.

The bilingual children may be utilising a sequential processing approach on the *Hand Movements* subtest, which is consistent with the idea that children learning to spell in transparent orthographies, place emphasis on sequential letter sound analysis (Wimmer & Hummer, 1990, Wimmer et al., 1994; Goswami et al., 1998). In addition the consistent grapheme-phonemes correspondences in Afrikaans permit these children to rely on the phonemic ordering and matching individual phonemes with the corresponding grapheme as a guide to spelling in this transparent orthography. This result is in line with Wimmer and Hummer's (1990) and Goswami et al's., (1998) findings in German and Spanish-speaking

children respectively who due to the transparent nature of these language orthographies, these children tend to rely on letter by letter decoding, which is also mastered more easily than children learning to spell in a less transparent or opaque orthography. Similarly, the monolingual English children's superior performance on the *Matrix Analogies* subtest, suggests that the spelling of English words needs to be made on the basis of memory for sequential letter order, which involves simultaneous processing (Kaufman & Kaufman, 1983b). Thus in agreement with Goswami et al's., (1998) findings monolingual English children in the present study were found to be more sensitive to processing larger orthographic units, which Kaufman and Kaufman (1983b) argue relies on simultaneous processing.

Importantly, the present study examined bilingual Afrikaans-English children, who have received spelling instruction in English and Afrikaans, thus demonstrating the influence of bilingualism or learning to spell in a language besides English. However, their significant better performance on the Hand Movements task from the sequential processing scale than Matrix Analogies from the simultaneous processing scale suggests that the bilingual Afrikaans-English children may have less familiarity with English in it's written form than in Afrikaans (Bialystok, 2002) or that perfect dual competence may not be maintained (Klein, 1993). According to Klein (1993) in many dual-medium schools in South Africa, even though these schools provide formal teaching in both languages, it is often the case that the bilingual's first language is a primary medium of instruction within a dual-medium school. This may explain the finding in which the bilingual Afrikaans-English children demonstrated a slightly better performance on the tasks that rely on sequential processing which is utilised to a greater extent in a transparent than in an opaque orthography (Frost et al., 1987; Kaufman & Kaufman, 1983a). In addition, Buthelezi (2003) notes that *code switching* is common in among bilingual schools educator. Thus the bilingual educators teaching the bilingual children may not be placing equal reliance on both English and Afrikaans concurrently but may be utilising the child's mother tongue, Afrikaans in the present case, to facilitate understanding of English. Direct observation of teacher's interaction with learners may need to be undertaken in order to assess the degree to which time is allocated for teaching in each language in the bilingual children at a dual medium school.

Chall (1996) and Bialystok's (2002) model notes that oral language proficiency is developing concurrently in L2 school children and does not precede spelling development the way it does

when children learn to spell in their L1. However Geva (2000) notes that oral language proficiency plays only a marginal role and that instead the orthographic similarity between L1 and L2 determines the way words are processed and consequently spelt by bilingual children. Furthermore, Harris (1992) notes that bilinguals may have different memory spans in their two languages even when they are equally fluent in both. Ellis's (1991, cited in Harris, 1992) study indicates that balanced Welsh-English bilinguals performed better when using counting or working with numbers in English, which have a shorter average digit length than the Welsh ones, which demonstrates a language feature on cognitive functioning. This is relevant to the present study as differences found between monolingual and bilingual children in terms of cognitive processing ability are not due to different intellectual capabilities but due to how both groups of children place differential reliance on these two processing ability to solve two specific cognitive tasks. Thus, whilst cognitive processing skills are similar in monolingual and bilingual children the way they are used to solve two specific cognitive tasks differs significantly according to the nature of the orthography of these children's first language (Bialystok, 2002).

In support of the specificity and uniqueness of the Matrix Analogies and Hand Movements subtests of the K-ABC's simultaneous processing and sequential processing scales, Goetz and Hall (1984) point to these tasks as possible discrepant sub-scales of the K-ABC. In Kaufman and Kaufman's (1983b) study of 9-year-old school children, *Matrix Analogies* demonstrated correlations with the sequential processing factor in addition to the expected simultaneous factor (r = .35 on the sequential processing factor versus r = .77 on the simultaneous processing factor). Similarly the *Hand Movements* subtest demonstrated correlations with the simultaneous processing factor in addition to the expected sequential factor (r = .70 on the sequential processing factor versus r = .45 on the simultaneous processing factor). From the K-ABC manual, Kaufman and Kaufman (1983b) describe the Matrix Analogies subtest as "measuring the child's ability to select the picture or design that best completes a 2-by-2 analogy"(p.46). This description acknowledges that there is a sequential component to it, as the series or sequence of pictures needs to be remembered, in addition to quickly and efficiently integrating these into a synthesised whole. The Hand Movements subtest is described by Kaufman and Kaufman (1983b) as "measuring the child's ability to copy the precise sequence of taps on the table with the fist, palm, or side of the palm performed by the examiner"(p.39). This description acknowledges that there is a simultaneous component to it in the form of focusing on the whole sequence of hand movements as a visual gestalt in

addition to the sequential aspect of remembering the right sequence of movements. Luria's (1970) model asserts that people are born with cognitive abilities, but these cognitive processing abilities are influenced by experience and culture (Gibbons, 1997). Language and experience with dissimilar writing systems represents a cultural factor that influences spelling acquisition and the cognitive processing skills that underlie spelling ability (Bialystok, 2002). Although the monolingual and bilingual children seemed to have acquired simultaneous processing and sequential processing skills, how they were used on two of the K-ABC's processing subtest (Matrix Analogies and Hand Movements) varied across language orthographies.

5.2 SPELLING WORDS AND NON-WORDS IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN

Overall the monolingual and bilingual children demonstrated a significantly better word than non-word spelling ability (see Table 4.3, Figure 4.4 and Tables 4.9 and 4.10 and Figure 4.4). Frith (1985) argues that English children first spell logographically and as a result they have limited sight vocabulary of commonly encountered or previously spelt words available to them. While teaching involves 'phonics' and 'whole word', Frith (1985) argues that words represented visually, which relies on simultaneous processing (Kirby, 1988; Kaufman & Kaufman, 1983b) should be easier to spell than those requiring the use of a newly taught alphabetic strategy or a sequential processing strategy (Kirby, 1988; Kaufman & Kaufman, 1983b). Both groups of children appear to have sound whole-word strategies and less defined phonics strategies within each language.

According to the results of the dependent *t*-test (see Table 4.10) the bilingual children spelt Afrikaans words were spelt better than Afrikaans non-words. This result is interesting as it suggests that that the bilingual children may be able to spell some familiar Afrikaans words using rime analogy or whole word approaches. This further suggests that although Afrikaans biases towards a phonological strategy lexical processing is necessary for complete spelling success in Afrikaans, and some children do make use of lexical processes for this language. According to the results presented in Table 4.10 the bilingual children demonstrate slightly better spelling English words than spelling English non-words skills. This result concurs with Goswami et al's., (1998) findings that children learning to spell in a transparent

orthography can make use of some lexical whole-word strategies, because the reliance on rime is an automatic process.

Orthography therefore plays a significant role in the ability to spell words and non-words in a mother tongue. Moreover, given the significance of the spelling scores in the bilingual children this result could suggest that these children may have access and an ability to use grapheme-phoneme correspondences from the outset of spelling, as Afrikaans displays a shallow orthography and the minimal difference between Afrikaans words and non-words may illustrate the adeptness that the bilingual Afrikaans-English children have at utilising both logographic and alphabetic strategies to spell (Frith, 1985). Alternatively, the alphabetic strategy may be used from the outset of spelling as due to the predictability of the orthography this allows for the majority of words to be spelt correctly using an alphabetic strategy (Stuart & Coltheart, 1988). This is evidenced in the error patterns present in the bilingual children's spelling data, which indicate a predominant use of an alphabetic or phonetic strategy (sequential processing) with a logographic or visual strategy (simultaneous processing) being relied upon to a lesser extent to spell Afrikaans words and non-words. For example, '*klaas*' for '*klaar*', or '*mes*' for '*mens*', and '*meeter*' for '*meker*' or '*selde*' for *sele,* as seen in Tables I-5 and I-6 in Appendix I respectively. As Afrikaans is a relatively transparent orthography with consistent letter sound relations in which the phonemes of the spoken word are represented by graphemes in a direct and unambiguous manner this may explain why children meet with more success in spelling words and non-words at a similar level in a transparent than children spelling in a more opaque orthography (Frost et al., 1987).

In comparing Afrikaans and English spelling in the bilingual children, spelling in the L1 (Afrikaans) was significantly better than spelling in the L2 (English). This suggests that instead of a whole word analogy, these children are attempting to activate whole-words phonologically (Bradshaw & Mattingley, 1995), which places greater emphasis on sequential than on simultaneous processing skills (Kirby, 1988). Non-words were derived from words and thus may be more suited to a visual analogy than grapheme-phoneme correspondences as English is opaque at the level of the phoneme. Thus in a shallow orthography, the orthographic input lexicon is activated by print, at least some of the time, and appears to be sustained longer for spellers of Afrikaans relative to English, as well as tends to exist as a viable strategy even for fairly skilled young spellers. Another factor that may explain this finding is that while the bilingual children were attending a dual-medium school these

schools tend to retain Afrikaans as the medium of teaching and learning if Afrikaans is the bilingual child's first language (Klein, 1993; Buthelezi, 2003). This could explain why the bilingual children are able to spell in their L1 significantly better than in their L2, because they may have had better oral and written proficiency as Bilaystok' (2002) model suggest is needed to benefit from spelling instruction, as Afrikaans is their mother tongue (Geva, 2000) whilst oral and written language proficiency in their L2 is concurrently developing along with their spelling skills. However studies also suggest that oral language proficiency exerts only a marginal role and instead the orthographic dissimilarity between L1 and L2 explains the significant spelling differences across their two dissimilar language orthographies (see Geva, 2000). Spelling successfully in an opaque L2 differs from spelling in a transparent L1 because the depth of a language's orthography places emphases on a different combination of simultaneous processing and sequential processing strategies for spelling success (Kaufman & Kaufman, 1983b). Therefore this finding supports previous studies findings such as those of Cossu, et al., 1988; Wimmer & Hummer, 1990, 1994; Goswami, et al., 1998; Oney & Durgunoĝlu, 1997; Holopaeinen et al., 2001; Pollo, Kessler, Treiman et al., 2005 that have consistently found that the depth of a languages orthography influences the spelling strategies used to spell and extends this to bilingual children's spelling in the South African context.

The results of the spelling error analyses in the bilingual children suggests that while some English words are spelt orthographically, most Afrikaans words and non-words are spelt largely using an alphabetic approach that entails sequential letter by letter decoding to a greater extent than simultaneous whole word strategies (Frith, 1985; Kaufman & Kaufman, 1983b; Elliot et al., 1990). This result supports Luria's (1970) and Stuart and Coltheart's view (1988) that is if simultaneous processing is less relied upon or less practiced in a transparent orthography or not accessed in scholastic instruction (Klein, 1993) such as when bilingual children's L1 is maintained as the primary medium of instruction and/or if code-switching is used by bilingual educators to facilitate English, bilingual children's English word and non-word spelling performance is affected, as the bilingual children display lower spelling ability of English words and non-words than Afrikaans words and non-words.
A spelling error analysis of spelling English words in the bilingual children indicated that these children may be attempting to decode the stimuli orthographically and phonologically simultaneously and, as a result, the more similar sounding the pairs of letter sounds, that are common to both orthographies (Coetzee, 1985) are to each other, the more difficult the verification process and the less accuracy in spelling English words than spelling Afrikaans

words or non-words. Afrikaans has a shallow orthography and only a small amount of letters that are interchangeable, but has a greater number of similar lexical neighbours (*reik/ryk*) than words in a less transparent language such as English. In the present situation the orthographic dissimilarity between L1 and L2 may have significantly compromised the bilingual Afrikaans-English children's spelling of English words. This result concurs with Geva et al's., (1997) study of bilingual Hebrew-English children where a trade-off exists between slower and inefficient access of lexical spelling strategies in the L2 on the one hand and the faster and less demanding access of L1 letter sound phonetic spelling strategies on the other hand. In the present study the Afrikaans words could be spelt either alphabetically of by activating the whole word using a phonological analogy, as Afrikaans words and non-words are spelt at a similar level, but still significantly different (see Table 4.10). This accounts for the significant gap between Afrikaans word and non-word spelling and English word and non-word spelling in the bilingual groups as the use of less demanding sequential phonemic letter decoding strategies may influence ineffective access of orthographic whole-word processing strategies needed to spell in their L2, as a phonemic code may be generated before an orthographic code (Frost et al., 1987; Seymour et al., 1992, 2003). Due to the simplicity of the rules governing the spelling sound correspondences in shallow orthographies a sufficient portion of the phonological code can accumulate before orthographic analysis can help word recognition (Frost et al., 1987). This result support Seymour et al's., (1992, 2003) dual route model which takes into consideration the effect of orthographic depth in spelling development, and argues that the difficulty of acquiring literacy moves from simple to complex phonemic structures and from shallow to a deep orthographies. Hence, learning to spell in Afrikaans is achieved more quickly than learning to spell in English (Seymour et al's., (1992, 2003).

In the monolingual children there was a significant difference between spelling English words and non-words with these children spelling English words significantly better than spelling English non-words (see Table 4.9). This support's Goswami's (1988) findings that monolingual English children place a greater emphasis on rime analogy, which relies on simultaneous processing to group the letters and some sequential processing to attach the sound to the letters (Kirby, 1988). Goswami (1993, 1999) notes that using grapheme-phoneme correspondences rules is more difficult as English is opaque at the level of individual phonemes and demonstrates an ambiguous letter sound relationship and as a result monolingual English children are more sensitive to rhyming words or sound segments that

are often spelt the same way, than individual letters associated with sequential processing and alphabetic strategies (Kaufman & Kaufman, 1983b). Sequential processing and letter-sound decoding using grapheme-phoneme correspondences are still developing in the both groups of children, given their differential performance between spelling English and Afrikaans word and non-word spelling scores and qualitative error analyses patterns.

It is essential to note that both groups of children in the present sample were already in Grade three and of a similar age, which may explain both rhyme or simultaneous processing and phonetic or sequential processing spelling strategies being present. Past research attests that these skills may not emerge concurrently but are found in all alphabetic orthographies and that the characteristic structure of a language's orthography at the sub-lexical and spoken level places different emphasis on these skills for spelling achievement (Wimmer & Hummer, 1990, 1994; Cisero & Royer, 1995; Frith et al., 1997; Goswami et al., 1998; Goswami, 1999). The present study utilised a qualitative error analysis (Frith, 1985; Seymour et al., 1992) theory-driven developmental spelling framework which permitted insight into the phonological and orthographic knowledge these children had at one point in time, and can support that these spelling strategies are used in both groups differently due to the dissimilarity between English and Afrikaans. The monolingual children were using a logographic or simultaneous processing) to a greater degree than a alphabetic or sequential processing strategy to spell English words and non-words, whilst the bilingual children were using an alphabetic strategy or sequential processing to a greater degree than simultaneous processing or logographic strategies to spell English and Afrikaans words and non-words (see Tables I-1 through I-6 in Appendix I). Thus, cognitive-linguistic processes exert their role in spelling in both languages and implicitly simultaneous processing and sequential processing as argued by Kaufman and Kaufman (1983b), in addition to oral language proficiency and L1 spelling development, particularly when aspects of phonological decoding skills, and implicitly, simultaneous processing and sequential processing (Kirby, 1988; Kaufman & Kaufman, 1983b) are used together but influence spelling performance differently in the bilingual children spelling in their two languages, as these children are able to significantly decode with a higher level of accuracy in spelling their L1 than in their L2. These results are in line with Fitzgerald's (1995) review that there are similarities in the developmental trajectories of word recognition processes in English first and English second language learners. This result also supports Seymour, Bunce and Evan's (1992) model as both logographic processes (which are associated with simultaneous processing) and alphabetic

processes which are linked to sequential processing) (Kirby, 1988; Kaufman & Kaufman, 1983b) are used to spell in the monolingual and in the bilingual groups.

Past research that has looked at children's ability to spell words have found that English children rely on familiarity with phonological and/or orthographic units and use a whole-word or direct lexical route, or analogy strategy due to the English orthography being more predictable at groups of letters than at the level of individual letters or phonemes (Wimmer & Hummer, 1990, Treiman 1993; Wimmer & Hummer, 1994 Spenser & Hanley, 2003). Afrikaans is a shallow orthography akin to Spanish. Goswami et al's., (1998) findings indicates that Spanish children may also rely on rime analogies, and reason that this is because reliance on rime is probably an automatic process. However because of the transparent nature of the Spanish orthography, grapheme-phoneme correspondences are mastered more easily than children learning to spell in a less transparent orthography. Therefore, children who learn to spell in a less transparent orthography such as English or French are more likely to benefit from processing large orthographic units than children learning to spell in highly transparent orthographies such as Spanish. For children learning to spell in a highly transparent orthography reliance on a letter-by-letter decoding strategy is the most effective strategy (Goswami et al., 1998). However, these studies compared children learning to spell in their mother tongue. The present study investigated both first and second language learners. The nature of the spelling errors made by the monolingual and bilingual children provides insight into spelling strategies adopted when children are faced with spelling in an opaque orthography as opposed to a transparent orthography.

5.2.1 Spelling English words and Afrikaans words compared

The monolingual children significantly outperformed the bilingual children in spelling English words, as revealed by the results of the two-independent sample *t*-test, (see Table 4.9) and illustrated in Figure 4.4 (87% versus. 29% correct). This result is in line with Bialystok's (2002) model that argues that a level of competence in oral language is needed in order to benefit from instruction in spelling. In addition this result implies that instruction in their transparent first language, Afrikaans, has benefited the bilingual children more than spelling in English their more opaque second language. This finding is particularly striking as the bilingual children were receiving spelling instruction in Afrikaans and English simultaneously and thus should be orally proficiency in both of their languages by Grade 3.

According to Bialystok's (2002) model a level or competence is needed in order to benefit from spelling instruction. The monolingual children thus had a higher level of English proficiency, which helped them spell English words and non-words significantly better than the bilingual children. In the case of the bilingual children, they were spelling in their second language, which was opaque in relation to their first. Secondly they may have a conversational level of English and not an academic one. This finding is supported by Bialystok's (2002) model that oral language proficiency in L2 develops concurrently with spelling skills, and does not precede spelling development the way it does in L1 spelling development. The present study did not explicitly address oral language proficiency and instead defined bilingualism as the ability to speak two languages, but as both Bialystok (1991) and Baker (1993) have noted bilingualism is difficult to research as there are different degrees of bilingualism, and the present study did not assess the degree of bilingualism that these bilingual children had, instead classified them as bilingual due to attending a dual-language (Genesee et al., 1984; Cummins, 1981, 1999). Although given the significance of the results orthographic depth seems to play an important role in the way spelling English words are processes and spelt in the bilingual children although future research may wish to control for oral language proficiency in terms of how much time is attributed to spelling instruction in each language.

Geva's (2000) review of research on the role of oral language proficiency in L2 reading and spelling suggests that it plays only a marginal role in explaining why some L2 young learners may experience difficulties in spelling English words and non-words. Rather the orthographic dissimilarity between L1 and L2 and word decoding processes that differ across languages needs to be considered. Geva et al's., (1997) findings indicates that even when bilingual Hebrew-English children were learning to spell in Hebrew and English simultaneously in dual-medium instruction school, in which the proportion of time attributed to spelling instruction was equal and controlled, specific features such as orthographic depth and morphophonemic complexity still consistently made different demands on the bilingual Hebrew-English children's processing's resources used to spell in both of their languages. The bilingual Hebrew-English children were able to spell more accurately in their L1 than in their L2, because their L1 was associated with a transparent orthography whilst their L2 was opaque. This supports the significant gap between spelling accuracy of English and Afrikaans words in the bilingual children, and the finding that the bilingual children were

able to spell Afrikaans words significantly better than English words (see Table 4.10, 62% versus 29% correct as illustrated in Figure 4.4).

A spelling error analysis of spelling English words in the monolingual children revealed that these children are relying on direct access strategies, such as memorising spelling patterns, to build up an orthographic lexicon from which they make analogies to new words and context-sensitive phoneme-grapheme patterns. Qualitatively, the spelling error analyses for English words highlights that the monolingual children were relying on a predominance of whole-word visual strategies (logographic), whilst phonetic strategies (alphabetic approach) were noted to a lesser extent (Kirby, 1988; Kaufman & Kaufman, 1983b). For example, the'*-er'* rime unit is generalised to spelling in other words using a visual whole-word analogy and integration of the word's familiar orthographic and/or phonological elements, as seen in '*docter*' and '*fiyer*', for '*doctor*' and '*fire*'. Real word substitution errors such as '*baby*' for *'body'* and '*many*' for *'money* ' are also found which demonstrates that the monolingual English children's reliance on visual strategies to spell English words (see Table I-1 in Appendix I). In addition, an error such as '*meony*' for '*money*' represents an order error, which is further indicative of a visual strategy to spell, whilst an error such as '*fiyer*' for '*fire*' represents an incorrect use of a letter combination that would be appropriate for some words but not for others, which is further consistent with a visual or simultaneous processing approach to spelling, whilst a sequential processing or an alphabetic strategy being noted to a lesser degree, as seen in the following examples, '*bodie*' for '*body*' and *doctar'* for '*doctor*' (Frith, 1985; Elliot et al., 1990).

The pattern of spelling errors for both English words and non-words in the monolingual children was similar, suggesting that these children were also attempting to spell English non-words using analogies with real word rimes and real word substitutions. For example, '*zoom*' for '*zome*' and '*god*' for '*gody*', or '*steeld*' for *'stild* which represent real word substitutions in spelling English non-words, and relatively few non-word responses '*uvent*' for '*ovent*' or '*ciyre*' for '*kire*'were noted (see Table I-2 in Appendix I). A similar strategy in decoding words and non-words is evidenced by the strong positive significant correlation between English words and non-words (r (28) = .52, p<.01, as shown in Table 4.11). However the significant differences in their spelling performance and error analysis patterns suggests that when the English non-words cannot be spelt on the basis of analogies with real words (using a combination of simultaneous processing to recognise the whole syllable or whole rime units

and some sequential processing to attach the sound to the similar spelling sequences) the monolingual English children's error rates are higher than when they can rely on familiar orthographic and/or phonological elements. This results is in line with Frith et al.,'s (1998) finding that because of the low orthographic consistency English spelling, L1 English children exhibit complex error prone strategies in phonological decoding or sequential processing (Kirby, 1988), which results in these children utilising a visual strategy or simultaneous strategy and to a lesser extent a sequential processing approach (Kaufman & Kaufman, 1983b) to spell English non-words. Therefore the monolingual children in the present study concurs with Frith et al.,'s (1998) findings that English children use their knowledge of common spelling patterns as a guide to spelling new or unfamiliar words because they find it difficult to use grapheme-phoneme correspondences rules to spell non-words by identifying the sounds within words because English is opaque at the level of the phoneme (Frith, 1985; Kirby 1988; Elliot et al., 1990). In contrast children learning to spell in highly transparent orthographies such as German carry out phonological decoding in an 'online' or serial fashion (as seen in the minimal difference in the bilingual children's Afrikaans words and non-words, 62% versus 51% correct as illustrated in Figure 4.4)which further implies that these children are possibly advancing more progressively through Frith's (1985) stages of spelling, and are adept at using both logographic and alphabetic strategies or area able to utilise alphabetic strategies from the outset of spelling due to the transparency of the orthography (Stuart & Coltheart, 1988).

5.2.2 Spelling English non-words and Afrikaans non- words compared

The monolingual children significantly outperformed the bilingual children in spelling English non-words, as revealed in the results of the two-independent sample *t*-test in (see Table 4.9) and illustrated in Figure 4.4 (41% versus 21% correct). This finding was surprising, given Goswami, et al's., (1998) findings that children learning to spell in a highly transparent orthography are superior to children learning to spell in an opaque orthography in spelling non-words. This result is consistent with Bialystok's (2001) model that states that children need to have a level of competence in oral language in order to benefit from spelling instruction. The non-words were legal as they were derived from real words, and as a result they would appear more acceptable to the monolingual first language than to the bilingual second language speakers of English, as seen in the monolingual children's spelling strategies of using real word based analogies to spell, rather than sequential phonemic analyses which

was seen in the bilingual children's spelling strategies (see Tables I-3 and I-4 in Appendix I), which was highlighted in the qualitative error spelling patterns distinguishing the two groups of children in spelling English non-words in the present study. The importance of oral language and written proficiency is evidenced by the fact that the bilingual children performed at almost the same level of spelling English words and non-words, (M =2.93, SD =1.04 for spelling English words versus, M=2.06, SD =1.11 for spelling English non words, as shown in Table 4.9, and illustrated in Figure 4.4). Thus, the bilingual children do not benefit from recognising familiar words, or utilise an analogy strategy but rather approach both tasks as spelling unfamiliar words, and thereby reverting to an alphabetic strategy (Frith, 1985).

However, the bilingual children demonstrated significantly better Afrikaans non-word than English non-word spelling ability as revealed by the dependent sample t-test (see Table 4.10) and illustrated in Figure 4.4 (51% versus 21%). Similarity in decoding both Afrikaans words and non-words (62% versus 51%) may be due to the predictability of the Afrikaans orthography allowing most words and non-words to be successful spelt with an alphabetic strategy. The Afrikaans orthography places less emphasis on logographic or simultaneous processing strategies but places a greater reliance on alphabetic or sequential processing strategies for spelling Afrikaans non-words, Coetzee (1985), and but this combination of simultaneous-sequential processing strategies is ineffective for spelling English non-words that have been derived from real words and cannot be decoded using sound alone. Spelling errors found in the bilingual children's spelling of English non-words were homophonic in the sense that they would give the correct pronunciation if read aloud by regular phonics rules (Elliot et al., 1990). For example, *'kaie'* for '*kire*', '*vous*' for '*fous*' and '*awint*' for '*ovent*', and concern subtle phonetic distinction between '*sh*' and *'z'* and '*tj'* for *'ch',* with a lesser emphasis on a visual strategy was noted such as '*huis*' for 'house' or '*vuur'*, for '*fire*' which represent visual errors or translated whole Afrikaans words used to spell English non-words as shown in Table I 4 in Appendix I). This set of finding is interesting and supports Jared and Kroll's (2003) findings that bilingual children can access and activate spelling-sound correspondences from their two languages (Jared & Kroll, 2001). Qualitatively these errors indicated that the bilingual children are able to carry out sequential phonemic analysis and able to distinguish that sounds need to be represented in the order they occur, they are also able to remember which letters represent which sounds and able to write them recognizable and in the correct sequence (Kaufman & Kaufman, 1983b; Kirby, 1988; Elliot et al., 1990).

However, predominate reliance on phonetic strategies indicates that the bilingual children may have a relatively small core vocabulary of irregularly spelt words in English and those that are used are from their well-practiced L1, Afrikaans, which may have compromised the bilingual children's spelling of English non-words. This result is in line with Pearson, Obler and Fernandez's (1993) finding that bilingual children have smaller vocabularies then monolingual children as a single vocabulary system underlies both languages and that inter-mixing and accessing both languages in spelling may interfere with one another particular when words in both languages share word bodies that are pronounced differently in the bilingual child's two languages (Djikstra et al., 1998; Jared & Kroll, 2003). The bilingual children displayed strong significant positive correlations correlation within and across the their two language orthographies such as spelling Afrikaans words and Afrikaans non-words, r (28) =. 30, p<. 05, spelling Afrikaans words and English words, r (28) = .62, p <. 001 and spelling Afrikaans words and English non-words, r (28) =. 59, p <. 001 as shown in Table 4.12. The bilingual children's degree of spelling English non-words success differed from the monolingual children because their significant correlation and spelling errors patterns suggest that they relied upon alphabetic strategies to a greater extent than logographic strategies and were attempting to decode a language that is opaque at the level of the phoneme (Kaufman & Kaufman, 1983b; Kirby, 1988. Therefore these results support Geva et al., 2000 findings that bilingual children learning to spell in a transparent first language exhibit an ineffective access of lexical processing strategies needed to spell in their opaque L2, and utilise phonetic strategies which are accessed more quickly but due to the fact that the English non-words were derived from real words an analogy or whole-word strategy is a more suitable strategy for spelling English non-words than a phonetic strategy which is successful for spelling non-words in a transparent orthography.

5.3 CROSS-LANGUAGE TRANSFER OF SPELLING STRATEGIES IN A FIRST LANGUAGE TO SPELLING IN A SECOND LANGUAGE

In the spelling performance of the bilingual children, instances of negative transfer were evident, and according to Durgunoğlu (2002) is one of the reasons that bilingual children show some interchanging of sounds between their two languages, such as 'f' for 'v', 'y' for 'i', and 'w' for 'v'. The errors analysis patterns of spelling English words and non-words yield many instances of such errors. For example, '*vous*' for '*fous*', '*fiyer*' for *'fire'* and '*ewent*' for '*event*'. In addition, errors such as, *haus*' for '*house*', '*tjurs*' for '*shurch'*, '*vaie*'

for '*fire*', '*trie*' for 'tree', '*manie*' for 'money', *kaie*' for '*kire*', '*donie*' for '*doney*', indicate that the bilingual children were using spelling sound correspondences to spell English words and non-words in addition to using these alphabetic skills to spell Afrikaans words and non-words, and meeting with more spelling success in Afrikaans than in English (Tables I-3, I-4, I-5 and I-6 in Appendix I and Figure 4.4). In the present study a common strategy in spelling Afrikaans words and non-words is to use the spelling sound correspondences systematically and spelling a word as it is heard, by using sequential letter by letter decoding strategies or activating whole words phonologically based on the sounds within words (Brasdshaw & Mattingley, 1995), hence transferring a strategy that is quite effective for the more transparent Afrikaans orthography to spelling English words and non-words. As a Spanish-English bilingual child reflects, " it is easier to read and write in Spanish, you just need to sound it out, when you do (it) in English you have to remember"(Durgunoĝlu (2002, p.5). Therefore, the bilingual children' spelling errors similar to the Spanish-English children in Durgunoĝlu's (2002) study, indicates a transfer of phonetic or sequential decoding strategy used in spelling Afrikaans words and non-words to spelling English words and non-words. This can be regarded a *negative* transfer effect of learning to spell in a transparent first language and opaque second language, which supports the significant differences in their good spelling in L1 and weaker spelling in the L2 as English is only a partially phonetic language and most words cannot be decided using sound alone (Kaufman & Kaufman, 1983b). This finding contrasts Comeau et al's., (1999) who found positive transfer and no significant difference in English-French bilingual and French children on measures of language comprehension and production (Genesee, Lambert & Holoborow, 1986; Cummins, 1999). This finding is not unexpected since both English and French are deep orthographies and hence both require a lexical procedure for success than could transfer from a French L1 to a English L2, in addition to a socio-political motivation of learning to read and spell in French and English which are considered prestigious languages by most French-English Canadians. However, in American a different educational outcome is seen with Spanish-English bilingual children whole first language is not valued and is associated with academic difficulties, in their L1 and L2 (Lambert, 1979; Crawford, 1995, cited in Berk, 2003).

South Africa has an additive model of bilingualism as well as an educational policy that promotes equality among all the 11 official languages and learning more than one language is common practice in most South African children (Swann, 2000; van Tonder, 2001; Buthelezi, 2003; Pandor, 2004). Therefore the advantage of having an additive model of bilingualism

and learning two languages, in dual medium schools that aim to encourage the development of bilingualism through teaching the child's mother tongue first (Klein, 1993; Buthelezi, 2003) to form a cognitive base for the second as argued Cummins's (1981, 1999) CUP model, is supported as learning to spell in a first language is related to spelling in a second language as the results in the present study indicate that there were moderate to strong positive significant correlations within and across the bilingual children's languages spelling performance (see Table 4.12). In addition the results suggest that there are metalinguistic sources of commonality across English and Afrikaans, in that both represent alphabetic languages that rely on letters representing sounds (Blachman, 2000), which is associated with sequential processing and the alphabetic principle. The results further suggests that if bilingual children are aware and sensitive to this sound-letter information in their first language they can accumulate it in their second languages as well (Bilaystok, 1999; Yelland, 1999). This does not encourage the use of visual rime analogies that English requires, however (Kaufman & Kaufman, 1983b). Bialystok's (2002) model argues that spelling in an L1 and L2 are related and that bilingual children have to develop the phoneme-grapheme rules and phonological skills associated with simultaneous processing and sequential processing strategies (Kirby, 1988; Kaufman & Kaufman, 1983b) used in their second language particularly when they are learning to spell in dissimilar orthographies simultaneously as the cognitive processing strategies used to spell are determined by the orthography that the child is learning to spell in (Frost et al., 1987). In a further examination of the effect of language orthography exerts on spelling the results of the correlational analyses and stepwise regression analyses discussed in the next section highlights that the relationship between simultaneous processing and sequential processing varies as a function of language orthography.

5.4 THE RELATIONSHIP BETWEEN SIMULTANEOUS PROCESSING AND SEQUENTIAL PROCESSING AND SPELLING IN MONOLINGUAL ENGLISH AND BILINGUAL AFRIKAANS-ENGLISH CHILDREN

The results of the correlational analyses suggest a strong positive highly significant relationship between simultaneous processing and sequential processing and spelling English words and non-words in the monolingual and in the bilingual group. In addition there was a significant although weak positive relationship between simultaneous processing and sequential processing and spelling Afrikaans words and non-words in the bilingual group (as

shown in Table 4.11 and Table 4.12 respectively). These significant positive correlations and associated relationship between simultaneous processing and sequential processing and spelling in both languages, illustrate the mutually enhancing role cognitive maturation and formal spelling instruction has on the spelling process in both Grade 3 children groups (Stanovich, 1986; Siegel, 1999). These results support international literature that simultaneous processing and sequential processing are important factors to consider in reading development (Das et al., 1975) in first and second language speakers and/or readers (Fourquean, 1987; Valencia & Raikin, 1988; Flanagan, 1995; Greenop 2004) and extends this to monolingual learning to spell in their mother tongue and bilingual children learning to spell in both their L1 and L2 simultaneously in the South African context. It is important to note that the results of the correlation results also support that each language's orthography affects the cognitive strategies employed, as well as supports Kirby's (1988) and Kaufman and Kaufman (1983b) view that these skills are important to spelling, because together they explain progress in spelling ability (see Table 4.11 and Table 4.12 respectively and qualitative error analyses tables in Appendix I discussed in section 5.2).

On the whole, the results of the regression analyses with English and Afrikaans spelling words or non-words as the dependent variable (see Table 4.13) indicate that the cognitive tasks that were found across the monolingual and the bilingual children's spelling tasks focused on decoding and sequential processing. This result supports and extends the findings of Das et al's., (1975) , Hooper & Hynd's (1982) study of English-speaking children, Fourquean's (1987) study of Latino school-aged children as well as Greenop (2004) study of English, Sotho and Zulu school-aged children which have found that the K-ABC's sequential processing scale is associated with reading skills and extends this finding to 9 year old monolingual and bilingual South African children's spelling skills. Both groups' of children demonstrated the same general sequential processing as well as simultaneous processing ability (see Table 4.6). There were also important differences found on two K-ABC subtests (Matrix Analogies and Hand Movements), which may imply that although both groups of children demonstrate the same cognitive processing ability different strategies are used to reach the same spelling level (Frith, 1985; Seymour et al., 1992; Seymour et al., 2003). It is important to note that there were significant differences on these subtests, which is important as each K-ABC subtest contributes skills used in the spelling process as well as implies that unique combinations of both cognitive processing skills are needed for spelling success in both English and Afrikaans orthographies.

5.4.1 Predictors of Spelling English Words

In the monolingual children, *Word Order* (20 %) and *Matrix Analogies* (16%), accounted for 36 % of the proportion of variance explained in spelling English words (see Table 4.13). *Word Order* requires the child to hold the sequence and the order of letters and sounds in memory in order for the word to be spelt, whilst *Matrix Analogies*, is related to the ability to represent abstract letters and sounds in the spelling process (Kaufman & Kaufman, 1983b). In terms of the K-ABC's manual (1983b, p 317), for 9 year old children, Word Order loads *r* =. 35 on the simultaneous factor, versus *r* = .77 on the simultaneous factor, whilst Matrix Analogies loads *r* =. 73 on the simultaneous factor versus *r* =. 44 on the sequential factor. Thus, no task relies on one type of processing strategy alone but both are needed to spell English words (Kaufman & Kaufman, 1983b). The amount of variance contributed by these two variables is moderately significant and provides support that monolingual children are using attention to visual detail and analogic thinking to generate a systematic strategy for inferring the nature of the analogy for each abstract item as measured by the Matrix Analogies subtest as well as auditory visual integration to generate a strategy for recalling a short series of stimuli without allowing much time for rehearsal as measured by the Word Order subtest to spell English words (Kaufman & Kaufman, 1983b). The fact that Word Order emerged first is interesting as Word Order is part of the sequential processing scale of the K-ABC (Kaufman & Kaufman, 1983b). However, Word Order displays a strong significant positive correlation with the sequential processing scale *r* (28) =. 63, *p*<. 001, simultaneous processing scale *r* (28) =. 41, *p*<. 05, as well as the mental processing composites scale, *r* (28) =. 59, *p*<. 001, which suggests that both simultaneous processing and sequential processing are needed to spell English words. Similarly, Matrix Analogies emerged as the second significant predictor of spelling English words and demonstrating a strong significant positive correlations with the simultaneous processing scale, *r* (28) =. 64, *p*<.001, and the mental processing composite scale, *r* (28)=56, *p*<.001(see Table 4.13). These results suggests that although sequential processing is important for spelling English words, due to the complex nature of the English phonological and orthographic systems simultaneous processing is needed for faster automatic spelling, as evidenced by the monolingual children's good English words spelling ability, as most English words cannot be spelt using letters sound correspondence rules alone (Kaufman and Kaufman, 1983b).
The strong positive correlations and superior performance on the Matrix Analogies subtest suggest that the monolingual children have well-developed simultaneous or whole-word

analogy skills important for spelling English words, whilst the strong significant correlation with Word order suggests that they can also rely and have acquired a level of sequential processing skills or phonological processing ability. The latter may still be developing or may be more complex in an orthography that is more opaque at the level of the phoneme (Wimmer et al., 1994). The results of the regression analyses also provide support for the significant findings between spelling English words and non-words in the monolingual children found in the present study. The lack or limited ability in spelling English non-words that can not be spelt on the basis of real familiar words in the monolingual children could be attributed to the still developing alphabetic knowledge. According to Kaufman and Kaufman (1983b) " reliance on memory of phonemic order and matching of individual phonemes with graphemes is not a completely productive strategy. The spelling of some English words must be made solely on the basis of memory for sequential letter order or commonly occurring spelling patterns as these larger syllabic units are used as a stimulus for generating the entire word from partial presentation"(p.269). Thus, consistent with Kaufman and Kaufman's (1983b) and Seymour et al's (1992) models both alphabetic and logographic skills are needed for skilled spelling in English where most words cannot be decoded using sound alone. Spelling English words relies on simultaneous processing to recognise the spelling patterns in words that share the same sound and on sequential processing to attach the sound to the letters (Kirby, 1988), which supports the monolingual's significant better performance on the Matrix Analogies subtest than the bilingual children.

In the case of the bilingual children, *Photo Series* emerged as the only significant predictor of spelling English words and accounted for 33 % of the proportion of variance explained (see Table 4.13). According to Kaufman and Kaufman (1983b) Photo Series forms part of the simultaneous processing scale, but displays correlations with both an expected simultaneous (r = .73) as well as a sequential processing component (r =.40). From the K-ABC's (1983b) manual, the Photo Series subtest "measures the child's ability organise a randomly placed array of photos illustrating an event and then order them in their proper time sequence" (p.49). This description acknowledges that there is a sequential processing component to Photo Series in addition to an expected simultaneous component. Photo series is similar to when the speller has to plan the order and correct sequence of letters beforehand and then integrate these letters in order to spell the word (Luria, 1970; Frith; 1985; Ellis & Young, 1998). In addition according to the correlational patterns, it was interesting to note that Photo Series demonstrates strong positive significant correlations with the simultaneous processing

scale, r (28) =. 73, p<.001 as well as with the mental processing composite scale, r (28) =.62, p<.001, (see Table 4.12) but no significant correlation with the sequential processing scale suggesting that the bilingual children have well-developed sequential processing skills consistent with learning to spelling in their transparent mother tongue (Luria, 1970; Frith; 1985; Ellis & Young, 1998; Wimmer et al., 1994; Goswami et al., 1998).The amount of variance contributed by this one variable is moderately significant and provides support that similar to the monolingual children, the bilingual children are using alphabetic and logographic strategies in parallel consistent with the orthographic stage (Seymour et al., 1992). This result supports Fitzgerald's (1995) view that there are similarities in the development of literacy skills in first and second language speakers, however specific differences do exist. Geva et al., (1997) and Geva (2000) argue that orthographic difference influence and place different demand on the cognitive processing resources and strategies that are used to spell.. Therefore, although both cognitive processing strategies may be used and are important to spell English words, bilingual children demonstrated a significantly lower level of spelling English words ability than the monolingual children, as well as a significantly lower level of spelling English words ability than spelling Afrikaans words (see Tables 4.9 and 4.10). Thus, whilst the correlations suggest some similarity in the spelling strategies across languages, the significant spelling results suggests that each language requires a different approach in terms of emphases placed on simultaneous processing and sequential processing strategies for spelling success in English words compared to Afrikaans words.

Thus, the bilingual children's English words spelling is significantly compromised in comparison to the monolingual children due to their still developing L2 oral language proficiency (Bialystok, 2002), but more importantly (see Geva et al., 1997; Geva, 2003) due to the orthography dissimilarly between their L1 and L2 languages. In addition, the effect of learning to spell in a dissimilar language also suggests that while bilingual children may be sensitive to phonological decoding, which is associated with sequential processing or alphabetic strategies (Kaufman & Kaufman, 1983b; Kirby, 1988), which may transfer to their second language, this is not a successful strategy for spelling in English as it is in Afrikaans. The predominance of a non-lexical spelling system assigns an incorrect rule-governed pronunciation (Elliot et al., 1990), which further suggests that the bilingual children have a limited vocabulary store of sight words in English, which has also been observed in other bilingual cognitive-linguistic developmental studies (Pearson et al., 1993; Grainger, 1993).

Bilinguals who are learning to spell in similar orthographies (French-English) are more likely to benefit from positive transfer (Comeau et al., 1999) than those learning to spell in dissimilar orthographies (Afrikaans-English, or Spanish-English) where negative transfer is evident (Durgunoğlu, 2002; Geva & Wang, 2003). The ease with which these children exhibit and seemed to have mastered grapheme-phoneme spelling sound rules, suggests that instruction in their transparent mother-tongue may be have permitted the bilingual children to accumulate grapheme-phoneme correspondence in their first language and to transfer this to their second language. This explains the dissimilar performance in spelling across their two languages as the bilingual Afrikaans-English educators may be placing a greater degree or time on Afrikaans or using it as a medium to facilitate understating of English spelling, (see Klein, 1993; van Tonder, 2002; Buthelezi, 2003) and hence these children may not be truly balanced in terms of linguistic proficiency in both of their languages. In terms of spelling English words, the results suggests that the orthographic dissimilarity between Afrikaans and English places different demands on the cognitive processing resources for spelling in each language. Whilst English demands a more logographic and some alphabetic skills to spell, Afrikaans is based on a clear and consistent set of letter grapheme-phoneme sound rules and may effectively be handled by a single process consistent with Seymour et al's., (1992) and Seymour et al's., (2003) models that incorporates the influence of orthographic depth on the relationship between alphabetic and logographic processes and spelling development, as children learning to spell in a transparent orthography may start to spell alphabetically without necessarily passing through a logographic stage (Start and Coltheart, 1988) or the latter may still be developing logographic processes, which consistent with Wimmer et al.,'s (1994) findings that logographic processes are used only by the end of Grade 3 and 4 start of in German spellers, whilst English children in contrast first use logographic strategies, and then alphabetic strategies to spell, as most words cannot be decoded using sound alone.

5.4.2 Predictors of Spelling English Non-Words

In the monolingual children, *Word Order* and *Hand Movements*, both from the K-ABC sequential processing scales were found to explain 41% of the proportion of variance of spelling English non-words. Word Order is an auditory motor task that measures auditory-visual integration and auditory motor memory without rehearsal. It is similar to the spelling process in that it requires the child to hold the correct sequence of letter sounds perceived and order of the letters in memory, in order for the word to be spelt. Hand Movements requires

good attention and concentration ability to attend to and remember the right sequence of letters and sounds in order to spell a word (Luria, 1970; Frith; 1985; Ellis & Young, 1998). From the K-ABC's interpretive manual (1983b) in 9-year-old children Word Order loaded *r* =. 75 on the sequential processing component versus *r* = .38 on the sequential processing component. Hand Movements loads *r* =. 50 on the sequential processing component versus *r* = .70 on the simultaneous processing component (p. 317). The amount of variance explained by these two variables is moderate to strong and provides support that sequential processing strategies are important for spelling English non-words. This seems a striking finding, as both these subtests call for a predominately alphabetic processing. The strong positive correlation between spelling English words and spelling English non-words of, *r* (28) =. 52, *p*<. 01, suggests that there is a similarity in the way both these spelling asks are being approached by the monolingual children. As the English non-words were derived from English words, this may have influenced the monolingual children to use analogy strategies in the form of using familiar orthographic and/or phonological patterns of real words to spell English-non-words, instead of a strictly letter by letter decoding phonological spelling strategies. However the results of the regression analysis also indicates that these children are able to use sequential processing skills or phonetic strategies to spell English non-words. According to Goswami (1986) analogy spelling strategies utilise a combination of phonological decoding or sequential processing skills and whole word analysis or simultaneous processing skills. Analogy spelling requires some sequential processing to attach a sound to the letter strings in rimes, although simultaneous processing is used to a larger extent to recognise the groupings of letters in space. Qualitatively, the spelling errors made by the monolingual children suggests that they were utilising common occurring visual-whole word analogy or rhyme-based spelling patterns as a guide to spelling English non-words. For example /*er*/ is a regular phonics rule and common occurring visual-orthographic pattern which was generalized to spelling other words 'such as *doct**er**'* for *'doctor'* and '*fiy**er***' 'for fire' (Table I-1 in Appendix I). This finding concurs with Frith et al's., (1998) finding that due to the low orthographic consistency children learning to spell in English tend to use complex and error prone strategies in phonological decoding to spell English non-words, whereas children learning to spell in German can using phonological decoding in a letter by letter fashion, to spell German non-words due to the predictability of German's letter-sound rules. In addition, this results is in line with Seymour et al's (1992, 2003) models of spelling which argue that the establishment of both the logographic and alphabetic lexicons are necessary for the development of the orthographic lexicon by which skilled reading and /or

spelling proceeds. The acquisition of these processes is proposed as simultaneous rather than successive and both these processes are needed for skilled spelling (Seymour, 1990) especially in a language such as English, which has a high proportion of words that do not conform to the consistent grapheme-phoneme correspondences rules (Wijk, 1966; Venesky, 1970).

In the bilingual children, *Word Order*, was found to be the only significant predictor of spelling English non-words, and accounted for 23 % of the proportion of variance explained Word Order is an auditory motor task that measures auditory-visual integration and auditory motor memory without rehearsal (Kaufman & Kaufman, 1983b). It is similar to the spelling process in that it requires the child to hold the correct sequence of letter sounds perceived and order of the letters in memory. According to the correlational pattern Word Order displayed a strong significant positive higher correlation with the sequential processing scale, r (28) =. 76, p<.001, than with the simultaneous processing scale, r (28) =. 62, p<.01, as well as a strong significant positive correlation with the mental processing composite scale, r (28) =.81, p<.001. The amount of variance contributed by this one variable is weak although significant and provides support that the bilingual children are primarily relying on alphabetic strategies to spell English non-words (Seymour et al., 1992, 2003). The correlational patterns suggest that the bilingual children are using sequential processing (alphabetic approach) to a larger extent than simultaneous processing strategies (logographic approach) to spell English non-words. The latter point is further supported by the fact that the bilingual children performed significantly poorer on spelling English non-words than Afrikaans non-words. Due to the English non-words being derived from familiar English words, the bilingual children did not demonstrate better non-word spelling ability as suggested in the research literature, because their L2 oral language proficiency is developing alongside their L2 spelling development and instruction (Geva, 2000). Orthography, therefore, plays a significant role in the ability to spell English words and non-words, in the monolingual and bilingual children. Wimmer and Hummer (1990, 1994) have proposed that English children use direct access strategies, such as memorizing spelling patterns in the orthographic lexicon, which they use to make analogies to new words by using context-sensitive mappings of grapheme-phoneme patterns. While in German, which is a relatively transparent orthography similar to Afrikaans, grapheme-phoneme mappings are largely used from the outset (Stuart & Coltheart, 1988; Wimmer & Hummer, 1990; Wimmer et al., 1994; Goswami et al., 1998). This is supported from the above findings as the monolingual children demonstrated a greater

difficulty in spelling English non-words that could not be spelt using an analogy to real words, which suggests a difficulty in using individual letter sound correspondences rules to spell English non-words. The bilingual children in contrast, perform significantly better spelling non-words in their transparent L1 than in their opaque L2, which suggests a superiority of utilising grapheme -phoneme sound rules from the outset (Stuart & Coltheart, 1988; Goswami et al., 1998).

5.4.3 Predictors of Spelling Afrikaans Words and Non-Words

In the bilingual children, *Word Order* was found to be the only significant predictor of spelling Afrikaans words and non-words and accounted for only 8% of the proportion of variance explained for each one. This amount of variance is very small and the correlations are only just significant, suggesting that, spelling most Afrikaans words and non-words are not fully explained by cognitive processing. The qualitative error patterns demonstrate a greater reliance on alphabetic strategies, which probably explains a large portion of variance. The Afrikaans orthography allows most words and non-words to be spelt correctly with an alphabetic strategy based on the languages' phonology alone and as a result less logographic strategies are needed or may be still developing in the present sample in support of Wimmer et al's (1990) findings that logographic strategies are used by young German spellers only by the start of Grade 4 (Coetzee, 1985; Doctor et al., 1987; Seymour et al., 1991, 2003). In the case of the bilingual children learning to spell in a transparent orthography such as Afrikaans, this may have influenced the development and an understanding of the importance of letter-sound correspondence rules for spelling success in a transparent orthography, which in turn explains the bilingual children's good overall Afrikaans word and non-word spelling ability as well as the small difference between Afrikaans word and non-word spelling skills. Thus, the effect of orthography on the rate of learning to spell in dissimilar orthographies is highlighted by the way the bilingual children approached spelling in their first transparent language as well as in their opaque second language. Shallow orthographies due to their simplicity may permit the development and use of decoding skills to occur more quickly than in a opaque language such as English, which demands engaging in dual-process learning consisting of discriminating the visual-spatial groups of letters, identifying and blending the individual letter sounds in order for a word to be spelt (Seymour et al., 1992). Spelling under these conditions where attention and processing resources are divided occurs more slowly than spelling under conditions where all resources can be focused on a single function, which

is implied in the use of grapheme-phoneme correspondences to spell in a transparent orthography as most words can be decode due to the 1:1 relation between letters and sounds and as a result less simultaneous processing is needed. Indeed, the spelling errors found in the monolingual children's English and non-word spelling and in the bilingual children's English and Afrikaans word and non-word spelling suggests that learning to spell in Afrikaans is much easier than learning to spell in English as a L1 or L2. The latter demands a wider range of cognitive processing skills than the former.

Overall, the results of the regression analyses provide an overall perspective of the main findings of the study; regarding the central research issue of the relationship between simultaneous processing and sequential processing and spelling. It is concluded that (a) both processing strategies are related to spelling English and Afrikaans words and non-words and are applicable to monolingual children spelling in their opaque first language and bilingual children spelling in both their dissimilar language orthographies, (b) both lexical or logographic and non-lexical or alphabetic spelling strategies are used concurrently in both languages at one point in time, (c) spelling strategy differences in phonological decoding in each languages can influence a smooth or challenging pattern of spelling attainment in bilingual children learning to spell in dissimilar orthographies (d) tasks demands and orthographic depth may interact with global L2 proficiency in determining the course of L2 spelling development, particular in bilingual children learning to spell in dissimilar L1 and L2 orthographies simultaneously (e) spelling in a transparent mother tongue influences the negative transfer of L1 spelling strategies to spelling in an opaque L2, suggesting that formal instruction in the orthographic specific patterns and concurrent developing L2 oral language proficiency and spelling skills are important for bilingual children spelling in English as a second language which differs to their transparent mother tongue. Therefore the results suggest that lexical (simultaneous processing) or whole word processes and non-lexical processes (sequential process) are used by both groups of children to spell English and Afrikaans words and non-words. Both routes are necessary to spell in both languages, however the degree to which they are utilised varies depending on the language's orthography as evident in the bilingual children's L1 good Afrikaans spelling ability, which relies largely on grapheme-phoneme correspondences as most Afrikaans words and non-words can be decoded using sound alone although some logographic were also evident. In contrast the bilingual children's lower spelling ability of English words and non-words is explained in terms of negative transfer, and ongoing L2 oral language proficiency

development which is developing alongside their L2 spelling skills. However, it is important to remember that the orthographic dissimilarity between L1 and L2, means that each language requires a different approach in terms of emphasis placed on simultaneous processing and sequential processing strategies for spelling success. The relationship between simultaneous processing and sequential processing strategies and spelling highlighted in the correlational and regression analyses demonstrate that spelling in Afrikaans biases towards a phonological strategy. However spelling in English requires both lexical (logographic) and sub-lexical (alphabetic) or simultaneous processing and sequential processing strategies as English unlike Afrikaans has a high proportion of words that do not conform to regular grapheme-phoneme sound rules (Wijk, 1966; Venesky, 1970; Kaufman & Kaufman 1983b; Seymour, 1990; Seymour et al., 1992, 2003).

Together, the idea is that neither cognitive processing skills nor phonological/orthographic skills that underlie spelling attainment are completely independent (Greenop, 2004) thus each skill is important for spelling as each provides a different view or perspective on the spelling process. The way a child spells a word provides insight into the processing strategies he/she is using to process and spell a word. However, it is important to note that both groups did not differ in terms of overall intellectual ability. This result support's Stanovich (1986) view and Siegel's (1999) findings that cognitive processing skills are necessary for spelling achievement as cognition and the spelling development have a variable reciprocal relationship throughout spelling development. Aspects of simultaneous processing (logographic or whole-word spelling strategies) and sequential processing (alphabetic or non-lexical spelling strategies were found to be predictors of spelling in both languages, demonstrating the importance of measuring these constructs. Importantly, the results of the present study support and extend previous cross-linguistic research of how the transparency of language's orthography has an effect on the relationship between simultaneous processing and sequential processing and spelling in monolingual and bilingual children. In particular how both spelling strategies are relied upon and used in different languages orthographies. Spelling English words and non-words relies on both types of processing spelling strategies, but due to it's opaque letter sound rules a greater degree of simultaneous processing than some sequential processing is evident, whilst spelling Afrikaans words and non-words demonstrates a clearer relationship with sequential processing than simultaneous processing as most words can be spelt using the language's phonology alone.

5.5 IMPLICATIONS OF FINDINGS:

In terms of teaching implications this research has shown that while both groups of Grade three children are at the same level of intellectual or spelling ability, the cognitive processing and strategies on which they use and rely to do this is different. If teaching programmes are aware of these differences they may be tailored to suit the language in which the child is learning to spell in. In teaching Afrikaans spelling the alphabetic principle and how to decode letter-sound correspondence rules in words and non-words seems critical due to its transparent orthography. However the aim of teaching English spelling to monolingual children and bilingual second language learners of English children is to teach them to spell visually using analogy strategies to known words as well as focus on teaching them the alphabetic principle to decode letter-sound correspondences in new and unfamiliar words. Teaching how to spell in English to bilingual Afrikaans-English children should work towards and incorporate their cognitive processing strength as identified in the Hand Movements subtest. For example emphasizing letter-sound relationships to build their confidence and motivation to continue spelling as well as how to spell visually by using groups of letter sequences in some words to spell other words. It is important to identify whether the spelling difficulty is at the level of sequential processing or simultaneous processing strategies or implicitly phonological awareness skills in order to tailor an appropriate remediation process (Kirby, 1988; Kaufman & Kaufman, 1983b). Providing opportunities to decompose, analyse letter sounds, examine words, make connections across words to abstract patterns strengthens pathways within and between lexical items and establishes connections at the neurological level (Foorman, 1995). Kaufman and Kaufman (1983b) and Naglieri (1999) have pointed out the importance of both simultaneous and sequential processing modes for spelling success as both strategies are needed to attain orthographic skilled spelling as argued by Seymour et al.,'s (1992, 2003) models. However, the results of the present study have shown that although simultaneous processing and sequential processing strategies were found and available in both languages both cognitive processing strategies are needed to different degrees or uniquely combined for spelling success in English and Afrikaans. Thus, spelling models and an assessment of cognitive processes necessary to spell need to take into consideration the nature of the transparency of the orthography that the child is learning to spell in (Spenser et al., 2003; Greenop, 2004). The importance of examining bilingual transfer is important both for assessment as well as for theoretically reasons. Durgunoĝlu (2002) argues that cross-language transfer could be

used as a potential diagnostic tool. The reasoning being that if bilingual children have had enough exposure and instruction in their first language (L1) and one is able to assess these skills and insights in their strong L1 one could expect these to transfer to their second language. The bilingual children's spelling performance demonstrated positive correlations between spelling in English and Afrikaans, and their spelling errors present evidence of a transfer of sequential phonemic analysis spelling strategies from learning to spell in a transparent L1 to an opaque L2. According to Kirby (1988) and Kaufman and Kaufman (1983b) sequential processing is important to analyse the sounds that make up a word by using letter-sound correspondence rules and represents a grasping of the alphabetic principle as a result of spelling instruction in both languages (Adams, 1990). Sequential processing was within the normal range for both groups, although sequential processing contributed more to spelling in Afrikaans than in English, because the relationship between letters and sound supports easier and faster computation and as a result bilingual children may acquire one grapheme-phoneme correspondence mechanism, which is then used to spell in both languages. This has implications for one of the challenges facing educators working in multilingual settings who wish to identify the causes of spelling difficulties of bilingual learners (Baker, 1993, 2000; Cummins, 1981; Durgunoglu, 2002; Geva & Wang, 2003). Similar to monolingual spellers, dyslexic bilingual readers and /or spellers regardless of language orthography consistently demonstrate a phonological processing skill deficit or poor sequential processing spelling strategies (Das et al., 1994; Durgunoğlu, 2002). In the present study bilingual children were able to transfer their well-developed and practiced L1 strategy to spelling in their second language (L2). Sequential processing skills represent a common source of metalinguistic cognitive abilities or decoding skills in both English and Afrikaans as both these languages are classified as alphabetic languages, whereby letters are used to represent or symbolise sounds. Therefore bilingual children who are sensitive to these cognitive skills when spelling in their L1 accumulate this insight to spelling in their L2. As Bialystok (2002, p. 192) explains " there is no single and generalized effect of bilingualism in the development of literacy skills. However, there are important differences in the way these are acquired by bilingual children, which are governed by the structure of the specific languages and writing systems. For this reason alone, bilingualism predictably impacts on children's ultimate acquisition of literacy."

5.6 CRITIQUE: STRENGTHS AND LIMITATIONS OF THE PRESENT STUDY

According to Bialystok (2002, p.160) "Little research has directly investigated the impact of bilingualism on the supreme achievement of schooling and its most indelible academic legacy: the acquisition of literacy." The present research study contributes research addressing this concern by having investigated the cognitive processes that bilingual children use to spell in their transparent L1 and in their opaque L2. The aims of this research were twofold. Firstly to describe and explain the orthographic differences apparent in the relationship between simultaneous and sequential processing and spelling skills in monolingual English and bilingual Afrikaans-English children. This study was one of the first to explore the mutual influential relationship argued by Kirby (1988) and Kaufman and Kaufman (1983b) between simultaneous processing and sequential cognitive processing skills and learning to spell in monolingual children learning to spell in their opaque L1 and bilingual children learning to spell in dissimilar orthographies, and the effects of orthographic transparency on the spelling development of monolingual and bilingual Grade 3 children. Secondly, the present study examined the transfer of spelling strategies between L1 and L2 in bilingual children learning to spell in dissimilar orthographies, which is fairly new and addresses a gap in traditional spelling models but has important implications for spelling instruction of bilingual children (Bialystok, 2002). The current research adds to the field, and stimulates research into the importance of learning to spell in a language other than English (Spenser et al., 1992, 2003). Thirdly, the present study locates itself within the fields of developmental cognitive psychology (models of spelling, phonological decoding, orthographic depth hypotheses, spelling development, bilingualism), neuropsychology (simultaneous processing and sequential processing) and has integrated research from various cognitive and neuropsychological areas to explore the significant differences in simultaneous processing and sequential processing and spelling development in monolingual English and bilingual Afrikaans-English children. The present study demonstrated the variable use of spelling strategies in monolingual and bilingual children and the necessity of incorporating orthography depth into spelling models as well as the importance of including simultaneous processing and sequential processing measures, which permits an understanding of how the brain processes spelling information as well as offers a better theoretical model than static reasoning and memory for viewing the dynamic processes that underlie cognitive tasks (Luria, 1970; Das, 1992a). In particular once connected to orthography these processing strategies provide a valuable description of the individual differences found in monolingual

children's spelling skills, as well as within and across the bilingual children's spelling skills. Fourthly, the present study utilised methodological triangulation in the form of quantitative spelling measures and qualitative spelling error analyses. The qualitative error analyse served to add insight and meaning to the spelling scores by demonstrating how both the monolingual and bilingual children had levels of spelling knowledge and demonstrated an understanding of strategies used to spell in their first and second language respectively. However it must be acknowledged that this research study is affected by overall limitations and weaknesses inherent in the *design, sample, instruments* and that need to be addressed in future research, which will be discussed below.

5.5.1 Design Considerations

The design utilised in the present study was an exploratory, cross-sectional and expost-facto in nature (TerreBlanche & Durrheim, 2002). The results of the present study necessitate replication to examine whether the orthographic trends remain in order for their theoretical significance to be incorporated into a theoretical model of spelling to guide teaching and assessment. Only then can a more definitive conclusion be made regarding the importance of orthographic differences playing a significant role in cognitive processing strategies, spelling ability, and the associated relationship between simultaneous processing and sequential processing and spelling words and non-words in English and Afrikaans. Although a contrast group consisting of monolingual English children was utilised, the absence of random assignment limits the possibility of making any definite causal conclusions (Coolican, 2004). Additionally, more in depth detail could be gained in examining children learning to spelling in different orthographies of various ages and across different grades in a longitudinally study.

5.5.2 Sample and Sampling Strategy

The non-probability and convenience sampling strategy utilised in the present study illustrates the specificity of bilingual Afrikaans-English sample and an additive model of bilingualism. In particular the specificity of the present study's sample of bilingual children from a dual-medium school limits the generalisability of the findings to a great extent, as they cannot be generalised to all bilingual children in South Africa. Although the present sample was drawn from within the same demographic area, future research may wish to investigate socio-economic differences. Geva and Wang (2003) have noted that apparent difference in these variables may explain monolingual and bilingual reading and spelling differences, thus

future research could examine these variables as covariates. Further research could replicate the present study and increase the sample size to examine oral language proficiency, or other cognitive processes that are important for spelling such as processing speed, syntactical or morphological knowledge for orthographic effects. Both groups of children demonstrate the same cognitive processing skills (simultaneous processing and sequential processing scales were not significantly different) for but both have done this using different strengths or unique combinations of simultaneous (logographic) and sequential (alphabetic) processing skills. In the present study each language orthography demonstrated a relationship between simultaneous processing and sequential processing and spelling, but there were specific differences to the language of spelling instruction that informed the spelling strategies that are used to spell. Afrikaans biases towards a phonological strategy as most words can be spelt successfully using an alphabetic strategy and as a result logographic strategies are less needed. However in English both lexical (logographic) and sub-lexical (alphabetic) or simultaneous processing and sequential processing are needed for spelling in English, with a greater emphasis on simultaneous processing that sequential processing skills as most words do not conform to grapheme-phoneme sound rules. Further research with a larger sample size could explore the exact nature of the cognitive strategies used in spelling words and non-words, by including measures of the levels of phonological awareness, as this may reliably point to the exact linguistic level of most importance to spelling in a specific language. In addition the results of the regression analyses highlight that simultaneous processing and sequential processing strategies do not fully explain spelling Afrikaans words and non-words to the same extent as they do in spelling English words and non-words in monolingual and bilingual second language spellers of English. Afrikaans can be decoded primarily focusing on letter sound rules that correctly describe the spelling of most written words and as a result less logographic strategies are needed, which further suggests that a greater reliance on alphabetic strategies probably explains a large portion of the variance of spelling Afrikaans words and non-words. The bilingual children‘s performance on spelling Afrikaans word and non-word measures indicated an overall good spelling ability. Further research studies within a larger sample size, may need to control for letter-sounding or phonological-decoding phonemic analysis tasks to establish the precise extent to which alphabetic skills alone predict spelling in Afrikaans in comparison to English in bilingual children learning to spell in a transparent L1 and opaque L2, as well as in monolingual English and Afrikaans children.

5.5.3 Instrumentation and Data Analysis Techniques

The K-ABC standard scores that make-up the age-graded norms were designed to be culturally fair (Kaufman & Kaufman, 1983a; Skuy, et al., 2000; Greenop; 2004) and appropriate to use with bilingual children (Fourqean, 1987; Flanagan, 1995). Further research may wish to develop norms for South African children. Research in this area is vital as little research exists in South Africa (Viljoen, Levett, Tredoux & Anderson, 1994; Foxcroft & Roodt, 2002). The present study indicates that the K-ABC is a useful measure to assess cognitive processing ability and using standard scores in the data analyses provides a consistent comparison between the two groups. The present study utilised Klein's (1993) English and Afrikaans word and non-word spelling tests that were matched for frequency, word-length, number of syllables and were valid measures that permitted an investigation into the spelling processes of monolingual and bilingual children, as the orthographic differences observed in the cognitive processes used to spell are not due to non-equivalent spelling tests (Klein, 1993). The present study demonstrated the psychometric reliability of Klein's (1993) spelling measures in the current sample (see Table 3.3). However, Klein's (1993) English and Afrikaans word and non-word spelling measures contain no norms; future research could examine monolingual and bilingual spellers in order to establish norms, as spelling difficulties could be better identified using South African norms, than using other international spelling tests which are normed on other populations. The present study found that orthographic differences place different demands on cognitive processing resources. Durgunoĝlu andVerhoeven (1998) point out that language is a social entity that is used by people to delineate their cultural or linguistic identities. Kotze (1987), Steyn (1995), Slabbert and Myers-Scotton (1997) argue that Afrikaans-speaking parents tend to want their children to be taught to spell using their child's first language in addition to learning to spell English as they place value in their children retaining their mother tongue, in contrast to L1 Zulu or Sotho speaking parents who place a greater value on learning to spell in English as an L2, than their mother tongue Kamwangamalu (1997). The present sample of bilingual children attending dual-medium instruction was sampled within the Johannesburg area, whereby schools are given the choice regarding language of instruction. This may have resulted in Afrikaans being used as the primary medium of instruction and in balanced bilingualism not being fully maintained (Klein, 1993; Swann, 2000). In the Johannesburg area many Afrikaans speaking communities are found due to social and historical reasons (Bram & Phelps, 1985; HSRC, 1996; UNESCO, 2000) associated with the Great Trek (1835-37). The

Great-Trek came due to the Afrikaans speaking population in the Cape refusing to be ruled by an English foreign power, and this in turn triggered the Anglo-Boer War (1899-1902) as the Afrikaans-speaking individuals wanted to keep themselves culturally and socially separate from the English, which represents a social-cultural political factor that has remained unchanged even to the present (Steyn, 1995). The present study did not assess or include a measure of socio-cultural linguist values and attitudes of Afrikaans and English of the bilingual children's parents, and future research in this regard is needed such as a specific qualitative ethnographic study, due to the importance of socio-political attitudes and values placed on learning more than one language and assumed equality among the 11 official South African languages as suitable mediums of spelling instruction (Buthelezi, 2003; Pandor, 2004). Only then can a more definite conclusion be made regarding the socio-cultural linguistic perceptions and values that may be influencing the bilingual Afrikaans-English children's spelling performance in their orthographically dissimilar L1 and L2.

5.7 SUMMARY OF FINDINGS IN THE PRESENT STUDY

It is important to note that both groups did not differ in terms of overall intellectual ability and were found to have the same level of cognitive processing ability as no significant differences were found on the K-ABC simultaneous processing and sequential processing scales, although their reliance on two subtests varied significantly across language orthographies. Spelling English and Afrikaans words and non-words places importance on simultaneous processing and sequential processing skills, as there were similarities in using simultaneous processing or logographic strategies and sequential processing or alphabetic strategies across languages, but the significant spelling results and predictors found suggests that each language orthography requires a different approach and a unique combination of both these processing strategies for spelling success, with the orthography of each language dictating the manner in which these cognitive processing strategies are used to spell even when the same teaching approaches are present at one point in time. According to Bialystok (2002, p. 16) "Literacy development in multilingual contexts emerges out of specific knowledge of the linguistic forms and orthographic spelling principles of individual languages and is unique to each of the child's languages". This was found in the present study as each language demonstrated a different and unique concurrent relationship between simultaneous processing, sequential processing and spelling. Orthographic differences between both languages, are particular evident in the bilingual children's spelling, whose L1 is transparent and L2 is opaque, as spelling success in each language requires a unique

combination of simultaneous processing or sequential processing or alphabetic strategies for spelling success. Sequential processing or alphabetic strategies demonstrated a positive relationship with spelling English and Afrikaans words and non-words, but contributed more to spelling in a shallow orthography most Afrikaans words and non-words can be spelt using sequential processing or alphabetic strategies based on this language's phonology alone. Spelling English words and non-words requires both simultaneous processing and sequential processing processes for spelling as most English words and non-words can be spelt using analogy, which relies on a greater extent on simultaneous processing than on sequential processing strategies (Goswami, 1999). This processing combination is unique to English because most English words and non-words cannot be decoded by sound alone due to the complexity of its orthography and ambiguous letter-sound rules. The overall educational implication of the findings implies that bilingual children learning to spell in dissimilar orthographies need formal spelling instruction in the unique combinations of sequential processing or alphabetic strategies and simultaneous processing or logographic strategies specific to spelling in their opaque L2, in addition to the unique cognitive processing combination needed to spell in their transparent L1. This would permit them to overcome the negative transfer effects of using a predominately alphabetic strategy (sequential processing) and lesser reliance on a simultaneous processing strategy (which may be still developing alongside the L2 oral language proficiency and spelling instruction) due to the predictability of the letter-sound correspondence rules in their L1. A sequential processing strategy alone is less effective for spelling in an opaque orthography such as English but remains an effective strategy for spelling in a transparent orthography such as Afrikaans. Only then can these bilingual children gain more from learning to spell in two dissimilar languages over and above their ability to demonstrate an awareness of decoding skills in both their languages which characterises their spelling development and their qualitative spelling approach (Geva, 2000; Bilaystok, 2002).

5.8 CHAPTER SUMMARY

This chapter presented a discussion of findings of the four research questions and whether they agreed or disagreed with previous empirical and theoretical literature. Implications of the findings for teaching, assessment, theoretical models of bilingual spelling were noted, as well as the strengths, weakness and conclusions reached in the present study. In essence, the transparency of a language's orthography influences the ease with which spelling strategies are used and uniquely combined to spell successfully in diverse language orthographies.

REFERENCE LIST

Adams, M. J. (1990). *Beginning to read: Reading, thinking and learning about print. Cambridge*: MIT Press.

Anastasi, A. (1988). *Psychological Testing*. New York: Macmillan Publishing Company.

Arnsberg, A & Arnsberg, A. In. Harris, R. J. (1992*). Cognitive Processing in Bilinguals.* Amsterdam: Elsevier Science.

Aro, M., & Erksine, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics, 24*, 621-635.

Ashman, R. C., & Das, J. P. (1980). Relation between planning and simultaneous-successive processing. *Perceptual and Motor Skills*, 51, 371-382.

Baker, (2000). *The Care and Education of Young Bilinguals: An Introduction for Professionals*. United Kingdom: Multilingual Matters.

Baker, C. (1993). *Foundations of Bilingual Education and Bilingualism*. United Kingdom: Multilingual Matters.

Ball E. W., & Blachman, B. (1991) Does phoneme segmentation training in kindergarden make a difference in early reading and development of spelling. *Reading Research Quarterly, 26*, 49-66.

Bialystok, E. (1991). *Language processing in bilingual children*. Great Britain: Cambridge University Press.

Bialystok, E. (1999). Cognitive complexity and attentional control in the bilingual mind. *Child Development, 70*, 636-644.

Bialystok, E. (2002). Acquisition of literacy in bilingual children: A framework for research, *Language Learning, 52 (1),* 159-199.

Bialystok, E., Majumder., S., & Martin, M.M. (2003). Developing phonological awareness is their a bilingual advantage? *Applied Psycholinguistics, 24,* 27-44.

Bhatia, T. K., & Ritchie, W. C. (1999). The bilingual child: Some issues and perspectives. In W. C. Ritchie, & T. K. Bhatia (Eds.), *Handbook of child language acquisition* (pp.569-643). San Diego: Academic Press.

Blachman, B. A. (2000). Phonological awareness. In M. L. Karnill & P.B. Mosethal (Eds.). *Handbook of reading research* (Vol 3, pp 483-502). New Jersey: Erlbaum.

Boden,C &Kirby, J. R. (1995). Successive processing, phonological coding and the remediation of reading. *Journal of Cognitive Education, 4 (2&3),* 19-32.

Boder, E. (1973). Developmental dyslexia: A diagnostic approach based on three atypical reading-spelling patterns. *Developmental Medicine and Child Neurology, 15,* 663-687.

Botha, J. P., & Aardt, J. M. H. (1981*). Afrikaans vir die Praktyk*. Johannesburg: McGraw Hill.

Botha, T. J. R., Ponelis, F. A., Combrink, J. G. H., & Odendaal, F. F. (1989). *Inleiding tot die Afrikaans Taalkunde*. Pretoria: Academica.

Bournot-Trites, M. Jarman, R. F., & Das, J. P. (1996) Luria's language theory within a cognitive theory. *Aphasiology, 9(2),* 123-135.

Bracken, A, B. (1985). A critical review of the Kaufman Assessment Battery (K-ABC). *School Psychology Review, 14(1)*, 21-36.

Bradley, M., & Bryant, P. E. (1980). Why children sometimes write words which they cannot read. In U. Frith. (Ed.). *Cognitive processes in spelling*. London: Academic.

Bradley, M., & Bryant, P. E. (1985). *Rhyme and Reason in Reading and Spelling*. United States of America: University of Michigan Press.

Bradshaw, J. L., & Mattingley, J. B. (1995). *Clinical Neuropsychology: Behavioural and Brain Scienc*e. London: Academic Press.

Bram, L. L., & Phillips, R. S. (1986). The Anglo-Boer War (1899-1902*). Funk & Wagnall's New Encyclopaedia, Volume 4*, 184-185.

Bryant, P. E., Bradley, M. MacLean, M. & Crossland, J. (1990). Nursery rhyme, phonological skills and reading. *Journal of Child Language, 16*, 407-428.

Burns, J. M., & Richgels, D. J. (1989). An investigation of the task requirements associated with invented spelling of 4 year olds with above average intelligence. *Journal of Reading Behaviour, 21,* 1-14.

Burt, J. S., & Tate, H. (2002). Does a Reading Lexicon provide orthographic representation for spelling? *Journal of Memory and Language, 46*, 518-543.

Buthelezi, Z. (2003). Researchers, Beware of your assumptions! The Unique case of South African Education. Paper presented at the IRA Multilanguage Literacy Symposium held in July 2003, Edinburgh, and Scotland, Online Document, p1-9, Accessed on April, 27th, 2005 at URL: http://www.readingonline.org/international/edinburgh/buthelezi.

Byrne, B., & Fielding-Barnsley, R. (1995). Evaluation of a programme to teach phonemic awareness to young children: A 2-and 3-year follow-up and new preschool trial. *Journal of Educational Psychology, 87*, 499-503.

Campbell, L. (1998). *Historical Linguistics*: *An Introduction*. Edinburgh: Edinburgh University Press.

Caravoulas, M. & Bruck, M. (1993). The effect of oral and written language input on children's phonological awareness: *A cross-linguistic study. Journal of Experimental Child Psychology, 26 (3),* 429-438.

Census, (1996). Census in brief; Report no: 03-01-11(1996]), Online Document, 1-2, Accessed on April, 20th, 2005 at URL: http://www.info.gov.za/reports/ 2003/census01_key.pdf.

Census, (2001). *Statistics South Africa: Key Results: Language*. Online Document, 1-8, Accessed on April, 20th, 2005 at: httpwww.info.gov.za/ otherdocs/2003/ census01_key.pdf.

Chall, J. S. (1996). *Stages of reading development*. (2nd ed.). Orlando: Harcourt Brace College Publishers.

Chattin, S. H & Bracken, B. A. (1989). School psychologists' evaluation of the K-ABC, McCarthy Scales, Stanford-Binet IV and WISC-R. *Journal of Psychoeducational Assessment 7(2)*, 112-130.

Chen, Z., &Siegler, R. S. (2000). Intellectual development in childhood. In R. Sternberg (Ed.). *Handbook of Intelligence*. United Kingdom: Cambridge: University Press.

Chisholm, L. (2000*). A South African Curriculum for the 21st Century: Report of the review committee on curriculum 2005*. Presented the Ministry of Education Professor Kadar Asamal. Online Document, Accessed on June 20, 2005 at URL: http://education.pwv.gov.za/policies/reports_2000/2005.htm.

Cisero, C, A., & Royer, J. M. (1995). The development and cross-language transfer of phonological awareness, *Contemporary Educational Psychology, 20*, 275-303.

Coetzee, A. E. (1985). *Fonetiek.* Pretoria: Academica.

Coffman, W. E. (1985). Review of the Kaufman Assessment Battery for Children. *In The ninth mental measurement yearbook*. Lincoln, Buros Institute of Mental Measurement.

Cohen, R.J., & Swerderlik, M. E. (2002). *Psychological Testing and Assessment.* United States of America: McGraw Hill Companies, Inc.

Coltheart, M. (1978). Lexical access in simple reading tasks. In G. Underwood (Ed.). *Strategies of information processing*, (pp. 151-216). Academic Press. London.

Coltheart, M. (1982). The psycholinguistic analysis of acquired dyslexics: Some illustrations. *In Philosophical Transactions of the Royal Society of London,* 151-164.

Coltheart, M., Curtis., & Atkins, P. (1992). Models of reading aloud: Dual route and processing approaches.

Comeau, L., Cormier, P., Grandmaison., & Lacroix., D. (1999). Awareness of phonological segments and reading ability in Italian children. *Applied Psycholinguistics, 9,* 1-16.

Cossu, G., Shankweiler, D., Liberman, I., Katz., & Tola, G. (1998). Awareness of phonological segments in reading ability in Italian children. *Applied Psycholinguistics, 8*, 1-16.

Coolican, H. (2004). *Research Methods and Statistics in Psychology*. (4th ed.). London: Hodder & Stoughton Educational.

Cummins, J. (1979). Linguistic interdependence and the educational development of young bilingual children. *Review of Educational Research, 49*, 221-251.

Cummins, J. (1981). Age on arrival and immigrant second language learning in Canada: A reassessment, *Applied Linguistics, 2*, 132-149.

Cummins, J. (1999). Alternative paradigms in bilingual education research: Does theory have place? *Educational Researcher, 28(7*), 26-32.

Cunningham, A., Stankovich, K. E. (Spring/Summer, 1998). *What Reading does for the Mind*. American Educator/American Federation of Teachers, 1-8.

Cunningham, A.E (2005). The effect of learning to read on children's minds. Online Documents, 1-16, Accessed on April 20, 2005 at URL: *http://www.childrenofthecode.org/interviews/cunningham.htm.*

Das, J. P .(1972). Patterns of cognitive ability in non-retarded and retarded children. *American Journal of Mental Deficiency, 77*, 6-12.

Das, J. P. (1992a). Beyond a unidimensional scale of merit. *Intelligence, 16,* 137-149.

Das, J. P. (1992b). The relevance of psychology in a developing country. *Psychology and Developing Societies, 4(1),* 5-19.

Das, J. P . (1995). Is there life after phonological coding? *Issues in Education, 1(1),* 97-90.

Das, J. P. & Abbott, J. (1995). PASS: An alternative approach to intelligence. *Psychology and Developing Societies, 7(2),* 155-184.

Das, J. P., Bisanz, G.L., & Mancini, G. (1984). Performance of good and poor readers on cognitive tasks: Changes with development and reading competence. *Journal of Learning Disabilities, 17*, 549-555.

Das, J. P., Kirby. J. & Jarman, R. F. (1975a). Simultaneous and Successive synthesis: An alternative model for cognitive abilities. *Psychological Bulletin, 82,* 87-103.

Das, J. P., Kirby, J & Jarman, R. (1975b). *Simultaneous and Sequential Cognitive Processes.* New York: Academic Press.

Das, J. P., & Mishra, R.K., & Kirby, J. R. (1994). Cognitive patterns of children with Dyslexia: A comparison between groups with high and average non-verbal intelligence. *Journal of Learning Disabilities, 27,* 235-242.

Das, J. P., Naglieri, J. A & Kirby, J. R. (1994). *Assessment of Cognitive Processes.* Boston: Allyn & Bacon.

De Klerk, V. & Bosch, B. (1994). Language attitudes in the Eastern Cape: tri-lingual survey. *South African Journal of Linguistics, 12(2):*50-59

Denckla, M., B. (1979). Childhood learning disabilities. In K. M. Heilman and E. Valenstein: *Clinical Neuropsychology* (Eds). New York: Oxford University Press.

De Oliveira, M. K. & Valsiner, J. (1998). Introduction: To be or not to be … literate. In M . K. Oliveira and J. Valsiner, *Literacy in Human Development*. London: Abex Publishing Corporation.

Delfior, S., Martos, F., & Cary, L. (2002). Differences in reading acquisition development in shallow orthographies: Portuguese and Spanish. *Applied Psycholinguistics, 23*, 135-148.

Department of Education (2005). *Curriculum: 2005*. Retrieved June 2005 at: www.education.pwv.gov.za.

Deumert, A and Swart. (2000) Language Planning and Policy. In R. Mesthrie, J. Swann, A., Deumert & W. L. Leap (2001*). Introducing Sociolinguistics*. Edinburgh: Edinburgh University Press. (p 384-418).

Dijksta, T., van Heuven., & Grainjer, J. (1998). Simulating cross-language competence within the Bilingual Interactive Activation Model. *Psychologia Beligica, 38*, 177-196.

Doctor, E. A., Ahmed., R., Ainslee, V., Cronje, T. Klein, D., & Knight, S. (1987) Cogntive aspecs of bilingualism. *South African Journal of Psychology, 17 (2*), 56-62.

Donaldson, B. C. (1991). *The influence of English on Afrikaans: A case study of linguistic change in language contact situation.* Pretoria: Van Schaik (Pty) Ltd.

Draper, N. R., & Smith, H. (1966). *Applied Regression Analysis*. New York: John Wiley & Sons Inc.

Duncan, L. G., & Seymour, P.H.K. (2000). Socio-economic differences in the foundational level. *British Journal of Psychology, 91,* 145-166.

Durgunoĝlu, A. Y., Nagy. W. E., & Hancin-Blatt, B. J. (1993). Cross-transfer of phonological awareness. *Journal of Educational Psychology, 85 (3),* 453-465.

Durgunoĝlu, A. Y., & Oney, B. (1999). A cross-linguistic comparison of phonological awareness and word recognition. *Reading and Writing: An interdisciplinary Journal, 11*, 281-299.

Durgunoĝlu, A. Y., & Verhoeven, L. (1998). *Literacy Development in a Multilingual Context: Cross-cultural Perspectives*. New Jersey: Lawrence Erlbaum Associates.

Durgunoĝlu, A. Y. (2002). Cross-linguistic transfer in literacy development and implications for language learners. *Annals of Dyslexia, Vol 52, 189-205*.

Ehri, L. C. (1986). Sources of difficulty in learning to spell and read. In M. L. Wolraich & D. Routh (Eds.). *Advances in the development and behavioural paediatrics* (Vol 7, pp. 121-195). Greenwich: JAI Press.

Ehri, L.C. (1997). Learning to read and learning to spell are one and the same, almost. In C.A. Perfetti, L. Rieben, & M. Fayol (Eds.), *Learning to spell: Research, theory, and practice across languages* (pp. 237-269). Mawah, NJ: Erlbaum.

Ehri, L. C., Nunes, S. R. Willows, D. M., Schuster, B. V., Yaghoub-Zadeh., Z., & Shanahan, T. (2001) Phonemic awareness helps children to read: Evidence from the National Reading Panel's metal-analysis. *Reading Research Quarterly, 36*, 250-587.

Ellis, W. A. and Young, W. A. (1996). *Human Cognitive Neuropsychology: A textbook with readings*. Hove: Psychology Press, Ltd, Publishers.

Eysenck, M. W., & Keane, M. T. (1995). *Cognitive Psychology: A Student's handbook.* London: Lawrence Erlbaum Associates.

Elliot, D. C., Smith., P., & McCullough, K. (1990). *The Differential Ability Scales: A diagnostic spelling test*. Windsor: National Foundation for Educational Research (NFER-NELSON).

Fitzgerald, J (1995). English-as-a-second language learners' cognitive reading process: A review in the United States. *Review of Educational Research, 65(2),* 145-190.

Flanagan, R. (1995). The utility of the Kaufman Assessment Battery for Children (K-ABC) and the Weschler Intelligence scales for linguistically different children: Clinical Considerations. *Psychology in schools, 32,* 5-11.

Foorman, B.R. (1995). Practiced connections of orthographic and phonological processing. In V.W. Berninger (Ed.), The varieties of orthographic knowledge, volume II: Relationships to phonology, reading and writing (pp. 377-418). Boston, Kluwer.

Fourquean, J. M. (1987). A K-ABC and WISC-R Comparison for Latino Learning-Disabled children of limited English proficiency. *Journal of School Psychology, vol 25(2),* 15-21.

Foxcroft, C., & Roodt, G. (2002). (Ed.). *An introduction to psychological assessment in the South African context.* Oxford: Oxford University Press.

Frith, U. (1985). *Beneath the surface of developmental dyslexia.* In Patterson, K., Coltheart, M., and Marshall, J. (Eds). Surface Dyslexia, Hove: Lawrence Erlbaum Associates.

Frost, R., Katz, L., Bentin, S. (1987). Strategies for visual word recognition and orthographic depth: A multilingual comparisons. *Journal of Experimental Psychology: Human Perception and Performance, 13 (1),* 101-115.

Frith, U. Landerl, K., & Wimmer, H., (1998). The impact on orthographic consistency on dyslexia: A German-English comparison, *Cognition, 63*, 315-334.

Fromkin, V., & Rodman,R. (1988*). An Introduction to Language* (6th ed.). Orlando: Holt, Rinehart and Winston.

Genesee, F., Lambert., & Holobow, N. E. (1986). The acquisition of second language by immersion: The Canadian Approach. *Infancia y Aprendizaje, 33*, 27-36.

Gentry, J. R. (1982). An analysis of developmental spelling: GNYS at work. *The Reading Teacher, 36*, 192-200.

Geva, E. (2000). Issues in the assessment of reading disabilities in L2 children-beliefs and research evidence. *Dyslexia (6),* 13-28.

Geva, E., Wade-Wooley, L., & Shany, M. (1997). The concurrent development of spelling and decoding in two orthographies. *Journal of Reading Behaviour, 25*, 383-406.

Geva, E., Wang, H. (2003). Spelling Performance. *Applied Psycholinguistics, 24, 1-23.*

Gibbons, P. (1997). *Teaching : A Cognitive Profile Perspective*, Online Document (p1-7). Accessed on June, 17th, 2005 at: URL: http:/www.gsep.pepperdine.edu/.

Gill, C.H., & Scharer, P.L. (1996). "Why do they get it on Friday and misspell it on Monday?" Teachers inquiring about their students as spellers. *Language Arts, 73*, 89-

Giordani, B., Boivin, M. J., Opel, B., Nyesila, D. D., & Lauer, R. E. (1996). Using the K-ABC with children in Zaire, Africa: An evaluation of the sequential-simultaneous processing distinction within an intercultural context. *International Journal of Disability, Development and Education, 43(1),* 5-24.

Glosser, G., Friedman, R, B., & Roeltgen, D. P. (1996). Clues to the Cognitive Organisation of Reading and Writing From Developmental Dyslexia, *Neuropsychology, vol, 10, no.2, 169-175*.

Goldstein, D. J., Smith, K. B., & Waldrep E. E. (1986). Factor Analytic study of the Kaufman Assessment Battery for Children. *Journal of Clinical Psychology, 42,* 890-894.

Goetz, E. T., & Hall, R. J. (1984). Evaluation of the Kaufman Assessment Battery for Children from an information-processing perspective. *Journal of Special Education, 18,* 281-296.

Goswami , U. (1988). Orthographic analogies and reading development. *Quarterly Journal of Experimental Psychology, 40A,* 239-268.

Goswami, U., & Bryant, P. (1990). *Phonological Skills and Learning to Read*. United Kingdom: Lawrence Erlbaum Associates.

Goswami,U., Gombert, J. E., & Barrera, F. (1998). Children's orthographic representations and linguistic transparency*, Applied Psycholinguistics, 19*, 19-52.

Goswami, U. (1999). The relationship between phonological awareness and orthographic representations in different orthographies. In M. Harris & G. Hatano (Eds.). *Learning to read and write: A cross-linguistic perspective* (pp.134-156). Cambridge: Cambridge University press.

Greenop, K. T. (2004). *The development of literacy skills in Zulu and Northern Sotho speaking children: A cognitive neuropsychological investigation*. Unpublished Doctoral Thesis: University of the Witwatersrand.

Grosjean, F. (1989). Neurolingusitcs, beware! The bilingual is not two monolinguals in one person. *Brain and Language, 36,* 3-15.

Hanon, P. (1995). *Literacy, Home, and School: Research and Practise in Teaching Literacy with Parents.* London: The Falmer Press.

Harris, R. J. (1992*). Cognitive Processing in Bilinguals.* Amsterdam: Elsevier Science.

Henderson, E. H., Beers, J. W. (1980). *Development and cognitive aspects of learning to spell: A reflection of word knowledge.* Newark, DE: International Reading Association.

Holopainen, L., Ahonene, T., Lyytinen, H. (2001). Predicting delay in reading and spelling achievement in a highly transparent language. *Journal of Learning Disabilities, 34*: 5: 401-414.

Hsieh, L., & Rapp, B. (2004). Functional magnetic resonance imaging of the cognitive components of the spelling process. *Brain and Language*, 6, 1-2.

Human Sciences Research Council (1996*). The socio-economic atlas for South Africa*, Pretoria: Human Sciences Research Council

Jared, D., & Kroll, J. F. (2003). Do Bilinguals Activate phonological representations in one or both languages when naming words? *Journal of Memory and Language, 44*, 2-31.

Jensen, A. R. (1962). Spelling errors and the serial position effect. *Journal of Educational Psychology, 56,* 334-336.

Kagan, A., & Saling, M. M. (1988). *An Introduction to Luria's Aphasiology: Theory and Application*: Johannesburg: WITS University Press.

Kamphaus, R.W., & Reynolds, C. R. (1987). *Clinical and research applications of the K-ABC*. Circle Pines, MN: American Guidance Service. Accessed on August, 27th 2005 at URL: http://www.aegnet.com/KABC.

Kamphaus, R. W. (1992). *Clinical Assessment of Children's Intelligence*, Boston: Alyn & Bacon.

Kamwangamalu, N. M. (1997). Multilingualism and education policy in post-apartheid South Africa: *Language Problems and Planning, 21 (3*), 234-253.

Karmiloff-Smith, A., Grant, J., Sims, K., Jones, M., & Cuckle, P. (1996). Rethinking metalinguistic awareness: Representing and accessing knowledge about what counts as a word, *Cognition, 58,* 197-218.

Kaufman, A. S., & Kaufman, N. L. (1983a). *K-ABC: Administration and Scoring Manual.* Circle Pines: American Guidance Service.

Kaufman, A. S., & Kaufman, N. L. (1983b). *K-ABC Interpretive Manual*. Circle pines: American Guidance Service.

Kaufman, A. S, & Kamphaus, R. W. (1984). Factor Analysis of the Kaufman Assessment Battery for Children (K-ABC) for the ages 2 ½ through 12 ½ years. *Journal of Educational Psychology, 76*,623-637.

Kaufman, A. S., Kamphaus. W., &Kaufman, N. L. (1985). New directions in intelligence testing: The Kaufman Assessment Battery for Children (K-ABC). IN. B. Wolman (Ed.). *Handbook of Intelligence: Theories, measurement and applications*. New York: Wiley.

Kaufman, A. S., & MacLean, J. E. (1987). Joint factor-analysis of the K-ABC and the WISC-R with normal children. *Journal of School Psychology, vol 25(2),* 105-118.

Kaufman, A. S. (1993). Joint exploratory factor analysis of the Kaufman Assessment Battery for Children and the Kaufman Adolescent and Adult Intelligence Tests *Journal of Clinical Child Psychology, 22,* 355-364.

Kaufman, A. S. (2000). Tests of Intelligence. In R. Sternberg. (Ed.). *Handbook of Intelligence*. United Kingdom: Cambridge University Press.

Keith, T. Z. (1985). Questioning the K-ABC: What does it measure? *School Psychology Review, 1,* 21-36.

Keith, T. Z., & Kranzler, J. H. (1999). The absence of structural fidelity precludes construct validity: Rejoinder to Naglieri on what the Cognitive Assessment System does and does not measure. *School Psychology Review, 28,* 117-144.

Kirby, J. R. (1988). *Individual differences and cognitive processing: Instructional application and methodological difficulties*. New York: Academic Press.

Kirtley, C., Bryant., MacLean, M. & Bradley, L. (1989). Rhyme, rime and the onset of reading. *Journal of Experimental Child Psychology, 48*, 224-245.

Kotze, E. F. (1987). A Black perspective on Afrikaans. In: Young, D. (ed.). Language: planning and medium in education. Rondebosch:Language Education Unit, University of Cape Town and SAALA.

Klein, D. (1993). *Bilingualism and Dyslexia: An Investigation*. Unpublished Doctoral Thesis. University of the Witwatersrand.

Kline, R. B. Snyder, J., & Castellanos, M. (1996). Lessons from the Kaufman Assessment Battery for Children (K-ABC): Towards a new cognitive assessment model. *Psychological Assessment, 8,* 7-17.

Kriegler, S. M., & Skuy, M. (1996). Perspectives on psychological assessment in South African schools. In P. Engelbrecht, S. M. Kriegler, and M. I Booysens (Eds). *Perspectives on Learning Difficulty*. Pretoria: J. L. Van Schaik Publishers.

Kooi,B. Y., Schultz, R. E & Baker, R.L (1965). Spelling errors and the serial position effect. *Journal of Educational Psychology, 53,* 105-109.

Lambert, W. E. (1978). Some cognitive and socio-cultural consequences of being bilingual.: Language and Linguistics (p214-229): In R. Mesthrie, J. Swann, A. Deumert & W. L. Leap (Eds.). *Introducing Sociolinguistics*. Edinburgh: Edinburgh University Press.

Landerl, K. (2000). Influences of orthographic consistency and reading instruction on the development of nonword reading skills. *European Journal of Psychology of Education, 15*, 239-257.

Language in Education Policy. (14 July 1997). Online Document, Accessed on August 20th, 2005 at URL: http://education.gov.za/polices_reports/langauge.htm.

Leap, W. L. & Mesthrie, R. (2000). Sociolinguistic and Education In R. Mesthrie, J. Swann, A. Deumert & W. L. Leap (Eds.). *Introducing Sociolinguistics*. Edinburgh: Edinburgh University Press. (p 354-383).

Lezak, M., D. (1998). *Neuropsychological Assessment*. Oxford: Oxford University Press

Liberman, I. Y., Rubin, H., Duques, S., & Carlisle, J. (1985). Linguistic abilities and spelling proficiencies in kindergartens and adult poor spellers. In D. B. Gray J. F. Kavanagh. (Eds.). *Biobehavioural measures of dyslexia* (pp.163-179). Parkton, MD: New York Press.

Luckett, K. (1991). "Ukufunda Ekhaya": Developing a culture of literacy in South African homes. Pietermaritzburg, South Africa. Online Document , Accessed on April, 25th, 2005 at URL: http://www.readininginline.org.

Lundberg, I., Olofosson, A., & Wall., S. (1980) Reading and spelling skills in the first school years from phonemic awareness skills in kindergarden. *Scandinavian Journal of Psychology, 21*, 159-173.

Luria, A. R. (1966a). *Higher Cortical Functions in Man*. New York: Basic Books.

Luria, A. R. (1966b). *Human Brain and Psychological Processes*. New York: Harper and Row.

Luria, A. R. (1970). The Functional Organisation of the brain. *Scientific American, 222*, 66-78.

MacDonald, C. A. (1989). Language in primary school: Pretoria: South Africa: Human Sciences Research Council. Online Document, Accessed on April, 25th, 2005 at URL: http://www.readininginline.org

MacLeary, H. (2004). The Relationship between Bilingualism and the performance of spatial task. *International Journal of Bilingual Educating and Bilingualism, vol 6 (6),* 423-438.

MacLean, M., Bryant, P., & Bradley, L. (1987). Rhyme, nursery rhymes and reading in early childhood. *Merrill-Palmer Quarterly, 33*, 255-282.

Mann, V. A., Tobin., Wilson, R. (1987) Measuring phonological awareness through the invented spelling of kindergarten children. *Merril-Palemer Quarterly, 33*, 351-391.

Matazow G. S., Kamphaus, F. A., Stanton, H. C., & Reynolds, C. R. (1991). Reliability of the Kaufman Assessment Battery for Children for Black and White Children. *Journal of School Psychology, 29*, 57-63.

Meschyan, G., & Hernandez, A, E.(2005). Impact of language proficiency and orthographic representation on bilingual word reading: A fMRI investigation. *Journal of Neuroimage, 6, 1-6.*

McClellamd, J. L., & Rumelhart, D. E. (1986). An interactive model of human learning and memory. In D. E Rumelhart, J. L. Mc Clelland, & PDP Groups (Eds.*). Parallel distributed processing: Vol 2. Psychological and biological models*. Cambridge MA: MIT Press.

Morris, J.M., & Biegler, E. D. (1985). An investigation of the Kaufman Assessment Battery for children: Results in the neurologically impaired. *Developmental Neurolinguistics, 3*, 67-79

Murphy, K. R., & Davidshofer, C. O. (2001*). Psychological Testing: Principles and Applications*. (5th ed.). New Jersey: Prentice Hall, Inc.

Naglieri, J. A. (1984). Concurrent and predictive validity of the K-ABC in a group of Navajo children. *Journal of School Psychology, 22*, 373-308.

Naglieri, J. A. (1985a). Use of the WISC-R and the K-ABC with learning disables, borderline mentally retarded and normal children*. Psychology in Schools, 22*, 133-141.

Naglieri, J. A. (1985b). Normal children's perforamce on the McCarthy Scales, Kaufman Assessment Battery and Peabody Individual Test. Journal of Psychoeducational Assessment, 3, 123-129.

Naglieri, J. A. (1989). A cognitive processing theory for the measurement of intelligence. *Educational Psychologist, 24*, 185-206.

Naglieri, JA. (1999). *Essentials of CAS Assessment*. New York: John Wiley & Sons.

Naglieri, J. A & Das, J. P. (1988). Planning-arousal-simultaneous-successive (PASS): A model for assessment. *Journal of School Psychology, 26*, 35-48.

Naglieri, J. A & Das, J. P. (1997). *Das-Naglieri Cognitive Assessment System: Interpretive Handbook*. IL: Riverside.

Naglieri, J. A., Das, J.P., & Jarman, R. F. (1990). Planning, Attention, Simultaneous and Successive Cogntive Processes as a model for Assessment. *School Psychology Review, 19,* 423-442.

Naglieri, J. A., & Jensen, A. R. (1987). Comparison of black-white differences on the WISC-R and the K-ABC: Spearman's hypothesis. *Intelligence, 11*, 21-43.

Naglieri, J. A., Prewett, P. N., & Bardos, A. N. (1989). An exploratory study of Planning, Attention, Simultaneous and Successive Cognitive Processes. *Journal of School Psychology, 27,* 347-364.

Ovando, C. J. and Collier, V. P. (1998). Bilingualism and English as Second Language Classrooms: Teaching in Multilingual contexts. (p. 295-399). In L. Berk (2003). *Child Development*. Boston: Pearson Inc.

Pandor, N. (2004). Message from the Minister of Education MP at the launch of the Readathon Campaign 2004. *Sunday Times*, 3 September 2004.

Paris, S. G. (April/May/June 2005). Reinterpreting the development of reading skills. *Reading Research Quarterly, Vol 40*, 184-202.

Patterson, K. E., & Morton, J. (1985). From orthography to phonology: An attempt at an old interpretation. In K. E. Patterson, J. C. Marshall and M, Coltheart. (Eds). *Surface Dyslexia: Neuropsychological and Cognitive Studies of Phonological Reading*. London: Lawrence Erlbaum Associates, Ltd.

Pearson, B. Z., Fernandez, S. C., & Oller, D. K. (1993). Lexical development in bilingual infants and toddlers: Comparison to monolingual norms. *Language Learning, 43*, 93-120.

Perfetti, C.A. (1992). The representation problem in reading acquisition. In P.B. Gough, L.C. Ehri, & R. Treiman (Eds.). *Reading acquisition* (pp. 145-174). Hillsdale, NJ: Erlbaum.

Perry, C., Ziegler C. J., & Coltheart, M. (2002). Dissociation between orthographic awareness and spelling awareness, *Applied Psycholinguistics, 23,* 43-73.

Pinker, S. (1994). *The Language Instinct*. London: Penguin.

Pollo, T. C., Kessler, B., & Treiman, R. (In press). Vowels, syllables, and letter names: Differences between young children's spelling in English and Portuguese, *Journal of Experimental Child psychology*, (1) 105-120

Read, C. (1975). *Children's creative spelling.* London: Routledge & Kegan Paul.

Richgels, D. (1995). Invented spelling ability and printed word learning in kindergarten. *Reading Research Quarterly, 30*, 96-109.

Rittle-Johnson, B. & Siegler, R. S. (1999). Learning to spell: Variability, choice, and change in children's strategy use. *Child Development, 70*, 332-348.

Rosnow, R., & Rosenthal, R. L. (1991). *Essential of Behavioural Research: Methods and Application.* (2nd ed.). Boston: McGraw Hill, Inc.

Schlagal, B. (2001). Traditional, developmental, and structured language approaches to spelling: Review and recommendations. *Annals of Dyslexia, 51*, 147-177.

Seidenberg, M., S. & McClellamd, J. L. (1989). A distributed, developmental model of word recognition and naming. *Psychological Reviews, 96*, 523-568.

Seymour, P. H. K., Bunce, F., & Evans, H. M. (1992). A framwork for orthographic assessment and remediation. In C. Stirling and C. Robson. (Eds.). *Psychology, Spelling and Education*. Clevedon: Multilingual Matters.

Seymour, P. H.K., Aro, M., & Erksine, J. M. (2003). Foundation literacy acquisition in European languages. *British Journal of Psychology, 94*, 143-175.

Shallice, T. (1979). Case-study approach in neuropsychological research. Journal of *Clinical Neuropsychology, 1,* 183-211.

Siegel, L. S. (1999). Phonological Processing Deficits as the basis for Spelling Disability. *Developmental Review, 13(3)*. 246-257.

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

Slabbert, Sarah & Carol Myers-Scotton. (1997). The structure of Tsotsitaal and Iscamtho: codeswitching and ingroup identity in South African townships. *Linguistics, Volume 35*, (2), 317-342

Snow, C. E., Burns, M. S. & Griffith, P (1998). (Eds.). Preventing reading difficulties in young children. Washington, D. C: National Academy Press, Online Document, Accessed on April 25th, 2005 at URL: www.books.nap.edu/openbook/03090614/html/index.html.

Stanovich, K. E. (1986). Matthew effects in spelling: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*, 360-406.

Statistics South Africa, (2004*). Percentage of Afrikaans and English spoke in South Africa across all nine provinces*. Online Document, Accessed on January 10th, 2005 at URL: http://www.statssa.co.za/languages.htm.

Sternberg, R. J. (1994). *Cognitive Psychology.* Orlando: Holt, Rinehart and Winston.

Steyn, JC (1995). A historical sketch of Afrikaans. In Webb, V.N. 1995. *The LiCCA (S.A.) Report*. Pretoria: JL van Schaik.

Stuart, M. & Coltheart, M. (1988). Does reading and spelling develop in a sequence of stages*? Cognition, 30,* 139-181.

Swann, D. (2000). Sociolinguistic and Education (p 148-183). In R. Mesthrie, J. Swann, A. Deumert & W. L. Leap (Eds.). *Introducing Sociolinguistics*. Edinburgh: Edinburgh University Press.

Sweeney, J. E., & Rourke, B. P. (1978). Neuropsychological significance of phonetically accurate and inaccurate spelling errors in young and old retarded spellers. *Brain & Language, 6*, 212-225.

Tangel, D.M., & Blachman, B. A, (1992). Effect of phoneme awareness of kindergarden's invented spelling. *Journal of Reading Behaviour, 24,* 233-261.

Tangel, D. M., & Blachman, B. A. (1995) The effect of phoneme awareness instruction on invented spelling: A one-year follow-up. *Journal of Reading Behaviour, 27, 4*, 153-185.

Telzrow, C. F.(1990). Does the PASS the pass test? A critique of the Das-Naglieri cognitive assessment system. *Journal of Psychoeducational Assessment, 8,* 344-355.

Terre Blanche, M., & Durrheim, K. (2002*). Research in Practise*. Cape Town: University of Cape Town Press.

Treiman, R. (1985). Phonemic Awareness and Spelling: Children's Judgements do not always agree with adults *Journal of Experimental Child Psychology, 39*, 182-201.

Treiman, R. (1993). *Beginning to spell: A study of first grade children.* New York: Oxford University Press.

Treiman , R. & Cassar., M. (1997). Can children and adults focus on sound as opposed to spelling in a phoneme counting task? *Developmental Psychology, 33,* 771-780

Treiman, R., & Bourassa, D. (2000). Written and Oral Spelling. *Applied Psycholinguistics, 21, 183-204.*

Tunmer, W. E., & Hoover, W. A. (1992). Cognitive and linguistic factors in learning to read. In P. H. Gough, L. C. Ehri and R. Treiman. *Reading Acquisition*. New Jersey: Lawrence Erlbaum Associates.

UNESCO World. (2000). *Language Survey Report:* Department of Arts, Culture, Science and Technology. Accessed on February 15th, 2006 at URL: http://www. UNESCO World Languages survey_files.

Vaid, J., & Genesee, F. (1980). Neuropsychological approaches to bilingualism: A critical review. *Canadian Journal of Psychology, 31*, 417-440.

Valencia, R. R. (1984). Stability of the Kaufman Assessment Battery for children for a sample of Mexican-American children. *Journal of School Psychology, 23(2),* 189-193.

Valencia, R. R., & Raikin, R. J. (1986). Confirmatory factor analysis of the Kaufman Assessment Battery for children. *Journal of Educational Measurement, 23*, 209-219.

Van Rensburg, C & A Jordaan. *The growth of Afrikaans in South Africa.* In Webb, V.N. 1995. The LiCCA (S.A.) Report. Pretoria: JL van Schaik.

Van Tonder, W. (2001). Language in Education in South Africa: Online Document, 1-11, Accessed on April 27th , 2005 at URL: http://www.und.ac.za/und/ling/archive/vton-01,htm.

Venezky, R. L. (1970). *The structure of English orthography.* The Hague: Mouton.

Viljoen, G., Levett., A., Tredoux, C., & Anderson, S. (1994) Using the Bender Gestalt in South Africa: some normative data for Zulu-speaking children, *South African Journal of Psychology, 24,* 145-151.

Warrick and Naglieri (1993). Gender differences in Planning, Attention, Simultaneous, and Successive (PASS) cognitive processes. *Journal of Educational Psychology, 85 (4),* 693-701.

Wijk, A. (1966*). Rules of pronunciation for the English Language*. Oxford University Press.

Wilson, V. L., Nolan, R. F., & Reynolds, C. R. (1989). Race and Gender differences effects on the Kaufman Assessment Battery for children. *Journal of School Psychology, 27(3)*, 289-296.

Wimmer, H. & Goswami, U. (1994). The influence of orthographic consistency on reading development: Word recognition in English and German children. *Cognition, 51,* 394-368.

Wimmer, H. Hummer, P. (1990). How German-Speaking first grade children learn to read and spells: Doubts about the logographic strategy. *Applied Psycholinguistics, 11*, 349-368.

Wimmer, H. Landerl, K., & Schneider, W. (1994). The role of rhyme awareness in learning to read in a regular language. *British Journal of Developmental Psychology, 12*, 469-484.

Yelland, G. Pollard, J., & Mercuri, A. (1999). The metalinguistic benefits of limited contact with a second language. *Applied Psycholinguistics*, *14,* 423-444.

Zins, J. E., & Barnett, D. W. (1984). A Validity study of the K-ABC, WISC-R, and the Standard Binet for Non-Referred children. *Journal of School Psychology, 22*, 369-371.

Zutell, J., & Rasinski, T. (1989). Reading and spelling connections in third and fifth grade students. *Reading Psychology, 10,* 137-155.

APPENDIX A: The K-ABC subtests contribution to spelling

Sequential Processing Scale	
Sub-test	**Description and Contribution to Spelling**
Hand Movements	Performing a series of hand movements in the same sequence as the examiner (Kaufman & Kaufman, 1983b). Hand Movements requires good attention and concentration, which similar to spelling in requiring the ability to attend and to concentrate on the remembering the right sequence of letters sounds perceived in order to spell a word (Luria, 1970; Frith; 1985; Ellis & Young, 1996).
Number Recall	Repeating a number of digits in the same sequence spoken by the examiner (Kaufman & Kaufman, 1983b). Number Recall, also requires good attention and concentration in order to recall the correct sequence of numbers, which is similar to the writing task of holding in memory the correct sequence of letters heard, and sequencing these letters in the correct order to spell a word (Luria, 1970; Frith; 1985; Ellis &Young, 1996).
Word Order	Touching a series of silhouettes of common objects that were named orally by the examiner (Kaufman & Kaufman, 1983b). Word Order is an auditory motor task that measures auditory-visual integration and auditor motor memory without rehearsal. It is similar to the spelling process in that it requires the child to hold the correct sequence of letter sounds perceived and order of the letters in memory, in order for the word to be spelt (Luria, 1970; Frith; 1985; Ellis &Young, 1996).

Simultaneous Processing Scale	
Sub-test	**Description**
Gestalt Closure	Naming an object or scene pictured in a partially completed inkblot drawing (Kaufman & Kaufman, 1983b). Gestalt Closure requires good perceptual skills, which is similar to the ability to perceive that speech sounds are symbolized by individual letters, and these individual letters are integrated to spell words (Luria, 1970; Frith; 1985;Ellis and Young, 1996)
Triangles	Assembling several identical triangles into an abstract pattern that matches a model (Kaufman & Kaufamn, 1983b) Triangles, involves analyzing the component pieces and requires flexible problem solving in the sense of being able to pay attention to the pieces being placed together correctly to form the triangles as well as paying attention to the correct colours of the components that make up the triangle. This is similar in to the advanced stages of spelling development whereby the child has to pay attention to the word's sounds as well as hold in memory the correct spelling sequence associated with overall structural shape of the word (Luria, 1970; Frith; 1985; Ellis & Young, 1996).
Matrix Analogies	Selecting the meaningful picture or abstract design that best completes a visual analogy (Kaufman & Kaufamn, 1983b). Matrix Analogies require the ability to utilize abstract analogies, which is directly related to being able to represent abstract letters and sounds in the spelling process (Luria, 1970; Frith; 1985; Ellis and Young, 1996).
Spatial Memory	Recalling the placement of pictures on a page that are exposed briefly (Kaufman & Kaufman, 1983b) Spatial Memory, involves good spatial skills in order to remember and identifying the location of various pictures. This is similar to the spelling process, whereby the speller needs to be able to visualize the required structures of letters, and to grasp the spatial relations among letters in order to be able to put these letters together to form and spell the whole word (Luria, 1970; Frith; 1985; Ellis and Young, 1996).
Photo Series	Placing Pictures of an event in a chronological order. Photo Series, measures "temporal relationships, time concepts, planning, anticipation of consequences and a common sense understanding of cause and effect-relationships" (Kaufman &Kaufman, 1983b, p50-51). Photo series is similar to the spelling process; in that the speller has to plan the order and correct sequence of letters beforehand and then integrate these letters in order to spell the word (Luria, 1970; Frith; 1985; Ellis and Young, 1996).

APPENDIX B: The K-ABC Remediation Programme Principles

Characteristics for Sequential and Simultaneous Learners (Kaufman et al., 1984)

Learner Characteristics	
Sequential Learner	**Simultaneous Leaner**
The sequential learner solves problems best by mentally arranging small amounts of information in consecutive, linear, and step-by-step manner. He/she is most comfortable with verbal instructions and cues, because the ability to interpret spoken language depends to a great extent on the sequence of words.	The simultaneous learner solves problems best by mentally integrating and synthesizing many parallel pieces of information at the same time. He/she is most at home with visual instructions and cues, because the ability to interpret the environment visually depends on perceiving and integrating many details at once.
Sequential processing is important in:	Simultaneous processing is important in:
▪ Learning and retaining basic arithmetic facts; ▪ Memorizing lists of spelling words; ▪ Making association between sounds and words; ▪ Learning the rules of grammar, the chronology of historical events; ▪ Remembering details; ▪ Following a set of rules, directions and steps; and ▪ Solving problems by breaking them down into their components or steps.	▪ Recognizing the shape and physical appearance of letters and numbers; ▪ Interpreting the overall effect or meaning of pictures and other visual stimuli, such as maps and charts; ▪ Understanding the overall meaning of a story or poem; ▪ Summarising, comparing and evaluation; ▪ Comprehending mathematical or scientific principles; and ▪ Solving problems by visually analyzing them in their entirety.

Sequential Learners who are weak in simultaneous processing may have difficulty with:	Simultaneous Learners who are weak in sequential processing many have difficulty with
▪ Sight word recognition; ▪ Reading/Spelling Comprehension; ▪ Understanding mathematical or scientific principles; ▪ Using concrete, hands-on materials; ▪ Using diagrams, charts, maps; ▪ Summarising, comparing; and evaluating.	▪ Word attack, decoding, phonics; ▪ Breaking down science or arithmetic into parts; ▪ Interpreting the parts and features of a design or drawing; ▪ Understanding the rules of games; ▪ Understanding and following oral instructions; and ▪ Remembering specific details and a sequence of the story.
Teacher Guidelines	
For the Sequential Learner	For the Simultaneous Leaner
1) Present teaching material step by step, gradually approaching the overall concept or skill. Lead up to the big question with a series of smaller ones. Break the tasks into parts. 2) Get the child to verbalise what is being learnt. When you teach a new word, have the child say it, aloud or silently. Emphasise verbal cues, directions, and memory strategies. 3) Teach and rehearse the steps required to do a problem or complete a task. Continue to refer back to the details or steps already mentioned or mastered. Offer a logical structure or procedure by appealing to the child's verbal/temporal orientation.	1) Present the overall concept or question before asking the child to solve the problem. Continue to refer back to the task, question or desired outcome. 2) Get the child to visualize what is to be learned. When you teach a new word, have the children write it and picture it mentally, see it on the page and in the mind's eye. Emphasise visual cues, directions and memory strategies. 3) Make tests concrete wherever possible by providing manipulative materials, pictures, models, diagrams, graphs. Offer a sense of the whole by appealing to the child's visual/spatial orientation.

For example:	For example
The sequential learner may look at one or two details of a picture, but miss the visual image as a whole.	The simultaneous learner may react to a picture as a whole but miss many details.
To help such a student toward an overall appreciation of the picture, start with the parts and work up to the whole. Rather than with "What does the picture show?" or "How does the picture make you feel**: first ask about the details.**	**To help such a learn notice the parts that contribute to the total image, begin by establishing an overall interpretation or reaction:** *"What does the picture show?"* *"How does the picture make you feel?"*
"*What is the little boy in the corner doing?"* *"Where is the dog?"* *"What expression do you see on the woman's face?"* *"What colours are used in the sky*"	**Then consider the details** "*What is the expression on the woman's face?"* *"What is the little bout in the corner doing?"* *"What colours are used in the sky?"*
Lead up to the questions about the overall interpretation or appreciation: "How do all these details give you clues about what is happening in this picture?"	Relate the details to the learner's initial interpretation: "How do these details explain why the picture made you feel they way you did?"
The sequential learner prefers a step-by-step teaching approach, one that may emphasize the gradual accumulation of details to remediate weak simultaneous processing skills.	**The simultaneous learner responds best to a holistic teaching approach that focuses on groups of details or images and stresses the overall meaning or configuration of the task to remediate weak sequential processing skills.**
(Kaufman & Kaufman, 1983a, 1983b; Kaufman et al., 1984)	(Kaufman & Kaufman, 1983a, 1983b; Kaufman et al., 1984)

APPENDIX C: Kaufman Assessment Battery Cognitive Processing Measures

1 Word Order

Instructions: See these pictures; *I want you to name them for me?*
For each object say: What is this?
Make sure the child knows each item and names it correctly:

STAR KEY BIRD CUP HOUSE

COVER PICTURE: Say *house-cup*
Show the picture to the child immediately. Ask the child to point to the two items named. If the child does not understand say:

I said house-cup first you touch the house and then you touch the cup.

Instruksies: Kyk na hierdie prente. *Ek will hê jy moet hulle vir my noem.*
Vir elke voorwerp, sê: Wat is dit?
Maak seker dat die kind weet wat elke item is en dat hy/sy dit korrek benoem.

STER SLEUTEL VOËL KOPPIE HUIS

VOORBEELD PRENT: Sê huis-koppie
Wys die prentjie vir die kind onmiddellik. Vra die kind om die twee genoemde items uit te wys. As die kind nie verstaan nie, sê:

Ek sê huis-koppie – eers raak jy aan die huis, dan raak jy aan die koppie.

Start at Item 7/Begin by Item 7

Scoring: Shade the response as Right of Wring/ Telling: Kleur die antwoord in as Reg of Verkeerd

7. CUP-KEY-BIRD
O Right O Wrong/ O Reg O Verkeerd

8. KEY-BIRD-STAR-HOUSE
O Right O Wrong

9. HOUSE-STAR-KEY-CUP
O Right O Wrong

10. MOON-TREE-CAT-HEART
O Right O Wrong

11. CAT-HAND-SHOE-BALL
O Right O Wrong

12. CAT-BALL-SHOE-MOON-HAND
O Right O Wrong

13. SHOE-TREE-BALL-HEART-MOON
O Right O Wrong

Say: *Now we are going to look at some colours. Name these colours as quickly as possible. First, I name the pictures, then you name some colours and then you try and touch the pictures I named. Let's try one. After 5 seconds of colour naming, turn the page.*

Sê: Nou gaan ons na 'n paar kleure kyk. Noem hierdie kleure so gou as moontlik. Eers noem ek die prent, dan noem jy 'n paar kleure en dan probeer jy om aan die prente te raak wat ek genoem het. Kom ons probeer een. Na 5 sekondes van kleurbenaming, blaai die bladsy om.

14. HAND-SHOE
O Right O Wrong

15. BALL-MOON
O Right O Wrong

16. TREE-HAND
O Right O Wrong

17. MOON-TREE-CAT
O Right O Wrong

18. CAT-BALL-TREE
O Right O Wrong

19. HEART-SHOE-HAND
O Right O Wrong

20. SHOE-MOON-HEART-BALL
O Right O Wrong

Ceiling: = 20
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 20
Foute: =
Routelling: =
Skaaltelling: =

2 Matrix Analogies

Show the child the picture on the page. Point out that one picture is missing. Ask them to choose the missing picture from the series of options. Administer the sample item to check that the child understands what is expected of him/her.

Wys vir die kind die prente op die bladsy. Wys uit dat een prent weg is. Vra die kind om die vermisde prent te kies uit ’n reeks van opsies. Wend die voorbeelditem aan om te kyk dat die kind verstaan wat van hom/haar verwag word.

Start at Item 5 Begin by Item 5

Scoring Table: Tellingtabel:

5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

Ceiling: = 20
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 20
Foute: =
Routelling: =
Skaaltelling: =

3 Spatial Memory

Show each picture for 5 seconds. After the child has seen the picture, turn the page and ask them to point to where it is on the page.

Wys elke prent vir 5 sekondes. Nadat die kind die prent gesien het, blaai die bladsy om en vra hulle om die prent uit te wys op die bladsy.

Start at Item 5/ Begin by Item 5

Scoring Table: Tellingtabel:

5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	

Ceiling: = 21
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 21
Foute: =
Routelling: =
Skaaltelling: =

4 Photo Series

Use the numbers on the back of each picture to place the pictures in a row in front of the child.

Say to the child: *These pictures show something happening. Which picture goes first, put it in my hand?*. **After the child has put the card in your hand say***: Which one goes next?*

If the child gets it wrong, show them how to do the tasks-
e.g. In this picture the candle is very big then it gets smaller and smaller

Gebruik die nommer op die agterkant van elke prent om die prente in 'n ry voor die kind te plaas.

Sê vir die kind: *Hierdie prente wys iets wat gebeur. Watter prent kom eerste – sit dit in my hand?* **Nadat die kind die prent in jou hand gesit het, sê***: Watter een kom volgende?*

Indien die kind verkeerd is, wys hom/haar hoe om die take te doen -
bv. In hierdie prent is die kers baie groot, dan word dit kleiner en kleiner.

Start at Item 7 and Write down the letters that the child uses. / Begin by Item 7 en skryf die letters wat die kind gebruik neer.

Scoring Table: Tellingtabel:

	Child's Sequence Kind se Volgorde	Correct Sequence Korrekte Volgorde
7.		ABCDEFG
8.		ABCDE
9.		ABCDEF
10.		ABCDEF OR GFEDCBA
11.		ABCDEFG
12.		ABCDEFGHIJ OR JIHGFEDCBA
13.		ABCDEFG
14.		ABCDEFGHI
15.		ABCDEFGHI
16.		ABCDEFGHI OR IHGFEDCBA
17.		ABCDEFG OR GFEDCBA

Ceiling: = 17
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 17
Foute: =
Routelling: =
Skaaltelling: =

5 Hand Movements

Show the child a series of hand movements and ask them to copy them once you have finished Wys die kind a reeks van handbewegings en vra hom/haar om dit na te aap as jy klaar is.

Scoring Table: Tellingtabel:

1.	SF	**8.**	SPF	**15.**	SPSPS
2.	FF	**9.**	SFFS	**16.**	FSFSP
3.	FS	**10**.	PFS	**17.**	PSFP
4.	PF	**11**.	FPS	**18.**	PFSF
5.	PS	**12.**	FPFP	**19.**	SPFSP
6.	SFS	**13.**	FSSP	**20.**	PSSPFF
7.	PSP	**14.**	SPSF	**21.**	PSPFS

Ceiling: = 21
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 21
Foute: =
Routelling: =
Skaaltelling: =

6 Gestalt Closure

Show the child a series of pictures and ask them to identify what they see. Score correct any response that is acceptable (e.g. bird, bat, robin, type of bird is acceptable). As long as the understanding of the picture is conveyed the item is correct (e.g. girl on her hands).

Wys vir die kind 'n reeks prente en vra hom/haar om te identifiseer wat hy/sy sien. Vat as korrek enige antwoord wat aanvaarbaar is (bv. voël, vlêrmuis, robin, tipe voël is aanvaarbaar). Die antwoord is reg solank as wat die verduideliking van die prent oorgedra word (bv. meisie op haar hande).

Start at Item 6/ Begin by Item 6

Scoring Table: Tellingtabel:

	Child's Response Kind se Antwoord	**Correct Response Korrekte Antwoord**
6.		Chair
7.		Camel
8.		Hammer
9.		Fish
10.		Ship
11.		Frog
12.		Dinosaur
13.		Fork
14.		Elephant
15.		Crown
16.		Jet
17.		Stove
18.		Typewriter
19.		Gymnast
20.		Sailboat
21.		Five
22.		Guitar
23.		Mountaineer
24.		Violin Player
25..		Teapot

Ceiling: = 25
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 25
Foute: =
Routelling: =
Skaaltelling: =

7 Number Recall

Tell the child you are going to say a list of numbers. After you have finished they must try and say the numbers back to you.

Verduidelik vir die kind dat jy ‘n lys nommers gaan sê. As jy klaar is, moet hulle probeer om die nommers vir jou op te sê.

Start at Item 6/ Begin by Item 6

Scoring Table: Tellingtabel:

1.	10-5	**8.**	4-1-9-6	**15.**	1-5-2-9-4-3
2.	1-8	**9.**	3-9-5-2	**16.**	4-2-5-8-6-3-10
3.	6-3	**10**.	5-4-8-1-10	**17.**	3-1-4-10-5-6-9
4.	5-6-4	**11**.	6-9-2-3-8	**18.**	8-10-1-5-9-6-2
5.	10-1-6	**12.**	2-10-3-8-9	**19.**	6-9-4-1-8-3-5-2
6.	9-4-2	**13.**	10-2-4-1-8-5		
7.	9-3-6-8	**14.**	9-8-3-10-1-6		

Ceiling: = 19
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 19
Foute: =
Routelling: =
Skaaltelling: =

8 Triangles

Show the child the diagram and tell them to make the diagram using the triangles provided.

Wys vir die kind die diagram and sê vir hom/haar om die diagram te maak met die driehoeke wat voorsien word.

Start at Item 10 Begin by Item 10

Scoring Table: Tellingtabel:

10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	

Ceiling: = 18
Errors: =
Raw Score: =
Scales Score: =

Plafon: = 18
Foute: =
Routelling: =
Skaaltelling: =

APPENDIX D: Klein's (1993) Spelling English and Afrikaans Words and Non-Words Tests/**AANHANGSEL D:** Klein (1993) se Spelling Toets van Engelse en Afrikaanse Woorde en Nie-Woorde.

Instructions: Give the child a blank page and tell them you are going to say a few words and they must write them down.

Aanwysings: Gee vir die kind 'n blanko bladsy en sê vir hom/haar dat jy 'n paar woorde gaan sê en hulle die woorde moet neerskryf.

English Words and Non-Words.			**Afrikaans Words and Non-Words**		
1.	house		1.	dogter	
2.	kire		2.	gaam	
3.	event		3.	huis	
4.	body		4.	gens	
5.	zome		5.	duis	
6.	kree		6.	hele	
7.	money		7.	booit	
8.	stild		8.	seker	
9.	doctor		9.	hierso	
10	gody		10	sele	
11.	uvent		11.	klaar	
12.	church		12.	meker	
13.	goctor		13.	mens	
14.	shurch		14.	mogter	
15.	fouse		15.	nooit	
16.	fire		16.	bierso	
17.	doney		17.	naam	
18.	child		18.	glaar	
19.	home		19.	besig	
20.	tree		20.	bierso	
Total Correct			**Total Correct**		

APPENDIX E: Permission to Conduct Research by the Gauteng provisional government and Gauteng Department of education (GDE)

Date:	**27 May 2004**
Name of Researcher:	**De Sousa Diana**
Address of Researcher:	**13 Rosemary Road**
	Roseacre
	Johannesburg, 2197
Telephone Number:	**(011) 4359660**
Fax Number:	**N/A**
Research Topic:	**"The Bilingual Mind…" Simultaneous and Sequential Cognitive Processing and Learning to Spell in Monolingual English and Bilingual Afrikaans-English Children in Grade Three.**
Number and type of schools:	**2 Primary Schools**
District/s/HO	**Johannesburg South**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

Permission has been granted to proceed with the above study subject to the conditions listed below being met, and may be withdrawn should any of these conditions be flouted:

1. ***The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.***
2. ***The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.***
3. ***A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.***

4. ***A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.***
5. ***The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.***
6. ***Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Senior Manager (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.***
7. ***Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year.***
8. ***Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.***
9. ***It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.***
10. ***The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.***
11. ***The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.***
12. ***On completion of the study the researcher must supply the Senior Manager: Strategic Policy Development, Management & Research Coordination with one Hard Cover bound and one Ring bound copy of the final, approved research report. The researcher would also provide the said manager with an electronic copy of the research abstract/summary and/or annotation.***
13. ***The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.***
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Senior Manager concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.
Kind regards
pp. Nomvula Ubisi
ALBERT CHANEE
ACTING DIVISIONAL MANAGER: OFSTED

The contents of this letter has been read and understood by the researcher.	
Signature of Researcher:	
Date:	

APPENDIX E: Permission from Principle of School

Rewlatch Primary School

Victoria Road
Rewlatch
Johannesburg
2197
Tel: 435 0560
Fax: 435 7651

17 June 2004

To whom it may concern,

Re: Permission to Conduct Research

This letter serves as permission for Ms. D.S. de Sousa to con duct her research at our school. Ms. de Sousa did furnish the school with a research approval letter from The Senior Manager (GDE) and explained the nature of her research.

The topic for the research is The Bilingual Mind…Simultaneous and Sequential Processing and Spelling Ability in Monolingual English and Bilingual Afrikaans-English Children.

This permission is subject to the candidates as laid out in the letter from the Senior Manager.

We would like to wish Ms. de Sousa all the best for her research and hope that it will be beneficial. We further look forward to receiving a copy of your findings.

Regards.

R. Symons
Headmaster

E.E. v.d. Westhuizen
H.O.D.

C:\MyFiles\Office\Testimonials\Ms DS de Sousa Permission to Conduct Research 1762003.wpd

Principal: RN Symons

APPENDIX E: Permission from Principle of School

LAERSKOOL W.H. COETZER PRIMARY

POSBUS 49034
ROSETTENVILLE

TEL : 435-0435/6
FAKS : 435-2739
EMAIL /
EPOS : whcoetzer@mweb.co.za

SESDE LAAN 2
THE HILL
2197

2 August 2004

To whom it may concern,

Re : Permission to Conduct Research

This letter serves as permission for Ms. D.S. de Sousa to conduct her research at our school. Ms. de Sousa did furnish the school with a research approval letter from The Senior Manager (GDE) and explained the nature of her research.

The topic for the research is "The Bilingual Mind... Simultaneous and Sequential Processing and Spelling Ability in Monolingual English and Bilingual Afrikaans-English Children.

The permission is subject to the candidates as laid out in the letter from the Senior Manager.

We would like to wish Ms. de Sousa all the best for her research and hope it will be beneficial. We further look forward to receiving a copy of your findings.

Regards

J.C. Breytenbach
Headmaster

APPENDIX F: University Committee Ethical Clearance Certificate

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

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R 14/49 De Sousa

CLEARANCE CERTIFICATE **PROTOCOL NUMBER H040803**

PROJECT TITLE The Bilingual Mind...Simultaneous & Sequential Processing & Spelling Ability of Monolingual English and Bilingual Afrikaans-English Children

INVESTIGATORS Miss DS De Sousa

SCHOOL/DEPARTMENT Human & Comm Development/Psychology

DATE CONSIDERED 04.08.25

DECISION OF COMMITTEE* Approved unconditionally

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

DATE 04.10.21 **CHAIRPERSON** _____
(Professor MC Penn)

* Guidelines for written "informed consent" attached where applicable

cc Supervisor: Dr A Peirson

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **one copy** returned to the Secretary, Room 100015, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorised to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure, as approved, I/we undertake to submit a revised protocol to the Committee.

I/we agree to submit a yearly progress report.

This ethical clearance will expire on

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX G: Letters of Parental Consent,





School of Human and Community Development,
Dr. Almarie Peirson Tel: 011 717 4517

DEAR PARENT /GUARDIAN

My name is Diana De Sousa I am conducting research for the purposes of obtaining my Masters in Research Psychology at the University of the Witwatersrand. My area of research focuses on how children spell and solve cognitive problems, with the aim of helping teachers to help children become better spellers. I would like to invite your child to participate in this study. With your permission your child will be asked to identify different sounds and spell them as well as asked to complete patterns, and reproduce a pattern with shapes. The assessment procedure involves sound, pattern and spelling game and will be administered by myself at your child's school during school-time at a time convenient to your child's class teacher. If I find any problem in your child's ability to participate in the sound, pattern and spelling games I will contact you. It is important to emphasize that your child will in no way be harmed by these games, and will take approximately 30-40 minutes per child to complete. No names of the children who participate in this study will be included in my final research report. Each child will be assigned a reference number to ensure confidentiality. You may chose to withdraw your child at any point without any negative consequences to you or your child. A summary of my research results will be offered to parents, should you be interested in my findings. If you agree to allow your child to participate in this study could you please sign the attached consent form. If you have any queries regarding the study, about the assessment procedures, please do not hesitate to contact my research supervisor, Dr Almarie Peirson or me.

Yours sincerely

Diana De Sousa
011 435-9660
(Master's Student)

Dr Almarie Peirson
(011) 717-4517
(Research Supervisor)

_____ _____

CONSENT FORM

I----------, parent/guardian of----------
have been informed regarding the nature of the study, and my child's participation in it. I hereby consent to allow my child to be given the sound, pattern and spelling games. by Diana De Sousa. I understand that my child will incur no harm as a result of this study, and have the right to withdraw my child from the study at any time, without any negative consequences to my child or me. I understand that my child's name will be confidential and his or her name will not be included in the final research report.

Signed _____

AANHANGSEL G: Brief vir Ouer Toestemming

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

School of Human & Community Development

School of Human and Community Development,
Dr. Almarie Peirson Tel: 011 717 4517

GEAGTE OUER/VOOG

My naam is Diana De Sousa. Ek doen navorsing ten einde my Meestersgraad in Navorsingsielkunde te bekom by die Universiteit van Witwatersrand. My area van navorsing fokus op hoe kinders spel en kognitiewe probleme oplos, met die doel om onderwysers te help om kinders beter te laat spel. Ek will graag u kind uitnooi om deel te wees van hierdie studie. Met u toestemming sal u kind gevra word om verskillende klanke te identifiseer en te spel, sowel as patrone te voltooi en te herproduseer met vorms. Die toetsproses behels klank, patroon en spelling speletjies en sal deur myself uitgevoer word by u kind se skool gedurende skooltyd, op 'n tydstip wat gerieflik is vir u kind se klasonderwyser(es). Indien ek enige probleme ondervind met u kind se vermoë om deel te neem in klank-, patroon- of spellingspeletjies, sal ek u kontak. Dit is belangrik om klem te lê daarop dat u kind geensins te ná gekom sal word deur hierdie speletjies nie. Die speletjies sal ongeveer 30-40 minute per kind vat om te voltooi. Geen name van kinders wat in hierdie studie deelneem sal ingesluit word in die finale verslag nie. Elke kind sal 'n verwysingsnommer toegeken word om vertroulikheid te verseker. U mag u kind op enige tydstip gedurende die studie onttrek sonder enige negatiewe nagevolge vir uself of u kind. 'n Opsomming van my navorsingsbevindinge sal aangebied word aan u as ouers as u geinteresseerd sou wees daarin. Indien u toestem wil gee om u kind aan die studie te laat deelneem, moet u asseblief die aangehegde toestemmingsvorm teken. Indien u enige verdere vrae het in verband met die studie of die toetsprosedures, moet u asseblief nie huiwer om my of my studieleier, Dr Almarie Peirson te kontak nie.

Die uwe,

Diana De Sousa	Dr Almarie Peirson
011 435-9660	(011) 717-4517
(Meesterstudent)	(Studieleier)
_____	_____

TOESTEMMINGSVORM

Ek----------, ouer/voog van----------

Is ingelig in verband met die aard van die studie en my kind se deelname aan die studie. Hiermee gee ek toestemming dat klank-, patron- en spellingspeletjies op my kind uitgevoer mag word deur Diana De Sousa. Ek verstaan dat my kind nie te ná gekom sal word as gevolg van die studie nie, en dat ek die reg het om my kind enige tyd uit die studie te onttrek, sonder enige negatiewe nagevolge vir myself of my kind. Ek verstaan dat my kind se naam as vertoulik hanteer sal word en dat sy/haar naam nie in die finale navorsingsverslag ingesluit sal word nie.

Signed _____

APPENDIX G: Child Assent Letter



Hello,
My name is Diana. I am university student that is interested in how bilingual children spell and solve puzzles.

Do you want to play these spelling games and puzzles?
If Yes write you name below. If you do not want to play these games say "no"
Nothing will happen to you of you do choose not to play.

Child:_____ Date:_____

Researcher:_____ Date:_____

AANHANGSEL G: Brief vir Toestemming vanaf Kinder Deelnemers

Hello,
My naam is Diana. Ek is 'n universiteitstudent wat belangstel in hoe tweetalige kinders spel en raaisels oplos.

Wil jy hierdie spelling speletjies en raaisels speel?
Indien jy wil, skryf jou naam hier onder. As jy nie hierdie speletjies wil speel nie, sê "nee".
Niks sal met jou gebeur as jy kies om nie te speel nie.

Kind:_____ Datum:_____

Navorser:_____ Datum:_____

APPENDIX H: Statistical Analyses

TABLE H1: Test for Normality

Test for Normality		
Variable	**D statistic**	**Pr > F**
Hd_Mov	.13	>.01
Glt_Clo	.17	>.01
Num_R	.16	>.01
Triangles	.10	>.13
Wd_Order	.95	>.02
Mtx_Ana	.14	>.01
Spat_Mem	.16	>.01
Pto_series	.24	>.24
KSEQSS	.09	>.09
KSIMSS	.07	>.07
MPC SS	.08	>.08
SpellEw	.16	>.01
SpellEnw	.15	>.01
SpellAw	.33	>.01
SpellAnw	.32	>.01

Note: Hd_Mov= Hand Movements, Glt_Clo= Gestalt Closure, Num_R= Number Recall, Triangles =Triangles, Wd_Order = Word Order, Mtx_Ana= Matrix Analogies, Spat_Mem=Spatial Memory, Pto_Series= Photo Series, SpellEw= spelling English words, SpellEnw = spelling English non-words, SpellAw= spelling Afrikaans words, Spell Anw= spelling Afrikaans non-words.

The results of the Kolmogorov-Smirnov " goodness of fit test" are summarised in Table H 1 above. The results indicate that there were no significantly differences, on all the variables as the values fell above the .05 level of significance. These results indicated that the data was normally distributed and that parametric statistical tests were valid to use to analyse the data in the present study.

TABLE H 2: Levene's Test for Homogeneity of Variance

Equality of Variances		
Variable	**F Value**	**Pr > F**
Hd_Mov	1.32	.44
Glt_Clo	1.21	.64
Num_R	1.27	.54
Triangles	1.17	.65
Wd_Order	1.17	.69
Mtx_Ana	1.21	.63
Spat_Mem	1.55	.26
Pto_series	1.49	.28
KSEQSS	1.13	.76
KSIMSS	1.08	.81
MPC SS	1.10	.78
SpellEw	1.03	.92
SpellEnw	1.02	.98
SpellAw	1.02	.97
SpellAnw	1.02	.94

Note: Hd_Mov= Hand Movements, Glt_Clo= Gestalt Closure, Num_R= Number Recall, Triangles =Triangles, Wd_Order = Word Order, Mtx_Ana= Matrix Analogies, Spat_Mem=Spatial Memory, Pto_Series= Photo Series. , SpellEw= spelling English words, SpellEnw = spelling English non-words, SpellAw= spelling Afrikaans words, Spell Anw= spelling Afrikaans non-words.

Note : p >0.1 not significant

Df (1; 29)(1; 29) for each sample

The results of Levene's test (*W*) for homogeneity of variances is summarised in Table H 2 above. The results indicate that there were no significant differences in the sample variances for the monolingual English and bilingual Afrikaans-English children. In line with this result parametric statistical tests were valid to use to analyse the data in the present study.

APPENDIX I: Qualitative Spelling Error Analyses

Qualitative error analysis was used to analyse the spelt words and non-words in the monolingual English and Afrikaans-English children. This was used to investigate the qualitative nature of spelling development in monolingual English children learning to spell in English and bilingual Afrikaans-English children learning to spell in Afrikaans and English.

TABLE I 1 Qualitative Error Analyses of spelling English words monolingual English children

Grade Three			
	Qualitative Error Categories		
English Words	**Visual Errors**		**Phonetic Errors**
house	hous		housse
body	baby		bodie
event			
doctor	docter	docta	
church	chirch		
fire			fiyer
child			
home			
tree			
money	many	meony	muany

Table I-1, indicates the qualitative errors made by the monolingual English children spelling English words, comprised of real word substitutions, '*baby* for '*body*', '*many*' for *money*' and '*five*' for '*fire*'. Furthermore, '*meony*' for '*money*' resembles an order error indicative of using a visual strategy to spell. However non-word errors of '*docta*' for 'doctor' and '*hous*', were also found. Qualitatively, the spelling errors made by the monolingual English children utilised rhyme and spelling patterns common with other words as a guide to spelling, for example:/*er*/ is a regular phonics rule but is generalised to spelling other words by using a visual-whole word analogy spelling strategy, which the monolingual English children used for spelling '*doct**er**'* and *fiy**er***'. Thus, in the monolingual English children an incorrect spelling usually results from, an error in a vowel or consonant digraph (for example, *meony* for *money*), or an incorrect use of letter combination that would be appropriate in some word but not others (for example, *fiyer* for *fire*) consistent with a visual approach to spelling, whilst an alphabetic approach to spelling was noted to a lesser degree.

TABLE I 2: Qualitative Error Analyses of spelling English Non-words in monolingual English children

Grade Three				
	Qualitative Error Categories			
English Non-Words	**Visual Errors**		**Phonetic Errors**	
kire	kerry	ciyre		
zome	zoom			
kree	cream			
stild	style, steeld			
gody	god. gold	goddy		
ovent			ovenet	
goctor				gocter
shurch		sherch	shersh	cherch
fouse				fous
doney	don, donkey			

Table I-2 indicates that the type of qualitative errors made by monolingual English children in spelling English non-words. For example; '*stild*' (to rhyme with child) produced a non-word error such as 'steeld", '*ciyre*' for '*kire*' *uvent*' for '*ovent*' and real word errors such as '*zoom*' for '*zome*', and *goody, god* for '*gody'*.

Thus, in the monolingual English children an incorrect spelling non-words, similar to spelling words, usually results from an error in a vowel or consonant digraph (for example, *sherch* for *shurch*), or an incorrect use of letter combination that would be appropriate in some word but not others (for example, *steeld* for *stild*) consistent with a visual approach to spelling, whilst an alphabetic approach to spelling was noted to a lesser degree.

TABLE I-3: Qualitative Error Analyses of spelling English words in bilingual Afrikaans-English children

Grade Three			
	Qualitative Error Categories		
English Words	**Visual Errors**	**Phonetic Errors**	
house	huis/hous		haus
body			bodie
event			ewent
doctor	docter	dokter	
church		tjurs	
fire	vuur	vaie	faie
child			
home		hoem	homme
tree		trie	
money		manie	

Table I-3 indicates the types of qualitative errors made by bilingual Afrikaans- English children in spelling English words. For example, for '*haus*' for house, '*faie*' for '*fire*', '*tjurs*' for '*church*,' represent non-word errors in that the bilingual Afrikaans-English children displayed in attempting to spell English words.

Thus, in bilingual Afrikaans-English children, errors in spelling English words are phonetic errors, which indicate that these children are using grapheme-phoneme correspondence rules as a guide to spelling. Additionally the errors found capture certain features of the pronunciation that ignores conventional spelling. For example /*tj*/ for /*ch*/. These errors are consistent with an alphabetic (sequential) phonetic approach to spelling, with visual spelling strategy being relied on to a lesser degree, as seen in' *docter*' for '*doctor*', and '*hous*' for '*house*'.

TABLE I-4: Qualitative Error Analyses of spelling English Non-Words in bilingual Afrikaans-English children

Grade Three			
	Qualitative Error Categories		
English Non-Words	**Visual Errors**	**Phonetic Errors**	
kire		kaie	kyer
zome		shome	som
kree		krie	
stild		styld	stield
gody		godie	
ovent		awint	
goctor		gokter	
shurch		tjutch	
fouse		vous	fous
doney		donie	

Table I-4 indicates the types of qualitative errors made by bilingual Afrikaans- English children in spelling English non-words, for example; '*kaie*' for '*kire*', '*vous*' for '*fous*' and '*shome*' for *'home'* represent (wrong) non-words in that the bilingual Afrikaans-English children displayed in attempting to spell English non-words.

Thus, in the bilingual Afrikaans-English children, similarly to their approach to spelling English words displayed phonetic errors, which indicate that, these children are using grapheme-phoneme correspondence rules as a guide to spelling. Additionally the errors found capture certain features of the pronunciation that ignores conventional spelling. For example 'v' for 'f'. These errors are consistent with an alphabetic (sequential) phonetic approach to spelling, with visual spelling strategy being relied on to a lesser degree.

TABLE I-5: Qualitative Error Analyses of spelling Afrikaans words in bilingual Afrikaans-English children

Grade Three					
	Qualitative Error Categories				
Afrikaans Words	**Visual Errors**	**Phonetic Errors**			
huis		hius	hys	hus	ys
hele	hulle			jele	heele
seker					sekir
dogter					dogtir
klaar	klaas			klae	klaa
mens	mes				
nooit					noeit
naam					nam
besig					bisig
hierso					heerso

Table I-5 summarises the type of errors that the bilingual Afrikaans-English children, exhibited in spelling Afrikaans words. The type of errors indicated that in spelling Afrikaans words the most frequent errors, included non-words responses such as '*bisig*' for '*besig*', and '*heerso*' for '*hierso*'. In addition, order errors such as '*hius*' for '*huis*' as well as to a lesser extent real word responses such as '*klaas*' for '*klaa*r', and '*mes*' for '*mens*' were also evident.

Qualitatively the errors exhibited in spelling Afrikaans words in the bilingual Afrikaans-English children, would give the correct pronunciation of the target word if read aloud by regular phonics rules, the error is a homophone of the target, with visual spelling strategy being relied on to a lesser degree.

TABLE I-6: Qualitative Errors Analyses of bilingual Afrikaans-English children in spelling Afrikaans non-words

Grade Three			
	Qualitative Error Categories		
Afrikaans Non-Words	**Visual Errors**	**Phonetic Errors**	
gaam			gam
gens			ges
duis		dus	dys
meker	meeter		
sele	selde		
booit			boeit
mogter			mogtur
glaar		klaar	glae
resig			risig
bierso			beerso

Table I-6 indicates the type of errors the bilingual Afrikaans-English children made in spelling Afrikaans non-word the qualitative errors found indicated that the bilingual Afrikaans-English children, produced incorrect non-words spellings, for example '*gens*' was spelt as '*ges*', 'ys' for 'huis'. However real word errors such as '*meeter*' for '*meker*' or '*selde*' for '*sele*' were noted to a lesser extent.

Qualitatively the errors exhibited in spelling Afrikaans words by the bilingual Afrikaans-English children, would give the correct pronunciation of the target word if read aloud by regular phonics rules, the error is a homophone of the target, with visual spelling strategy being relied on to a lesser degree.