To be or not to be bilingual:

Cognitive processing skills and literacy development

in monolingual English,

emergent bilingual Zulu and English, as well as

bilingual Afrikaans and English speaking children

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A controversial idea in science,

as everyone knows,

means that

some people love it,

some could not care less, and

some are highly opposed to it.”

(Tulving, 2002, p. 1)

DECLARATION

I declare that:

this thesis presents research work I personally carried out and does not incorporate without acknowledgment any material previously submitted for a degree or diploma at any university; and

to the best of my knowledge, it does not contain any materials previously published or written by another person except where due reference is made in the text, and all substantive contributions by other persons to the work presented, including jointly authored publications, are clearly acknowledged.

This declaration unequivocally states that this is my own, original work. Where secondary material has been used (either from a printed source, a previously unpublished research report, or electronic media), this has been meticulously acknowledged and referenced.

Diana Soares de Sousa

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ABSTRACT

Background: Literacy in multilingual contexts includes social and cognitive dimensions (GoPaul-McNicol & Armour-Thomas, 1997). Becoming literate carries with it the ability to develop and access higher-order thinking skills that are the building blocks for cognitive academic language proficiency, as well as the means that define educational opportunities (Bialystok, 2007). South Africa has 11 official languages and a multilingual education policy but South African schools are able to determine their language of instruction policy of monolingualism or multilingualism (Heugh, 2010). This raises the question of whether monolingualism or bilingualism influences children's successful acquisition of reading. It is important to investigate the effect this has on reading processes and skills of monolingual and bilingual children because this issue has received limited research attention while it contributes to our greater understanding of how children's cognitive capacities for literacy attainment are either constrained or promoted through broader social factors operating in a child's literacy-learning environment (Bialystok, 2007; Vygotsky, 1978). Cognitive processing and reading skills were assessed in monolingual and bilingual children at a public school in an urban area of Johannesburg. An English-speaking monolingual group with English as the language of instruction (*N* = 100) was compared with a Zulu-English bilingual group with Zulu as first language (L1) speaking proficiency and English as second language (L2) literacy experience (*N* = 100) on measures of reading, phonological awareness, vocabulary skills, and working memory. Performance in cognitive processing and reading skills of these two groups was compared to an Afrikaans-English bilingual group (*N* = 100) with dual medium instruction. Tests of language proficiency confirmed that the Afrikaans-English bilinguals were balanced bilinguals and that the Zulu-English bilinguals were partial bilinguals.

Aim and method: The purpose of this study was to expand knowledge in the field of second language reading acquisition and language of instruction by examining the impact of language related factors on the cognitive development and literacy competence of monolingual and bilingual children in the South African context. The central tenet of the bio-ecological approach to language, cognitive and reading assessment is that language acquisition is inseparable from the context in which it is learned (Armour-Thomas & Go-Paul-McNicol, 1997). Drawing from this approach, the present research project investigated the effects of the level of orthographic transparency on reading development in the transparent L1 and opaque L2 of biliterate Afrikaans-English bilinguals learning to read in a dual medium school setting. The effects of oral *vs*. written language proficiency in the L1 on the acquisition of L2 English reading was also investigated by examining whether reading processes and skills transferred from one language to another and the direction or nature of this transfer in partial and balanced bilinguals. Finally, whether a balanced bilingualism and biliteracy experience had beneficial effects on cognitive tasks demanding high levels of working memory capacity, was investigated.

Results: Reading in Afrikaans – the more transparent orthography – reached a higher competency level than reading in the less transparent English**.** Dual medium learners and L1 English monolingual learners acquired reading skills in their home language(s) at a higher level than L2 English with L1 Zulu speaking proficiency learners did. Dual medium learners outperformed both monolingual learners and L2 English with L1 Zulu speaking proficiency learners on tests of phonological awareness, working memory, and reading comprehension. They also reached similar competency levels in tests of vocabulary knowledge than monolingual English (L1) learners. These differences translated into different relationships and strengths for reading attainment in monolingual and bilingual children. These findings provide support for a language-based and context-dependent bio-ecological model of reading attainment for South African children.

Conclusions: Bilingual children who are exposed to dual medium reading instruction programmes that value bilingualism philosophically and support it pedagogically create optimal conditions for high levels of cognitive development and academic achievement, both in the first and in the L2. Absence of mother tongue instruction and English-only instruction result in a reading achievement gap between emergent Zulu-English bilinguals and English monolinguals. This effect is not observed in the biliterate Afrikaans-English bilinguals; instead, these children performed better than the English monolinguals on many English tasks and working tasks requiring high levels of executive control and analysis of linguistic knowledge, despite English being their L2 while learning to concurrently read in Afrikaans and English. Arguments for and (misguided) arguments against dual medium education are examined to identify the consequences of translating this model of education into effective schooling practices, given the socio-political contexts in which educational reforms take place at local schools and in communities (Heugh, 2002). More broadly, good early childhood education includes a rich language learning environment with skilled, responsive teachers who facilitate children's literacy learning by providing intentional exposure to and support for vocabulary and concept development. Classroom settings that provide extensive opportunities to build children's reading competences are beneficial for young dual language learners no less than for children acquiring literacy skills in a one-language environment (Cummins, 2000; Heugh, 2002).

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CHAPTER 1:
INTRODUCTION: LEARNING TO READ IN SOUTH AFRICA

"Language and knowledge about language are no longer a central focus of the educational process. It is time for critical pedagogy to take seriously and to heart issues of language, since not doing so will continue to lead to a flawed understanding of oppression and in the liberating potential of education."

(Regan, 2009, p. viii)

This thesis takes the position that language(s) of instruction can significantly influence the cognitive development and academic achievement of dual language learners. The data from this study shows that neo-colonial English-centric models of education do not meet the educational needs of bilingual leaners, and at the same time, how inappropriate attitudes with regard to English-only instruction lie at the heart of poor educational outcomes of dual language learners (Heugh, 2010). This study has important implications for improving the quality of language teaching, as well as learning policy and practice while South Africa is still grappling with significant and complex educational challenges to produce well-educated, literate bi/multilingual citizens (Heugh, 2010).

This research project has drawn on my personal experience as a bilingual child and on a firm belief in the cognitive, educational, and social advantages of bi-/multilingualism. The most recent national systemic evaluation of literacy and numeracy demonstrates that in Gauteng, where the present study was conducted, approximately 70% of Grade three learners cannot read or count (Department of Education, 2004). In short, we are confronted with complex language and educational reform challenges in South Africa. This chapter aims at identifying and describing the need for research into the cognitive processing skills that are important for reading development and academic success in the multicultural and multilingual South African context. The chapter provides a current and historical context for the study, sketches the linguistic structure of the languages under investigation, and presents a problem statement and rationale for the present study.

1.1 THE CURRENT CONTEXT

As is the norm in most African countries, including South Africa, the vast majority of the population is multilingual or bilingual. South Africa has approximately 51 million people, more than 28 different languages are spoken[1], and of these, 11 are recognised as official languages (Statistics South Africa, 2012). The language spectrum of this country includes nine indigenous languages, namely: isiXhosa, Sepedi, Setswana, Sesotho, Xitsonga, siSwati, Tshivenda, and isiNdebele. The two remaining languages - English and Afrikaans (based on Dutch) - are products of the colonial era (Heugh, 2010). Figure 1.1 shows the percentage of mother tongue speakers of each language from the 1996 and 2011 census figures, demonstrating that multilingualism is a continuing and growing phenomenon in this country (Statistics South Africa, 2011). This diversity of cultures and languages in South Africa inspired Archbishop Desmond Tutu's familiar phrase: "*the rainbow nation*", which describes the nation that came into being in 1994.

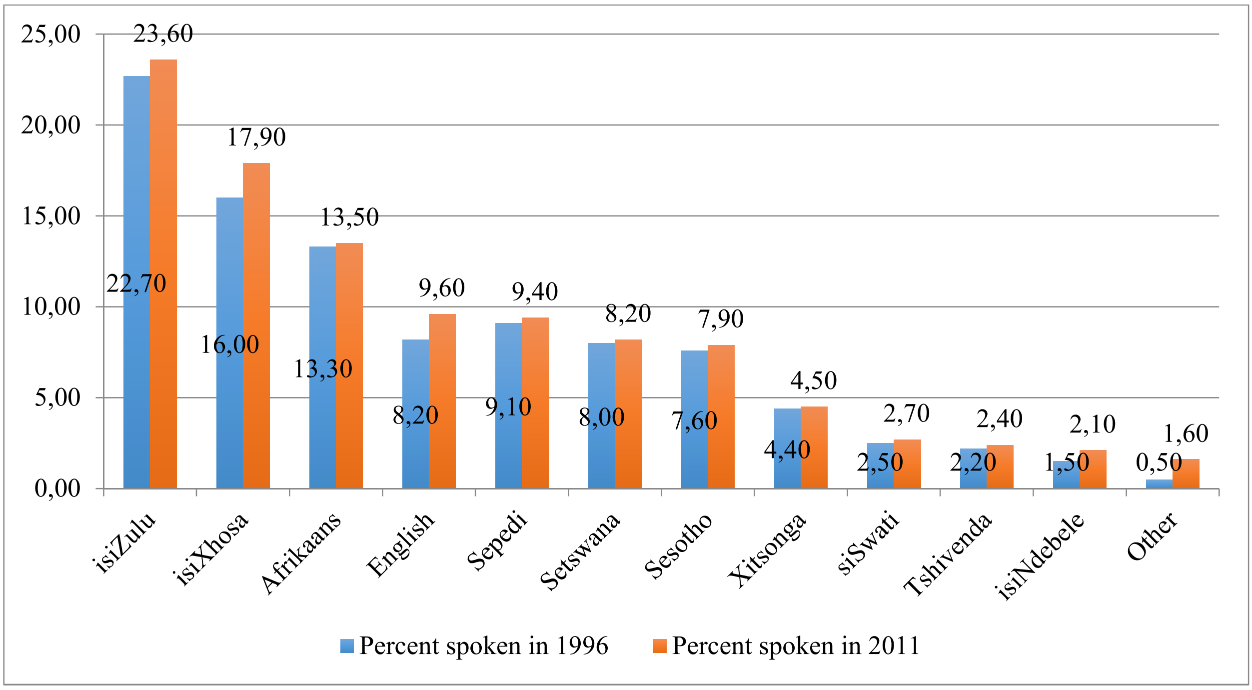

Figure 1.1: **Per cent of home language speakers in 1996 and 2011 (adapted from Statistics South Africa, 2011).**

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[1] ***Note.*** Others include Arabic, German, Greek, Gujarati, Hebrew, Hindi, Portuguese, Sanskrit, Tamil, Telegu, Urdu, and Sign Language (Statistics South Africa, 2011).

Figure 1.2 below reflects the geographical distribution of languages in South Africa.

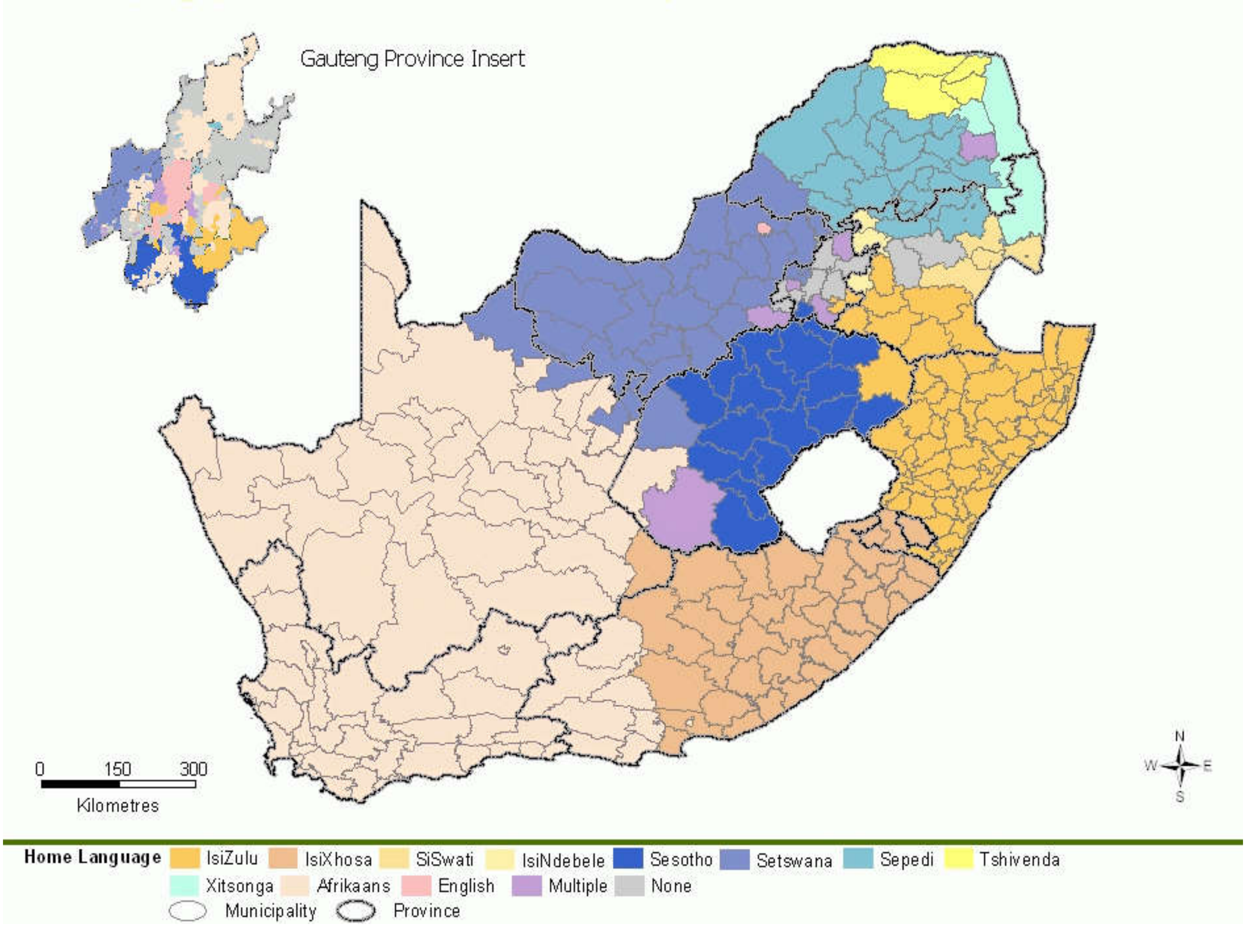


***Figure 1.2*:** **Geographical distribution of languages spoken in South Africa (adapted from Statistics South Africa 2011 population census data, and the UNESCO world language report, 2000).**

As can be seen in Figure 1.2, linguistic diversity is not uniform across the provinces of South Africa. In the Gauteng Province, and specifically in the city of Johannesburg, where this study had been conducted, Afrikaans, Zulu[2] and English are spoken as first languages by respectively 21, 12 and 8.2% of the population (Statistics South Africa, 2011). This diversity of languages requires researchers to investigate ways in which learners can have access to optimal conditions for linguistic, cognitive, and academic growth amidst this unique context (Heugh, 2010). Pivotal to this need is the issue of language-in-education policies and

[2] Zulu is used in this chapter to refer to isiZulu from this point forward.

practices in South Africa. Inequalities in education arise out of the sociocultural and political history of the country, which is examined in the next section (Heugh, 2010).

1.1.1 The South African educational context

The education system in South Africa is a complex product of political changes that in turn influence language of instruction practices, described in more detail later in the chapter. At present, the main themes characterising the South African education system are:

- The political and educational history of South Africa has resulted in a number of different contexts of education and in the dominance of English as the preferred language of instruction.
- The slow and limited implementation of the policies of multilingualism, including "home language alongside an additional language" as set out in the language-in-education policy.
- Language-instruction practices, particularly the use of English as the medium of instruction are considered by many language experts as a primary cause of poor academic achievement in children who speak other home languages.
- There are a number of reasons why the development and use of African languages in education are the subject of much debate and not prioritised. Thus, home language instruction and / or bilingual education programmes are not widely implemented.
- Parents have a choice of medium of instruction from the first school year.
- Adequate language-in-education practices require awareness and application of a number of theoretical concepts (Chapter 2) to highlight specific language components and skills that should be addressed in teaching monolingual and bilingual children.

With its 11 official languages, South Africa provides the opportunity for developing multilingualism and this study aimed at investigating the development of cognitive-linguistic processes underlying the development of academic language in Grade 3 learners in order to address the following questions:

- Are there differences in the rate and process of development of oral language proficiency and literacy acquisition between monolingual and bilingual learners?
- Are there other factors (e.g. language background and educational context) that may explain individual variation in the rate and ultimately academic competency of different learners?

1.1.2 Comparison between different educational contexts

The hegemony of English refers to the belief that access to English is central to African empowerment borne out of the colonial history of South Africa whereby individuals who lacked competence in English were unable to develop to their educational potential. This belief also gave rise to the negative views of African languages, in particular, used by the apartheid government to achieve an undereducated African working class. Heugh (2010) argues that the more inaccessible the language of power is for the majority the greater pressure will be exerted to obtain access to English as a language of power. Webb (2010, p. 164) further adds that African-languages speakers do not have a sense of “linguistic nationalism”, because nationalism in African is based on race and not ethnicity. Webb (2010) further adds that there is a lack of support from parents to implement a multilingual policy due to the lack of a full understanding of the negative impact of promoting a language of instruction that has words and concepts that differ to a bilingual child’s first-language. In this way depriving the bilingual child of using knowledge gained in their first languages to apply to what they are learning. Table 1.1 summarises the percentage of second-language English learners using English as a medium of instruction in specific provinces in South Africa.

Table 1.1 Percentage of second-language English learners selecting English as the medium of instruction and proportion of schools using English as language of instruction in (adapted from Webb, 2010).

Province	Percentage of second-language English learners selecting English as the medium of instruction	Percentage of school using English as the language of instruction
Gauteng	74	74
Eastern Cape	64	67
Western Cape	48	37
Limpopo	79	77
KwaZulu-Natal	64	64

Another reason for the limited implementation of a multilingual language policy is the heterogeneity of in the home language backgrounds of learners, which makes the choice of English for Gauteng urban schools understandable at a pragmatic level. In some rural schools the language of instruction is the home language from grade one-to-three, with English taught as a subject from Grade 1. From grade 4, learners are transitioned into English medium of instruction and expected to demonstrate their knowledge and understanding of English, which is their L2 or even L3 (Webb, 2010).

The limited implementation of home language instruction alongside English (L2) instruction is not unique to South Africa. Heugh (2010) cites research carried out in Ethiopia, a much poorer country relative to South Africa, where children are instructed in their home language, Amharic, for either four, six, or 8 years of home language instruction. Children with eight years of home language schooling demonstrated higher scores on mathematics, science and biology compared to children with four or six years of home language instruction. In a similar vein Obondo (2008) reported that 22 out of 34 countries use African languages as the medium of language instruction at primary school level and of these only 3 use African languages as the medium of instruction at secondary school level. According to Obondo (2008) one criticism levelled at bilingual additive instruction appears to be the possibility that such an instructional approach does not provide sufficient exposure to the second language as teaching time is divided between L1 and L2. Obondo (2008) described a number of research projects in various African countries where indigenous languages have been used as the language medium of instruction, some have not succeeded in promoting high level of academic achievement due to these being perceived as denying access to English as the language of power.

Fleisch (2008, p. 98) notes that although research points to a relationship between academic achievement and English language proficiency, there is limited research into the "generative mechanisms, the underlying reasons that link children's experiences with language at school and their failure to become proficient in reading", i.e., exactly how language is linked to academic achievement at a cognitive-linguistic level to uncover what learners are learning about language that may facilitate or compromise their academic achievement and that home language instruction does not exist in a social and political vacuum" The results of Braam (2004) and Malherbe (1977) contribute some insights into the perceived advantages of bilingual and home language instruction. Braam (2004) investigated reading achievement in lower middle class children attending an English-Afrikaans school in the Cape Flats, 55% of the children enrolled in English instruction despite Afrikaans being their home language. These children outperformed Afrikaans-speaking children attending Afrikaans instruction. Braam (2004) attributes the results to a complex set of social dynamics. In this particular community Afrikaans is stigmatised as the language of the lower class with teaching practices reinforcing this stigmatisation through oral language teaching, while teachers in the English stream, supporting the perception of English as language of academic achievement alongside teaching practices that promote higher-order thinking. Malherbe (1977) found that children who had Afrikaans home language instruction up to Grade 7, followed by dual-medium instruction in Afrikaans and English from Grades 8-12 performed better on tests of reading than monolingual Afrikaans and English in both the first-language and L2. This pattern of findings was evident in rural schools, which are less well-resourced than urban schools. Fleisch (2008) points out that comparisons of academic achievement between Afrikaans and African languages need to bear in mind that the apartheid government invested more money in the development of academic texts in Afrikaans relative to that of English. Heugh (2010) points out that the support for home language instruction within the context of bilingual education is seen in the Department of Education and Training's application of the Bantu Education Act during apartheid, Grade 12 results were significantly better with 8 years of home language instruction then when home language instruction was reduced to three.

In contrast to the generally positive findings on academic achievement of children educated in their home language and/or bilingual additive programmes, the language underachievement levels of children instructed to read in their L2 has received a substantial amount of research attention. Broom (2004) studied the reading achievement of third grade learners in 20 urban primary schools and found that the L2 English participants scored one scale score below first-language English speakers, suggesting that they had not reached the same level of academic language proficiency as their first-language peers despite a substantial period of exposure to English. Pretorius and Mampuru (2007) investigated reading achievement in Grades 1, 3 and 5 in all eight languages of South Africa and found that two-thirds of Grade 1 children could not read in their home language with the majority of L2 English learners improving in word deciding skills with increased exposure to English in academic language proficiency by Grade 5. However, word decoding and comprehensions still lagged behind the proficiency levels of English first language children, confirming that oral language proficiency is linked to academic achievement, which is in turn critical for reading comprehension and thus literacy attainment. These studies (Broom 2014, Pretorius & Mampuru, 2007) confirm that there is a difference between reading achievement in a first-language and L2, imply strong social and cognitive influences on reading achievement, and confirm that the role of language on reading performance of bilingual children is not straightforward, but has an impact on level of reading achievement in bilingual children.

The present study aimed at comparing the language and literacy skills of Grade 3 learners in three contexts: (1) English monolingual children learning to read in their home language, (2) emergent Zulu-English children with L1 Zulu spoken proficiency, and L2 English literacy instruction, and (3) bilingual Afrikaans-English children attending Afrikaans and English literacy instruction. Each of these contexts offer the opportunity for comparative descriptions of language learning and associated advantages and disadvantages of language learning and literacy acquisition for children's language learning. As pointed out in the introduction, the development of an academic language should be the primary goal of education. In multilingual contexts, this requires the need to understand how additional languages are learned in different contexts so that those experiences found to be facilitative of reading achievement could be incorporated into teaching practices (Bialystok, 2007). The next section addresses the theory and research pertaining to language and literacy acquisition both internationally and in South Africa.

> *"Most researchers who have studied both monolinguals and bilinguals undoubtedly agree that working with bilinguals is a more difficult and challenging enterprise."*
>
> (Grosjean, 1989, p. 131)

As eloquently stated by Grosjean (1989), bilingualism or the ability to speak two languages (Baker 2000) is a difficult area to research because of the diverse ways in which children can acquire two languages. Some children learn both languages at home and at school, while others may learn one language at home and another at school. These factors are important in determining the effects of bilingualism on cognitive and academic language development. For example, in South Africa, many bilingual Zulu–English speaking children typically have early oral language input in Zulu, with English gradually introduced at school. They are emergent bilinguals (Verhoeven, 2007) because their second language (L2) develops subsequent to the acquisition of the L1. They are L2 English learners, since they may first encounter this new language when they go to school. Consequently, they have limited oral language proficiency in this language. This situation contrasts to that of other bilingual learners who have encountered both languages before scholastic instruction begins, as in the case of some bilingual Afrikaans-English speaking children. These children are often bilingual from birth due to one parent speaking to them in Afrikaans and the other in English and may also obtain instruction in both languages (Steyn, 1995). These different situations make bilingualism and bilingual education important fields of contradiction and contestation worthy of research attention (Bialystok, 2007).

For example, questions arise about the link between bilingual development and literacy attainment, whether degree / type of bilingualism impacts on learning to read, whether there are advantages to learning to read in more than one language, and whether learning a second language is essentially the same as learning one's first. To answer these questions requires research into the role of bilingualism on learners' levels of cognitive and academic development using a cross-linguistic and cross-cultural research design. Such a study can illuminate the significance of bilingualism on children's cognitive development and academic achievement. The multicultural and multilingual nature of South Africa lends itself to such research on bilingualism and cognitive development.

Within the context of multilingualism and multiculturalism in South Africa, literacy development must be defined in such a way that encompasses the complex interactions among language-in-education policies and practices, cognition, society, and culture (Bialystok, 2007). Therefore, the more language learning is conceptualised as not only an "in the head process" but also in terms of socio-cognitive interactions, the more "ecological" it becomes. Such an ecological approach is relevant to learners, teachers, curriculum designers, teacher, education, and educational policies (Kern & Schultz, 2005, p. 1), and is central to the current study, since it takes into account the immediate and larger South African sociocultural contexts in which children become literate.

1.2 THE HISTORICAL CONTEXT

Prior to 1994, linguistic diversity in South Africa was utilised to justify a segregated school system for children from different language groups. The assumed intention was to promote each individual group's cultural heritage and customs by establishing schools according to each group's individual language and race (Heugh, 2010). Ideally, the impact of this should have meant that the majority of African language speaking children whose first language was different from English would have been able to attain academic success by means of their mother tongue. However, the opposite prevailed and learning opportunities were more readily available to the White (minority) group, with inferior facilities being created for the African language (majority) groups (Heugh, 2010). English and Afrikaans (White) schools were advantaged in terms of better teaching, resources, and training. Thus, learners attending these schools were exposed to learning opportunities that allowed them to develop to their full academic potential.

On the other hand, Black schools were disadvantaged in terms of teaching, resources, and training. Hence, these schools afforded minimal opportunities and as a result, these learners often could not cope academically (Heugh, 2010). Subsequently, African language (Black) schools were required to use English, and later Afrikaans, as mediums of instruction. This served to promote the status of these languages as languages of power, and at the same time excluded the other nine African languages from being perceived as languages of social, economic, or political power (Heugh, 2010). In 1976, the Soweto uprising led to the end of

Afrikaans as a medium of instruction at Black schools. However, that had the effect of placing English, also a perceived language of colonialism and power, in the role of language of liberation (Heugh, 2010). Afrikaans came to be viewed as the language of oppression, English became the language of freedom and democracy (Heugh, 2010).

The end of the apartheid regime led to the abolishment of this segregated education system. It was replaced by a system aimed at integrating all language groups and cultures within the language-in-education policy (1997) that stated that multilingualism should be encouraged with the home language being promoted, while ensuring exposure to additional languages. This education policy was designed to maintain and develop the mother tongue proficiency alongside L2 English for the majority of African language speaking children, which would ensure optimal cognitive and academic development. The end of apartheid meant that English-language medium schools with their better facilities became accessible to all learners, regardless of their language proficiency. Thus, many African language speaking parents who had been disadvantaged in the past, were keen on their children attending schools that were previously inaccessible (Heugh, 2002).

Presently, parents of African-language speaking children still demand that their children receive their basic education through English medium instruction (Buthelezi, 2003; Ramadiro, 2012). Thus, one could argue that the label *rainbow nation* is a bit optimistic; South Africa remains divided along linguistic and ethnic/ racial lines. Furthermore, the contrast between a multilingual policy and the lack of multilingualism in practice is striking, especially after the constitution has elevated the nine African languages to official status. Yet, literacy instruction takes place in English and / or Afrikaans only (Heugh, 2010). Afrikaans could have become the preferred language in the country, if not for the previously mentioned close connection between Afrikaans and the apartheid regime. Afrikaans has also been affected by the post-apartheid favouring of English, but White Afrikaner voices are able to raise emotional arguments for the survival and revival of Afrikaans (Heugh, 2010). This can be seen, for instance, in the Afrikaans impact on English by means of loanwords, such as the word 'braai'[3] being used in non-Afrikaans discourse (Heugh, 2010). Consequently, most L1 speakers of Afrikaans can opt for mother tongue instruction or dual medium instruction at primary and high school levels. On the other hand, African languages, including Zulu,

[3] The word 'braai' is the Afrikaans translation for the English 'barbecue' or 'roast'.

although used extensively in oral communication are not used as mediums of instruction beyond Grades 3 or 4.

The neglect of mother tongue / dual medium education applies to speakers with a Zulu language background and not to those who are either Afrikaans or English as an L1 (Heugh, 2010). Therefore, with a different justification, the education policy adopted in post-apartheid South Africa still resembles the one that was in place in the apartheid era: English remains the dominant language medium of instruction, whereas African languages are marginalised, in effect “a perpetuation of inequalities of the past” (Webb, 2004, p. 147). Heugh (2010) points outs that South Africa shows a preference for looking towards neo-colonial English-centric models of education, which do not adequately address the educational needs of bilingual children, instead of dual medium models that do meet the needs of such learners. Henning and Dampier (2012) challenge researchers to provide compelling evidence in relation to the benefits of bilingual education or dual medium instruction for optimal cognitive development and academic achievement in bilingual children in South Africa. In particular, researchers must address the magnitude of advantage conferred to strengthen the argument that might be mustered in support of dual medium instruction beyond the early school years.

There are numerous studies that show that neglect of mother tongue instruction is related to general underachievement of second language learners (Cummins, 2000). Cummins (1998, p. 3) asserts that there are over 100 empirical studies reporting “a positive association between additive bilingualism [involving maintenance and continued development of the mother tongue] and students’ linguistic, cognitive and academic growth.” The benefits of mother tongue instruction or an additive approach to bilingualism in an education system (defined here as “a legitimate mechanism for creating equal education opportunities”) are increasingly being recognised (Malherbe, 1977, p. 21). For example, in Guatemala, a poor country with poor educational outcomes for the majority of bilingual children, researchers implemented bilingual / dual medium instruction from Grades 1 to 6 (Dutcher, 1995). They controlled for quality of teaching across languages, ensured teachers were trained to use bilingual pedagogical methods, and incorporated an awareness programme to promote positive attitudes of parents, thereby elevating the status of the local Amerindian language in a predominantly Spanish country; much like English in South Africa. Researchers report that “Experimental students were not disadvantaged in the acquisition of English language skills”

(Dutcher, 1995, p. 12). Furthermore, from Grade 4 onwards, the biliteracy instruction group outperformed children taught to read only through a second language. Thus, academic language proficiency in L2 English appears in no way prejudiced by maintenance and continual development of the learners' first language. This result has been replicated in a number of contexts; including Australia, India, South-East Asia, North America, and Europe (Dutcher, 1995). Therefore, the success of dual medium models depends on many things, including parental and community support for biliteracy instruction.

Of particular note is that Guatemala, unlike South Africa, does not have an educational policy that recognises the benefits of mother tongue instruction and commits itself to an additive approach to bilingualism within the education system. Yet, the Guatemala case shows that language policy successes are ones that take into account environmental and social variables associated with literacy practices linked to an awareness of the benefits of Spanish home instruction alongside L2 English instruction (i.e. dual medium instruction) to address educational equity and linguistic diversity for the learning and development of young bilingual children, even under poor conditions.

Why then, are the benefits of mother tongue instruction or positive impact of additive bilingualism on cognitive development and academic achievement still being ignored by African language speakers in South Africa? Could parents of African language speaking children be motivated to value and invest in literacy support in their children's L1 if it can be shown that mother tongue and L2 instruction results in high levels of L1 and L2 cognitive development and literacy competence? Prinsloo (2007) argues that the significance of mother tongue education alongside L2 English on a child's cognitive development and academic success does not appear to have been established. This author further argues that there is little public or parental awareness of the magnitude of the advantage conferred by dual medium instruction (mother tongue plus L2) on the cognitive development and academic success of bilingual children acquiring reading processes and skills in one or both languages in the South African context. Prinsloo (2007) points out this has been the case because other factors; including poverty, poor resourcing, low teacher capacity, poor school management, HIV / AIDS, and lack of a literacy culture; are cited as explanatory factors for poor literacy scores in African language speaking communities. The issue of medium of instruction, or role of language in education persists as though unresolved, however, concerns about children's academic achievement have remained prominent.

1.2.1 What are the reasons for poor academic attainment of South African Grade 3 children?

The central argument of this study is that the dismal standard of literacy levels of Grade 3 leaners in Gauteng is in part owing to the lack of acknowledgement of the critical role of language in education. In the multilingual South African context, this oversight manifests as poor academic achievement. At the same time, the effects of language-in-education practices are not straightforward: There is a complex interaction of cognitive, educational, and social factors. Failure to consider these factors would, in all likelihood, continue to perpetuate low academic achievement levels. I propose the following reasons for the current crisis in education.

1.2.2 Lack of awareness of the cognitive-linguistic processes underlying academic language development in bilinguals

Firstly, educators seem to be unaware of the cognitive-linguistic mechanisms underlying learning to read in more than one language. Bilingualism is poorly understood, and the existing research has yielded inconsistent results. This is one of the reasons why additive bilingual teaching methods are not always used by educators to facilitate the development of language and literacy of bilingual children.

The development of language skills in the bilingual child can be explained by the iceberg analogy of bilingualism (Baker, 2000), illustrated in Figure 1.3. This analogy explains that the learner will use a common underlying proficiency (CUP) for all language components that he / she is required to learn. CUP facilitates the transfer of cognitive skills to a second language. A solid first language foundation is needed before a second one can be introduced (Cummins, 1999). For the majority of African language-speaking children, this ideal is often not met and these learners cannot be considered fully proficient bilingual language learners because of a poor language base in either the first language or the L2. In South Africa, information is available about learners' medium of instruction, but often little or no knowledge exists about their first language development and proficiency.

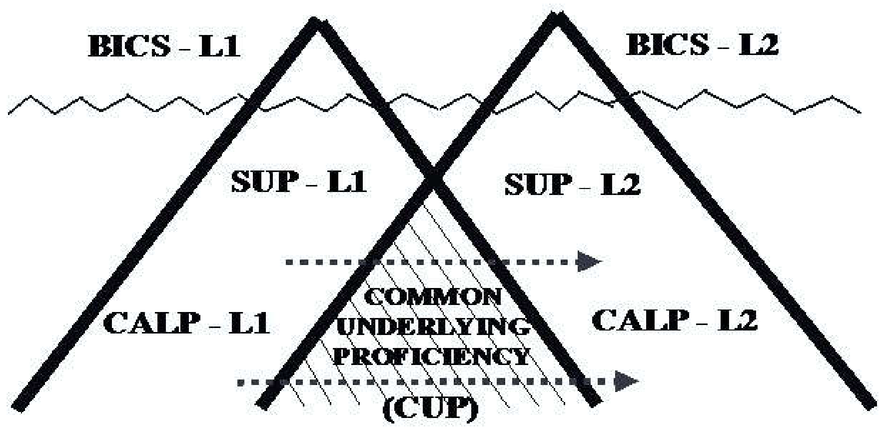


Figure 1.3: **Cummin's (1981, 1999) iceberg model of bilingualism (adapted from Cummins, 1981).**

Cummins (2000) distinguishes between basic interpersonal communicative skills (BICS) and cognitive academic language proficiency (CALP). BICS is the small visible, surface level of language, which requires one to three years to develop but is insufficient to facilitate academic success. It involves the ability to communicate basic needs and wants, and to participate in basic interpersonal conversations. CALP is the larger, hidden, deeper structure of language, which comprises the ability to communicate thoughts, ideas with clarity and efficiency, and an ability to participate in advanced interpersonal conversations. It takes at least five to seven years to develop and is required for academic success, since it involves the ability to communicate effectively in cognitively demanding educational settings (Cummins, 1999, 2000). Each language has a separate underlying proficiency (SUP), which includes the cognitive-linguistic nature of the writing system that the child learns to read and spell in in his / her first and / or second language (such as whether it permits easy letter-to-sound decoding or the use of a more complex letter-sound chunking strategy). This is an important variable in explaining reading measures across languages (Bialystok, Luk, & Kwan, 2005) and thus needs to be considered in relation to the CALP of bilingual children.

Developmental progress from BICS towards CALP is dependent on a print-rich, mentally stimulating environment (Cummins, 1981). A learner's ability to manipulate language in a situation where the context is not evident can be described as an ideational aspect of language because the learner needs a high level of language awareness and sense of how to use it (Cummins, 1981). When BICS is compared to CALP, BICS is described as the universal and instinctive skills commonly associated with a learner's native language, such as vocabulary knowledge (Schwartz, Share, Leikin, & Kozminsky, 2008), whilst CALP implies higher meta-linguistic development (Cummins, 2000), such as phonological awareness (Schwartz *et al.*, 2008).

Ideally, the learner's English language skills will develop to a level where he / she will have CALP and will be able to cope with de-contextualised language in the Language of Teaching and Learning (LoTL) (Cummins, 2000). In the case of many L2 learners, this advanced level is absent. Second language learners often develop the ability to communicate in English, but not CALP because it needs a more extensive exposure to language structure. The learners' ability to attain their academic potential thus depends heavily on their language skills in the LoTL (Cummins, 2000). English as LoTL may have a negative impact on the learners' cognitive processing skills linked to reading attainment resulting in poor reading attainment and inadequate academic language proficiency. Cognitive processing skills; such as phonological awareness, vocabulary, and working memory that underpin CALP (Cummins, 2000) may be influenced by the structure of the LoTL and the specific structure of each different first language to which a bilingual child is exposed.

1.2.3 Lack of awareness of the complex relationship between language, cognition, and reading in children with diverse linguistic profiles

Secondly, existing research on educational achievement does not reveal the complex interaction between language-related factors and bilingualism, cognitive-linguistic processing skills, and reading achievement. This unexplained interaction manifests as poor academic achievement while the real causes are not identified. Consequently, educational interventions are not effective. Effective teaching strategies are more likely to emerge from relevant investigations on how children's language background and educational context impact their ability to acquire or have difficulty in acquiring literacy competency. Language is central to academic achievement. Language mediates thought and forms the foundation of literacy achievement (Reagan, 2009, p. vii). A clear conceptualisation of the nature of language representation and processing is necessary to explain language proficiency, to understand how learning to read in additional languages is facilitated or constrained by sociocultural factors in order to develop appropriate assessment, intervention and educational methods and materials.

Much research has been conducted investigating the link between depth of orthography and the development of cognitive processing skills that underlie reading acquisition in different languages. The research has indicated that speakers of particular languages (e.g. speakers of English *vs*. speakers of German) utilise learning strategies in ways that can be traced to specific ways the particular languages provide access to phoneme-conversion rules. For example, English children use logographic and alphabetic strategies to read, whereas German children use an alphabetic approach to read due to the orthography of German permitting easy access to grapheme-phoneme conversion rules. Despite some significant first steps toward developing theories of reading in languages besides English (Frost, 2005; Seymour, Aro & Erksine, 2003; Perfetti, Liu & Tan, 2005; Ziegler & Goswami, 2005, cited in Share, 2007), the large volume of English reading research, together with the standing that English theories of reading enjoy in contemporary society and culture, have led researchers to question the applicability of English language findings to other languages and orthographies. In particular, Share (2007, p. 604) challenges the assumption that reading science can be founded on whether an English-language theory or finding extends to language X or orthography X, where X is regarded as any of the special cases. Instead, English warrants the special case status and the outcomes from *non*-Anglophone studies are likely to offer a better approximation of how reading works. The extreme ambiguity of the English spelling-to-sound code that has shaped contemporary reading science focuses on Anglo-centric research issues that have only limited significance for a universal science of reading. Therefore, Perfetti, Liu, and Tan (2005) point out that a fuller understanding of both the universal and language-specific features of reading is required in research on learning to read in different orthographies, particularly in bilingual children (Perfetti *et al*., 2005). This issue is addressed in the present study by examining learning to read in the two languages of biliterate Afrikaans-English bilinguals. This issue is important given the 11 official languages in South Africa, which characterise this country and make it one of the countries with the highest number of official languages in the world (Heugh, 2010).

1.2.4 Lack of support for the use of dual medium instruction

Thirdly, for a number of reasons to be explored in more detail later in the thesis, the implementation of support for the use of dual medium instruction has not received adequate attention. In addition, research evidence for the cognitive, educational, and social advantages of bilingualism in South Africa are needed during the foundation phase. This is the phase during which the primary goal of education is to develop academic language so that learners can engage meaningfully with content through appropriate teaching of academic language in the first three grades that will enable them to take advantage of learning opportunities across the curriculum. For reasons to be outlined later, I believe that my study has implications for language teaching practice of bilingual children in South Africa.

In general, research indicates that learning and speaking more than one language confer cognitive advantages in general cognitive functioning, including executive control and working memory, as well as in areas of learning that have a strong cognitive component, such as phonological awareness (Laurent & Martinot, 2009; Morales, Calvo, & Bialystok 2013; Schwartz *et al.*, 2008). On the other hand, learning two languages can also result in less progressive performance in some tasks (e.g. tasks where words need to be retrieved quickly) due to possible smaller vocabularies when each language is considered independently (Pearson *et al.*, 1997). Moreover, the effects of dual language learning may depend on the specific languages being learned.

Cognitive advantages conferred by dual language learning for tasks, such as sounding out words when learning to read may depend on which two languages a child is learning. In bilinguals whose two languages have similar writing systems, Bialystok and colleagues (Bialystok, Luk & Kwan*,* 2005) report a bilingual advantage in decoding when bilinguals are compared with monolinguals. These authors have found that both Spanish-English and Hebrew-English bilinguals, whose two languages are based on the alphabetic principle, have significantly higher scores on non-word decoding when compared to their English-speaking monolingual peers. The bilinguals also show strong correlations between their non-word decoding skills in their two languages. Bilinguals whose two languages are written using the same system also have the potential of transferring reading skills across languages. However, for bilinguals whose two languages have a different writing system, such as Chinese-English bilinguals, although they showed some advantage over the monolinguals in terms of decoding skills, their advantage is modest and insignificant. Moreover, phonological awareness skills are related across languages for bilinguals and appear to transfer between languages, regardless of the language combinations. Given that phonological awareness develops from experience with languages, educational practitioners who work with young bilingual children should have some awareness of the bilingual child's needs to receive quality experiences (i.e. experience with fluent speakers) in each of their languages for optimal cognitive development and reading success.

Share (2007) contends that Chinese represents an extreme point on the spoken / written continuum in terms of diglossia (Ferguson, 1959). The finding that reading accuracy in Chinese does not correlate with phonological awareness in Bialystok, Luk, and Kwan's (2005) study, confirms this divergence. In a later study examining Chinese speaking children learning L2 English (ESL) in Hong Kong, Chinese-English bilinguals in Canada, and a monolingual English group in Canada, Bialystok, McBride-Chang, and Luk (2005) explain that Chinese-English bilinguals in Canada perform similarly to the monolinguals in Canada on phonological awareness tasks while the Chinese speaking ESL students perform the worst. The Chinese speaking ESL students are learning English, a minority language in Hong Kong, where the majority language and language of schooling is Cantonese. All three groups perform similarly well on syllable awareness tasks. Bialystok, McBride-Chang, and Luk (2005) suggest that phonological awareness develops in the context of the languages with which the child has consistent experiences; English enables phonological awareness, while exposure to Chinese promotes syllable awareness. The authors also suggest that phonological awareness develops in part because of experience with particular languages and that bilingualism on its own does not influence phonological awareness skills. In other words, similarities between the two languages, the language of the child's school experience, and the quantity of exposure to each language contributes to bilingual children's reading performance. Thus, educational practitioners should have some awareness of the structure of each language the child is learning, (e.g. do the languages share the same alphabet? Is the language read from left to right or right to left? Are syllables or phonemes used to represent units of spoken language?). These topics are important for the teaching of reading and remediation of reading difficulties in the different languages of young bilingual children. Table 1.2 summarises the pertinent linguistic and orthographic characteristics of the target South African languages in the present research, discussed in more detail in the next section.

Table 1.2: Language family and total number of different speech sounds and symbols in Afrikaans, English, and Zulu (compiled from Botha, Ponelis, Combrink & Odendall, 1989; Suzman, 1996).

Language	Language family	Total number of symbols	Total number of sounds
Afrikaans	Indo-European (West Germanic branch)	57	57
English	Indo-European (West Germanic branch)	104	50
Zulu	Niger-Congo (Bantu)	54	54

1.3 LINGUISTIC SKETCH OF THE AFRIKAANS, ENGLISH, AND ZULU LANGUAGES

Afrikaans, Zulu, and English are three of the national languages of South Africa; respectively, they are transparent and opaque orthographies. However, these languages are phonetically dissimilar languages. Both English and Afrikaans belong to the Indo-European, specifically West Germanic, language family (Botha, Polenis, Combrink, & Odendall, 1989). This relationship between Afrikaans and English may be seen in overlapping words with the same meanings but different spelling, such as ‘palace/paleis’ and ‘constable/konstabel.’ Afrikaans developed from 16th century Dutch. Afrikaans is the youngest Germanic language in Africa. Although Afrikaans and English are connected to the West Germanic language family, many differences exist between them. The main difference is depth of orthography. English has an irregular orthography. For example, the English letter ‘a’; which, in different word contexts; represents the vowels in ‘h<u>a</u>t’, ‘b<u>a</u>th’, and ‘plate’. In addition, many English words cannot be read using sound alone, such as ‘laugh’ and ‘yacht’. Afrikaans can be directly written as it is spoken. Its orthography is transparent, similar to German, with a clear and unambiguous correspondence between spelling and sounds. English sounds map to more syllables and consonant clusters appearing before and after vowels than do Afrikaans sounds (Botha *et al.*, 1989). Similar to Afrikaans, Zulu has a transparent orthography that places emphasis on the syllable. It belongs to the Niger-Congo family of languages. This language family is characterised by an agglutinating structure, whereby prefix and suffices are used to form words. The Zulu language is characterised by vowel harmony. Vowel harmony means that certain vowels cannot occur with other specific vowels within a word. For example, [o] appears if the following syllable has a high vowel [i] or [u], otherwise [ ] appears (Suzman, 1996).

From the preceding discussion, it can be hypothesised that differences in the Afrikaans, Zulu, and English orthographies may produce differences in reading attainment. This has important implications for reading instruction, as well as remediation of reading difficulties. Furthermore, the present study sought to contribute research about the role of bilingualism on children's reading attainment in two orthographically dissimilar languages, i.e. orthographically transparent Afrikaans and orthographically opaque English within the same group of bilinguals. These languages have high prestige and status due to historical and sociolinguistic reasons (Heugh, 2002).

1.3.1 Mother tongue education in bi- and multilingual contexts: Some implications for reading achievement in bilingual youth in South Africa

Differences in vocabulary abilities have also been identified between bilingual children who are simultaneous learners and sequential learners. *Simultaneous bilinguals* have started acquiring two languages beginning at birth or sometime during the first year of life, while *sequential bilinguals* are children who begin the process of acquiring the second language after making significant progress toward the acquisition of the home language (Uchikoshi, 2012). In a recent longitudinal study, Cantonese-English and Spanish-English bilinguals who are exposed to English from a younger age have more expansive English vocabulary scores at the age of five than dual language learner (DLL) children who are exposed to English later. This gap does not lessen even at the end of the second grade (Uchikoshi, 2012). This finding suggests that the quality and quantity of their exposure to each language affects vocabulary growth and subsequent reading comprehension, perhaps irrespective of the language being learned.

A major question remains whether bilingual children benefit from English-only instruction to the same degree that they may benefit from a transitional approach that initially uses the home language and gradually moves to English-only instruction. There is some support in the research literature that a transitional approach and an English-only approach may produce similar results on English outcomes in the short term. Farver, Lonigan, & Eppe, (2009) found that English-only schooling is as effective as a Spanish-to-English transitional strategy when a specific early literacy and learning intervention is used. However, these authors have not collected data on comparable outcomes in Spanish for young Spanish speaking DLLs, which limits any strong conclusion about whether bilingual children benefit from English-only instruction to the same degree that they may benefit from a transitional approach.

Barnett *et al.* (2007) propose that although children in high-quality dual medium instruction *and* children in high quality English-only instruction show significant gains in language, literacy, and mathematics while Spanish children in dual medium instruction show greater gains in Spanish than their English-only counterparts without losses in their English language scores. Duran, Roseth, and Hoffman (2010) have found no differences between English-only instruction and instruction that includes some Spanish-on-English language and literacy scores. Moreover, children who experience instruction in Spanish have higher scores in Spanish vocabulary and letter-word identification at kindergarten entry. It appears, then, that English-only instruction is detrimental to Spanish language development without providing an added boost to English development. However, Vitiello, Downer, and Williford (2011) announce that more instruction in Spanish only is associated with a lower chance of attaining English proficiency at the end of Grade 2, particularly for children who enter preschool with very low English proficiency. Since this is not an experimental study, we cannot draw strong causal inferences. However, the findings do suggest that at some point, use of the home language might impede sufficient exposure to English. Therefore, it is important to provide home language learning opportunities, as well as adequate exposure and learning opportunities in English.

In a recent review of related research, Espinosa (2010) identified that the best evidence available points to the value of early reading instruction in the home language and in English for reading achievement in English. Espinosa (2010) points out that literacy learning programmes that use a 50 / 50 English-Spanish bilingual approach with young learners are effective in supporting the development of reading skills in both the home language and in English. Illiterate Spanish-English bilingual children are able to develop English language and reading skills on par with their monolingual English speaking peers, while also continuing to develop their Spanish language and reading skills.

Based on the preceding argument, the problem statement and the rationale for this study are presented next.

1.4 PROBLEM STATEMENT

> *"A complete understanding of language acquisition and language proficiency in children can only be achieved by considering how varied social and linguistic contexts alter the processes linked to language acquisition and language use. Despite this, there is surprisingly little research attention paid to a detailed examination of the context in which language acquisition occurs and the impact of variations in context for different types of children."*
>
> Bialystok (2007, p. 393)

> *"The research in South Africa does not as yet have data to echo what bilingual research in the USA, such as Thomas and Collier (2002), has found after decades of large-scale research. We are not convinced, either that these findings can be applied to the South African contexts, as most of the research in that vast literature concerns Spanish and English, or French and English, in the case of Canadian research-languages from the Indo-European group share, which many similarities in syntax and morphology as well as lexis with English, with many cognates. This is not the case with indigenous South African languages."*
>
> Henning and Dampier (2012, p. 105)

Cognates are translation equivalents in two languages with the same or very similar form, e.g. the English-French word pair *tomato-tomate,* or the Spanish-English word pair *giant-gigante* (Amaral, Garrison & Klentschy, 2002; Brysbaert & Duyck, 2010). Research has shown that pointing out cognates can be of value for vocabulary instruction in languages with common word roots and connections between words. This support for conceptual language development has been shown to be effective for promoting language development and reading competency in young bilinguals (August, Carlo, Dressler & Snow, 2005). For example, both monolingual and bilingual learners may be unfamiliar with a term, such as metamorphosis. Bilinguals, however, may be less familiar with some of the concept related words (e.g. *caterpillar, butterfly, hatching*) that teachers may use to teach academic content, and may thus benefit from teachers connecting concepts that are understood in their home language to words in English, e.g. *the butterfly is la mariposa* (Amaral *et al.,* 2002). Similarly, embedded Spanish explanations of English vocabulary words during storybook reading has been shown to produce greater gains than support given solely in English (Lugo-

Neris, Jackson & Goldstein, 2010). Interactive reading or "dialogic reading" can promote vocabulary and other language skills. Interactive or dialogic reading is a strategy that engages children in discussions of texts. Teachers that focus on accessing children's prior knowledge about the concepts and vocabulary in the text, ask questions throughout the text, and encourage discussion of the content and themes (Collins, 2005; Whitehurst, 1992) promote vocabulary achievement.

On the other hand, Collins' (2009) study of Portuguese-English bilinguals' vocabulary support and include five elements of instruction: (1) gesturing, (2) defining, (3) using a decontextualized statement, (4) providing synonymous phrases, and (5) pointing to illustrations. However, it excludes Portuguese words that have English cognates, thereby examining the power of vocabulary support and instruction alone. Collins (2009, p. 94) concludes, *"Results show that there is no minimum level of receptive knowledge necessary before children benefit from exposure and word support. Explanations are helpful regardless of initial L2 (second language) vocabulary levels"*. Therefore, although children's language learning can benefit from the use of cognates, research has also shown that explicit vocabulary support in both languages and many opportunities to use both languages in situations that are motivating and meaningful are important for promoting young children's language development irrespective of whether languages share common root words.

In essence, children learning academic content in a language they are simultaneously learning to speak and understand, probably need additional support to make the content comprehensible to them. Teachers working with bilingual children must, therefore, consider using teaching strategies; such as interactive approaches targeting both content and language; use of graphics, illustrations, and other visuals aids; direct teaching to help students learn skills and concepts; focusing on material with familiar content in addition, of course, to teaching new content; and using the home language to support concept and language development in the L2 (Durand, 2011). We know that effective instruction is a necessary foundation for academic success for all language learners. We also know that "generic" effective instruction is probably not sufficient to promote academic success and accelerated cognitive development among young bilingual children in the absence of teaching strategies that promote balanced bilingualism and biliteracy, such as those created in dual medium programmes. What does this mean for South Africa? Although the research on dual medium programmes is meagre, one implication is that teachers need to allocate time and space for explicit instruction on language and concept development in both languages, and provide extensive opportunities to build children's linguistic and cognitive competencies (Durand, 2011).

The present study takes up Henning and Dampier's (2012) challenge to show that dual medium instruction, which is philosophically and pedagogically supported creates optimal conditions for high levels of cognitive development and academic achievement, both in the L1 and in the L2. At the same time, it shows that the perception of English-only instruction as the best option for attaining academic success in emergent Zulu-English children goes against the principles of the language education policy in the language policy (1997) of the Department of Education. The principles include non-discrimination, promotion of multilingualism through an additive approach to bilingualism (i.e. mother tongue education). Heugh (2006, 2010) points out that arguments against dual medium instruction for optimal cognitive development in education in South Africa rely on rhetorical techniques that hide a bias for supporting the status quo in relation to language use in education, namely a replacement of first language education by an English-only approach. Indeed, Henning and Dampier's (2012, p. 103) argument that many African language speaking children do not have a mother tongue and, therefore, do not need mother tongue instruction is evident in the quotation below:

> *"Children in schools in urban areas show a large degree of linguistic diversity. Gosdell (2011) argues that the notion of mother-tongue [sic] is not easily defined in such areas. Children attending the English medium 'private' school, that we studied, use up to eight different African languages in their home environment."*

Yet, Heugh (2010) points out that *"it is a deficit argument that constructs a messy amalgam of languages for children in multilingual settings"*. This is the result of research evidence in a number of contexts which shows that bilingual children with biliteracy instruction have better language proficiency than monolingual children (Dutcher, 1995). When dual language learners mix languages, they do so for a specific purpose, namely to prevent adults or other authority figures form knowing what they are saying, not because of language confusion. Cummins (2000) would not support a deficit theory, and the authors cited above have not considered more substantially their reading of his argument.

A body of research has consistently shown that individuals who begin to learn in their second language during early childhood become more proficient in their second language than in their first language when monolingual norms are used, e.g. Spanish-English bilinguals (Hammer *et al.,* 2008). This outcome is likely due to English that is the language of instruction, therefore, children are gaining more practice speaking and comprehending English during the day; they are spending less time speaking and comprehending Spanish than their monolingual Spanish peers. In older individuals, the opposite pattern is evident and the first language remains the dominant language. Such trends have been found for the accuracy of pronunciation of Korean-English bilinguals (Yeni-Komshian, Flege, & Liu 2000), as well as for the speed and accuracy of lexical retrieval of Spanish-English bilinguals (Kohnert, Bates, & Hernández, 1999) and of Russian-English bilinguals (McElree, Jia, & Litvak, 2000). This suggests that the language context in which children learn language may matter for how well they can comprehend a given language. Therefore, much of language and cognitive development occurs in the context of social interaction with parents, caregivers, teachers, peers, and other people. Through social interaction, the developing child learns about language, understanding words, and communicating through language. It is language that provides the medium through which children learn how to use language to acquire new knowledge by processing units of language when particular aspects of language (e.g. sound, meaning, grammar) are accessed (Bialystok, 2007).

Research from the 1950s seems to indicate that children learning two languages acquire language more slowly than monolingual children do and achieve smaller vocabularies but in the majority of studies, vocabulary is measured only in English, and the effects of other variables co-occurring with language status, including socioeconomic status (SES) and schooling, are ignored. In more recent studies when such variables are controlled, no differences are found between bilinguals and monolinguals (Bialystok 2010; Romaine, 2004). This finding suggests that SES and schooling, rather than learning two languages, contribute to children's smaller vocabulary size. Similarly, the well-documented and widely-publicized achievement gap between bilingual and native English speakers is sometimes taken as evidence that learning two languages must negatively affect cognition. However, when factors such as SES and school of attendance are controlled, the achievement gap is greatly diminished (Crosnoe & Turley, 2011). A 1962 watershed paper by Peal and Lambert (1962) rectifies many of the methodological weaknesses in previous studies that report negative or detrimental effects of learning two languages on cognitive development. Since that time research has sought to identify and elucidate the areas in which bilingualism benefits language and cognitive development and the areas in which it has little to no deleterious effects on development (Bialystok 1999, 2010; Bialystok *et al.*, 2005; Bialystok & Viswanathan, 2009; Bialystok & Martin, 2004; Morales, Calvo & Bialystok, 2013).

Wolff (2006, p. 18-23) recognises the benefits to be derived from an additive approach to bilingualism:

> *"Educational policies would … be well advised to view multilingualism as an important resource to be utilised as widely as possible since this draws on the children's prior experience, their established abilities, and relates directly to their linguistic, social and cultural environments. Any educational policy, which in consequence deprives children of their mother tongue during education particularly in environments characterised by social marginalisation, cultural alienation and economic stress as is true for many communities in Africa will, produce an unnecessarily high rate of emotional and socio-cultural cripples who are retarded in their cognitive development and deficient in terms of psychological stability. Faced with heavy institutional multilingualism, particularly in urban agglomerations, with English as the preferred target language to which they have only restricted access and largely in the form of inadequate role models … joblessness and juvenile delinquency are just two of the likely social consequences; the other is the emergence of 'new' languages filling the vacuum. Educationists, linguists, sociologists have barely begun to look at a totally new set of problems arising from this consequence."*

1.5 RATIONALE FOR THE PRESENT STUDY

> *"Look at the world of people, and you will be overwhelmed by what you see. But select from that mass a well-chosen few, and observe them with insight, and they will tell you more than the multitudes together"*
>
> (Leedy & Ormrod, 2005, p. 179)

Sufficient empirical evidence exists to indicate the need to identify and distinguish the effects of cognitive processing skills for optimal cognitive development and reading achievement in literacy-learning interventions in children around the world (Department of Education, 2004; National Early Literacy Report, 2009; Snow, Burns & Griffith, 1999; Snow, 2006). Differences between reading success in different languages are associated with the proficiency level attained in each language and the nature / type of bilingualism. This is why language proficiency and age at acquisition are factors that have received much research attention. The impact of linguistic and social contexts interaction in bilingual children is a far less explored issue, as is the extent to which degree or nature of bilingualism contributes to performance on literacy related tasks compared to monolingual peers, and identifying specific cognitive abilities of bilingual children who are at different stages of bilingual proficiency.

As our knowledge advances, it is likely that there are strong connections between the elements of proficiency in a language, age of acquisition, degree and nature of bilingualism, as well as the degree and type of linguistic awareness. Environmental, social, and cognitive factors are likely to be intertwined rather than separate factors. This is because language development requires stimulation from the environment, i.e. children develop language skills but the time at which these skills are developed can vary. Language is also a cultural phenomenon and thus part of the environment (Bialystok, 2007). The present study utilises a "multi-group design" (Gravetter & Forzano, 2009) to examine language variables across several groups: emergent bilinguals, biliterate bilinguals, and monolinguals. It demonstrates differences in reading performance and its composite skills while also taking into consideration the cultural influences, as well as the social contexts in which reading skills are demonstrated. In addition, it takes into account the roles that language and culture play in the cognitive development and reading competency of children with different linguistic profiles, namely, children learning to reading in their native, second, or multiple languages.

Bilingualism has been shown to enrich our brains and enable them to process information more efficiently. It may enhance metacognition, foster thinking and creative problem solving and is associated with a lower rate of dementia in the elderly (Bialystok, Craik & Freedman, 2007; Lasagabaster, 2000). Although cognitive behaviour, such as language knowledge and use are properties of the developing human brain and thus more biological than environmental, the present study offers some attempt to demonstrate that language knowledge and use are influenced by external linguistic and social experiences. Thus, cognitive processing skills linked to reading attainment might be influenced by the contexts in which bilingualism develops, with variations in context determining the effects bilingualism has on cognitive functioning and reading attainment.

Given that there is limited literature about cognitive processes and reading skills of monolingual and bilingual learners, it is important to conduct a descriptive study of literacy attainment and its composite skills in monolingual and bilingual children in the multicultural, multilingual South African context. This country is a socially diverse multicultural, and multilingual society with a policy of official additive bilingualism. A diversity of schools exists: English medium only, that monolingual English and emergent Zulu-English bilinguals attend and dual medium schools that biliterate Afrikaans-English children attend. This blend of linguistic, sociocultural, and political variety makes South Africa a unique setting in which to investigate issues around language development, cognitive consequences of additive bilingualism, and how social environments determine the way in which children are developing cognitive processing skills for reading attainment in any language, are enhanced through social context. The insights of this research endeavour can be used to elaborate models of language and cognitive development for monolingual and bilingual children. This process will also lead to a framework for understanding the relationships and interactions that define whether learning two languages, instead of only one, has effects on information processing systems in ways that affect children's language learning. This line of research will lead to the creation of a model of reading development for different types of South Africa children. Such a model is needed to address the persistent educational problems involving language in emergent bilinguals with the aim of improving their academic achievement in order to empower them and contribute to South African's political, economic and social future, and at the same time contribute to our greater understanding of the nature of the human language faculty (Grosjean, 1989; Heugh, 2002; 2010).

1.6 CONCLUSION

> *"Language is the defining element of our social and cognitive lives, and to the extent that other practitioners that work with bilingual children understand how languages are learned, used, and enjoyed, we will understand as well how individuals and societies interact and how we can make those interactions more harmonious and the induction of our children in these societies more seamless and productive for everyone."*
>
> Bialystok (2007, p. 397)

Cognitive processing skills play a critical role in reading achievement, which form the foundation for a learner to be able to attain his / her academic potential (National Report, 2000). By achieving their full academic potential, learners are empowered to contribute to the encompassing well-being of society (Heugh, 2010). Post-apartheid South Africa redresses racial segregation in the education system by bringing together learners from different languages and cultures through implementing a single multicultural, multilingual educational policy (Heugh, 2002; 2010). Learners who speak African languages face many challenges in acquiring reading competency in a context where the language of instruction (English) is not their mother tongue but the language in which they are expected to become literate. In general, there is limited specific research about literacy development in monolingual and bilingual children in South Africa. Thus, there is a need for this line of research to provide a realistic view of how educators, practitioners, and policymakers are able to translate evidence from research findings to best practice in the education of monolingual and bilingual children (Heugh, 2002; 2006; 2010).

1.7 STRUCTURE OF THESIS

Table 1.3: An outline of the chapters in this thesis.

Chapter	Content
1. Introduction to literacy development in the multicultural, multi-lingual South African context.	This chapter provides a description of the context in which literacy occurs in South Africa, including language related factors in the teaching and learning process. This chapter also provides the problem statement, the rationale for the study, and an outline of chapters.
2. Factors impacting on literacy development of young learners in the multilingual South Africa.	This chapter serves as the theoretical underpinning of this study. It integrates relevant available literature findings within the field of phonological awareness, vocabulary knowledge, working memory (WM) and reading of learners varying in linguistic background and educational context. This chapter provides an evaluation of the previously stated areas including limitations in current research and literature. This chapter also presents a bio-ecological reading framework for explaining reading attainment of young monolingual and bilingual learners in the South Africa context.
3. Method	This chapter contains the aims of the study, research method in terms of research design, ethical considerations, sample, materials and apparatus used during the research project. In addition, the procedures that were followed in terms of data collection, recording, and analysis are presented.
4. Results and discussion of results and lessons learned	The collected and statistically processed data are presented in this chapter. Based on the results, conclusions are drawn, implications of the findings are presented, and ideas for future research are recommended.
References	This section contains a comprehensive and detailed list of all of the sources of information referred to in this thesis.
Appendices	The appendices are the relevant documents pertaining to this study, not included in the main text.

1.8 RESEARCH AIMS AND RATIONALE

> *"Language is the defining element in our social and cognitive lives, and to the extent to which we understand how languages are learned, used, and enjoyed, we will understand as well how individuals and societies interact and how we can make those interactions more harmonious and induction of our children into these societies more seamless and productive for everyone."*
>
> (Bialystok, 2007, p. 397)

The aim of the present research is to establish how developing cognitive capacities for literacy attainment are either constrained or facilitated through social context and educational background. The effect that bilingualism has on cognitive and reading development is examined. The cognitive consequences of additive *vs*. subtractive bilingualism are also examined. Collectively, these research aims reflect the most current research related to literacy development that are relevant to the education of monolingual and bilingual children in South Africa, and will provide the reader with a conceptual framework for understanding the findings obtained in the present study. Research about the literacy development of monolingual and bilingual children is limited (Greenop, 2004). The findings of the present research project thus add to the field of literacy acquisition in monolingual and bilingual children in South Africa. It provides some guidance to support the learning and literacy development in monolingual and bilingual children in other parts of the world who are faced with similar challenges in learning to read similar to monolingual and bilingual children in South Africa.

1.9 CHAPTER SUMMARY

The need for research in the field of cognitive processing skills and reading acquisition of monolingual and bilingual learners in a multicultural, multilingual education context was identified. The scarcity of relevant literature (both nationally and internationally) led to the formulation of the problem statement and rationale for the present study. The unique South African context emphasises the need for additional research to consider the effects of bilingualism on literacy development to understand the effects of multiple languages on individuals and societies and how well-established cognitive processing skills that contribute to word recognition ability (discussed in the next chapter) are influenced by the contexts in which children develop. It can be expected that differences in early childhood experiences are relevant to understanding the literacy development of bilingual children, since linguistic and social influences shape cognitive processing and the effects of culturally determined patterns of language input on children could lead to different patterns of cognitive processing and hence language learning (Bialystok, 2007; GoPaul-McNicol & Armour-Thomas, 1997; Vygotsky, 1978). Developmental research about issues of language acquisition and performance is largely driven by the continuing concern of parents for their children's optimal literacy acquisition. At the same time, not all children become bilingual, so the balance between linguistic, cognitive, and social factors created in multicultural and multi-lingual societies define special relationships between the interacting forces of a child's linguistic environment and a child's cognitive abilities, and determines how languages and environments in multilingual societies interact in developing children's cognitive and reading competency.

In summary, educators and practitioners who work with bilingual children need to become critical readers of research in the expanding fields of developmental cognitive neuroscience, educational neuroscience, L2 development, and medium of instruction. Such research has already begun to shed light on the nature of bilingual language processing. This line of research can help inform educational practices with bilingual children by showing which educational practices result in more optimal educational outcomes. At the same time, educators and practitioners should be careful not to misinterpret research findings in the above fields to justify questionable educational practices (Heugh, 2010; Conboy, 2013).

CHAPTER 2:
FACTORS IMPACTING ON LITERACY DEVELOPMENT IN YOUNG MONOLINGUAL AND BILINGUAL LEARNERS

2.1 INTRODUCTION

> *"The ability to mentally maintain information in an active readily accessible state, while concurrently and selectively processing new information, is one of the greatest accomplishments of the human mind; it makes possible planning, reasoning, problem-solving* [sic]*, reading, and abstraction. Of course some minds accomplish these goals with more success than others."*
>
> (Conway, Kane, & Engle, 2007, p 3).

The previous chapter sought to introduce and orientate the reader to the historical and current South African educational context. This chapter serves as the theoretical and conceptual basis for this research project. It discusses monolingual theories of reading, theories of bilingualism, cross-language transfer, as well as additive and subtractive types of bilingualism. These aspects form the basis of the research perspective that guides the present study. These areas are critically evaluated with shortcomings in current research and highlighted in existing literature. A framework that considers the role of language related variables on the cognitive development and literacy competency of monolingual and bilingual children in the South African context is presented. The proposed bio-ecological reading framework is influenced by information processing literature (Carrol, 1993; Horn, 1985; Sternberg, 1988) and by the works of Vygotsky (1978) and Bronfenbrenner (1979) and the view of Bialystok (2002; 2007) all of whom highlight a dynamic interactive relationship between cognitive processes and social experiences nested within contexts that cannot be understood apart from one another. A more detailed account of the inseparability of context and cognition is found in Sternberg's (1988) triarchic theory of intelligence. Influenced by these authors, the present research takes the position that learning to read is in part a bio-ecological and sociocultural dependent endeavour (GoPaul-McNicol & Armour-Thomas, 1997).

According to this view, children are born with diverse cognitive capacities within a specific ecology. The term *ecology* is found in Bronfenbrenner's (1978) ecological theory. It is used to describe how environmental factors affect children's reading development by facilitating or restricting the use of cognitive processes in tasks that require the expression of cognitive abilities (Bialysok, 1997). The idea that cognition is related to ecology comes from a basic principle of Vygotsky's (1978) sociocultural cognitive perspective, which argues that developing cognitive potential(s) emerge, develop, and are demonstrated in the context of a sociocultural milieu.

Cognitive abilities, processes, or potentials enable us to acquire knowledge, to reason, to remember, to perceive information through various sensory modalities, to retrieve information from memory, to make decisions, and to exercise judgement. There is also a speed factor associated with the manner in which these capacities are used during the performance of cognitive and academic tasks (Carrol, 1993; Horn, 1985; Sternberg, 1988). Performance in cognitive and academic tasks may be described as "achieved" to the extent that the nature and quality of learning experiences to which children are exposed require the demonstration of these capacities (Carrol, 1993; Horn, 1985; Sternberg, 1988). Cognitive processing skills required for reading in one context may be the same as in another context. However, the expression of these abilities in outward behaviour differs to the extent in which the educational experiences in one context are psychologically and socio-linguistically different to another context (Bialystok, 2007; Heugh, 2010). It is also possible that the cognitive processing skills needed to read in one context / language are different to the ones in another context / language (Geva & Siegel, 2000). Consequently, the expression of these cognitive processing skills may reflect different reading strategies or be related to slightly different oral language and underlying cognitive capacities (Geva & Siegel, 2000). This line of thought has led to the current research conceptualising reading behaviour as a bio-ecological phenomenon. It argues for a bio-ecological perspective to understand reading development of monolingual and bilingual children in South Africa. Such a model of reading is needed for a holistic view of the reading process, taking into account the roles that language and culture play in the cognitive development and reading attainment of monolingual and bilingual children in the South African context.

As eloquently pointed out by Conway *et al.,* (2007), people with higher working memory capacities score higher on tests of reading comprehension because a person's working memory capacity reflects not only how many items are stored but also how efficiently he / she can manipulate information. The relationship between language and memory is best captured by the dynamic properties of working memory. Working memory is defined as *"a limited capacity system for temporary storage and manipulation of information for complex tasks such as comprehension, learning, and reasoning"* (Goldstein, 2011, p. 132). In the chapters that follow, we will see that this is also true for the relationship between language related variables, cognition, and reading. In other words, the relationship between language, cognition, and reading ability is best captured by a dynamic model of reading achievement that takes into consideration the expression of cognitive capacities and reading competency in the context in which they are learned.

The task facing bilingual children learning to read in one or both of their languages is to develop fluent, automatized language processing. According to Williams (2010), language processing (word recognition) requires a number of coordinated, functional networks and more demanding language processing (word retrieval) requires more elaborate networks. Each network has a core region, necessary for a particular type of processing and other regions are recruited as processing demands increase. Furthermore, as language processing becomes more automatic, the level of activation in the core regions that are less central to the task is reduced. In turn, this means that as language processing become more automatic less general cognitive resources are recruited and the cortical networks become more focal and specific to language. This explanation coincides with Conway *et al.,* (2007) who argue that the relationship between working memory and language processing is complex and dynamic and varies as a function of level of task demands and level of language proficiency of the learner. According to Conway *et al.,* (2007), learning to read involves a variety of cognitive-linguistic processing skills; such as phonological awareness, phonological short-term memory, retrieval and production of words, and oral vocabulary knowledge. Reading also involves higher levels of language processing consisting of morphology, syntax, and self-regulation. Thus, oral proficiency in the L2 is a strong predictor of reading comprehension. This is assessed in the present study as the relationship between oral language and reading proficiency in bilingual children and has important implications for teaching practices.

2.2 THE NATURE OF LANGUAGE, LANGUAGE PROFICIENCY, AND READING ACQUISITION

Reading is an important academic language skill. It involves the ability to read for knowledge, write coherently, and think critically about the written word (Adams, 1990). The skill takes time to acquire, and thus researchers in psychology and educational psychology investigate the development of reading and its composite cognitive processes to understand how to prevent reading difficulties before they occur (Adams, 1990).

Reading instruction includes the curriculum, classroom teaching methods, assessment practices, and remedial instruction. According to Kirby *et al.* (2005), curriculum planners and teachers are not ideally positioned to judge theories and assumptions upon which they are based. This is particularly true in the South African context. For example, research in this country has shown that *"the reading components of literacy are included haphazardly within teacher preparation programmes"* (Van der Merwe & Nel, 2012, p. 137), and the existence of a *"cultural mismatch between teachers and learners and communication barriers that cause emotional and behavioural problems in classrooms"* occurs frequently (Du Plessis, 2012, p. 94).

Ecological theory lends itself nicely to studies on parental involvement and literacy achievement in young bilingual children. This is because it considers all of the systems in which children develop, from proximal (school and family) to distal (culture and neighbourhoods), and their bi-directional interactions (Bronfenbrenner, 1979). An ecological theory claims that optimal learning occurs when there are harmonious interactions between systems (e.g. school and family). Culture directly and indirectly influences the systems in which children develop (Bronfenbrenner 1979; Halgunseth, Petersen, Stark & Moodie, 2009). When the culture of the school and the culture of the family come into contact with each other, they influence and change each other, creating a unique "developmental niche" (Super & Harkness, 1986) in which bilingual children develop (Trumbull, Rothstein-Fisch, & Hernandez, 2003). Thus, an ecological theory predicts that optimal learning for bilingual children occurs when there is a strong, harmonious partnership between families and dual medium programmes, which include the consideration and incorporation of the culture and language in literacy instruction.

The best evidence suggests that early childhood programmes that encourage and maintain parents' involvement in their children's literacy instruction contributes to the learning and development of literacy skills in young bilingual children (Coleman, 1987; 1988). Dual medium instruction programmes are in a unique position to help parents of bilingual children to recognise that their language and culture are strengths, and use cultural and linguistic resources in ways that promote children's learning experiences and literacy development, such as building literacy skills in their children's home language alongside the language of schooling (Durand, 2011).

Whether children learn English, another language, or multiple languages, all children are language learners (Share, 2007). Early childhood literacy education should provide a rich language learning environment in which all children have language models, intentional exposure to and support for language and concept development, and extensive opportunities to build their language competencies. Skilled, responsive teachers who facilitate children's learning across the curriculum form the basis of good teaching practice for both monolingual and bilingual children (Espinosa, 2010). In order for early childhood literacy education to be optimally beneficial for young bilingual children, however, additional supports must be present (Espinosa, 2010).

The best evidence available suggests that high-quality bilingual education contributes to the development of language and academic skills in both languages. Teachers in dual medium programmes must have adequate language skills for them to engage meaningfully and extensively with bilingual children. Finally, effective bilingual education programmes provide an emotionally supportive but stimulating learning environment where children are encouraged to explore and expand their growing repertoire of language, cognitive, and communication skills (Espinosa, 2010).

Internationally; the results of published, longitudinal, and critical research (Coleman, 1987; 1988; Dutcher, 1995; Ramirez, Yuen, Padden, Nelson, & Pruitt, 1991; Swain, 1996; Thomas & Collier, 2002; and the World Bank, 1995) have shown conclusively that teachers of bilingual children should be able to design and implement dynamic, flexible instructional programmes. These instructional programmes are sensitive to the individual needs and language experiences of their learners, with the general aim being the achievement of the best social and cognitive match possible between each bilingual learner and his / her home and school learning environment (Bialystok, 2007). Therefore, it is the moral and ethical responsibility of researchers in psychology and educational psychology to provide the empirical basis from which best practices in curriculum, teaching, and assessment can be extracted (Bialystok, 2007). A comprehensive theory based on solid evidence would provide a road map for the development of evidence-based practice and contribute significantly to teacher education for enhancing educational practice in South Africa (Heugh, 2010).

Cummins (2000) identifies three types of literacy, namely: *functional literacy*, which focuses on the cognitive aspects of learning to read; *cultural literacy*, which underscores the importance of meaning given to text depending on social context; and *critical literacy*, which is concerned with social power and resources. The present research concentrates on *functional literacy* because this is the type of literacy children learn in the early school grades. Cummins (2000) defines functional literacy as being able to read and comprehend written language to convey meaning. Literacy involves cognitive-linguistic skills that schools need to measure and evaluate in order to determine whether children are able to read and comprehend text at an age-appropriate level. Children, unlike adults, are learning to read. The degree to which children speak with adults is related to their language learning ability (Kuhl, Conboy, Padden, Nelson, & Pruitt, 2003). Thus, relative language proficiency, frequency of use of each language, and social-cognitive aspects of learning to read in a first or second language need to be examined for monolingual and bilingual children in South Africa. For the purpose of this study, literacy encompasses levels of reading and its composite cognitive processing skills without neglecting the social circumstances in which literacy is acquired (Bialystok, 2007).

The South African education policy (Department of Education, 2004, p. 1) on language and literacy states that there are five learning outcomes in the early school grades, namely:

Learning Outcome One: The learner is able to listen for information and enjoyment, and respond appropriately and critically in a wide range of situations;

Learning Outcome Two: The learner is able to communicate confidently and effectively in a spoken language in a wide range of situations;

Learning Outcome Three: The learner is able to read and view information for enjoyment, and respond critically to the aesthetic, cultural; and emotional values in texts;

Learning Outcome Four: The learner is able to write different kinds of factual and imaginative text for a wide range of purposes; and

Learning Outcome Five: The learner is able to use language to think and reason, and access, process, and use information for learning.

These outcomes encompass Cummins' definition of functional literacy, and thus the present research is concerned with Learning Outcome Three, namely the ability to read. Furthermore, the aforementioned learning outcomes do not provide information on the cognitive-linguistic processes underlying literacy acquisition. Neither do they prescribe teaching methods for teachers to facilitate the development of literacy skills. In addition, no distinction is made between oral language and academic language proficiency. Rather, the central focus is on how language is used and experienced, which is limited in terms of policy for curriculum design, and language and literacy instruction (Regan, 2009, p. 11).

The following section discusses the cognitive-neuropsychological approach to reading, as well as research showing that measures of brain activity demonstrate that variations in language learning environments are associated with different language learning profiles. This is important because learning in the form of connections between neurons is established for each language based on experience with that language. This process requires time, as well as rich input in each language and extensive practice speaking and reading in each language to which a bilingual individual is exposed (Meschyan & Hernandez, 2005; Kim, Reikin, Lee, & Hirsch, 1997). Given that experience shapes children's learning mechanisms or strategies, models of learning need to reflect that bilingual children may learn differently from monolingual children (Bialystok, 2002, 2007; Meschyan & Hernandez, 2005; Kim *et al.*, 1997). For example, monolingual models do not account for the fact that the bilingual children learning to read in one or both of their languages need to discover different sound systems and language rules. It is known that brain activity is associated with these variables (Meschyan & Hernandez, 2005; Kim *et al.*, 1997) but more research is needed to understand the specific relationships involved.

In particular, how individual differences across children in first language development relate to individual differences in second language learning and reading attainment. Additionally, it is important to understand to what extent bilingual children can apply their home language skills when learning a second language. Some evidence suggests that this results in a greater rate of learning of the second language without apparent detriment to the acquisition of the first language (Cummins, 2000; Espinosa, 2010). At the same time, educational practitioners need to be careful not to generalise limited research on bilingual children's reading development to all bilingual children, because the similarity of a learner's two languages to each other and level of bilingualism may affect language learning and level of reading attainment (Bialystok, Luk & Kwan, 2005).

Finally, studies that examine environmental and social variables as influences on language learning need to address parental or social attitudes towards choice of the language of instruction. Language, culture, and reading achievement are closely linked in bilingual children and show the influence on cognitive development (Bialystok, 2002). The manner in which language related social and cognitive variables mediate the effects of bilingualism on reading competency and cognitive functioning of bilingual children in South Africa has received limited research attention (Heugh, 2002). Most studies of early bilingualism in this country have not carefully examined a range of cognitive and social dimensions of language on cognitive development and reading achievement in monolingual and bilingual children in a single study. Existing studies have focused on specific language components or isolated skills, and most studies have addressed the rates and patterns of L1 and L2 acquisition in relation to L1 acquisition (Geva & Siegel, 2000). However, in the case of the present study, monolingual children's language learning and literacy acquisition will be compared with emergent bilingual Zulu-English children with L1 Zulu spoken proficiency only and L2 English instruction as the latter children will be expected to pass the same assessments as their monolingual peers. At the same time, the emergent bilingual and the English monolingual children will be compared with bilingual Afrikaans-English children with spoken and reading proficiency in both languages, attending dual medium instruction for three years, to understand if additive bilingualism affords these children cognitive advantages to enhance the learning experiences of bilingual children who speak other languages. Literacy acquisition is the focus of this study because previous research has shown that children learn to read more efficiently in their home language and learning to read in a second language is possible through greater oral proficiency in the L2 when the L1 is used to facilitate the development of the L2. Levels of bilingualism and social factors that determine whether bilingualism is supported, that contribute to oral L2 acquisition should contribute significantly to L2 literacy development (August & Shanahan, 2006).

Social contexts are described as "a nested set of systems surrounding the child". The systems most distant to the child, including culture, shape the proximal systems, which include schools and parents. The proximal system is the source of children's direct interactions with the world and these interactions are the primary "engines of development" (Bronfenbrenner & Morris, 1998, p. 996). However, a bio-ecological theory is not a theory of reading because it focuses on processes involved in any aspect of a child's development. At the same time, the cognitive-neuropsychological approach to reading focuses on the nature of internal processes underlying reading, a sub-skill of language (Hoff, 2006). However, a bio-ecological perspective lends itself aptly to studying literacy attainment in linguistically diverse children, since it can combine neurology, cognition, and a language environment to account for the manner in which monolingual and bilingual children process language differently, and thus explain different levels of cognitive ability and reading competency in children with different linguistic profiles and educational backgrounds (Hoff, 2006).

The goal of the next section of the literature view is to elucidate the mental mechanisms that permit reading acquisition in young children. Additionally, the literature review presented next has the goal of considering the role of environmental support in language acquisition to address the larger question of how the ecology of children's surroundings supports and shapes reading attainment (Coltheart, Rastle, Perry, & Langdon, 2001). As a point of departure, it may be useful to examine L1 reading cognitive-neuropsychological models as they have some relevance to the model proposed in the present study and that is under construction in this chapter.

2.3 THE COGNITIVE-NEUROPSYCHOLOGICAL APPROACH TO READING

Several theories of reading from a cognitive-neuropsychological perspective have been proposed to explain different aspects of children's ability to read words. However, they all share a central assumption: Information relevant to word pronunciation can be drawn from two distinct sources, (1) a sound-to-print conversion procedure and (b) a procedure that links the orthographic lexicon to the phonological lexicon. These procedures are more likely to occur in parallel than in a sequential manner, with partial activation of one procedure promoting and supporting the other (Coltheart *et al.*, 2001). Cognitive-neuropsychology is an influential approach to studying reading attainment and its development in Europe. This interdisciplinary field places critical importance on the relationship between various cognitive processes and reading, and the relationship between disordered or damaged cognitive processes and reading performance (Coltheart, 1985). Some of these theories have been incorporated into the theoretical framework of Wagner, Torgeson, Laughon, Simmons, and Rashotte (1994), and an extensive research body confirms their existence and validity (National Reading Report, 2000).

2.3.1 Dual-route theory

The dual-route cascade model of word recognition was developed by Coltheart *et al.* (2001). This model of reading ability is illustrated in Figure 2.1: The Dual-route Cascade Model of Word Reading (adapted from Coltheart *et al*., 2001, p. 213).

This model functions as follows: When a word is visually represented, initial activation of visual features spreads, in a cascade-like manner, from letter units then to orthographic nodes in the orthographic lexicon, then to whole-word nodes in the phonological lexicon and phoneme buffer. This process initiates word reading when a specific criterion is met. The orthographic route is sensitive to printed word frequency. In contrast, the phonological route operates as follows: Visual features activate letter units, which support word pronunciation by means of translating print into a phonological code via the application of discrete grapheme-phoneme-correspondence (GPC) rules. When GPC rules are applied, units within the phoneme buffer are activated. This then triggers the pronunciation of the word. This route is particularly sensitive to grapheme-phoneme-consistency in printed words. The phonological route operates independently from the orthographic lexicon so it can deal with the pronunciation of familiar and unfamiliar words but it cannot process irregular words with complete accuracy. The latter is dealt with by a semantic route specialised for processing of familiar words, whether regular (i.e. those that follow GPC rules) or irregular words (i.e. those that do not follow GPC rules) but it cannot recognise or pronounce unknown words as these are dealt with by the orthographic and phonological routes, respectively.

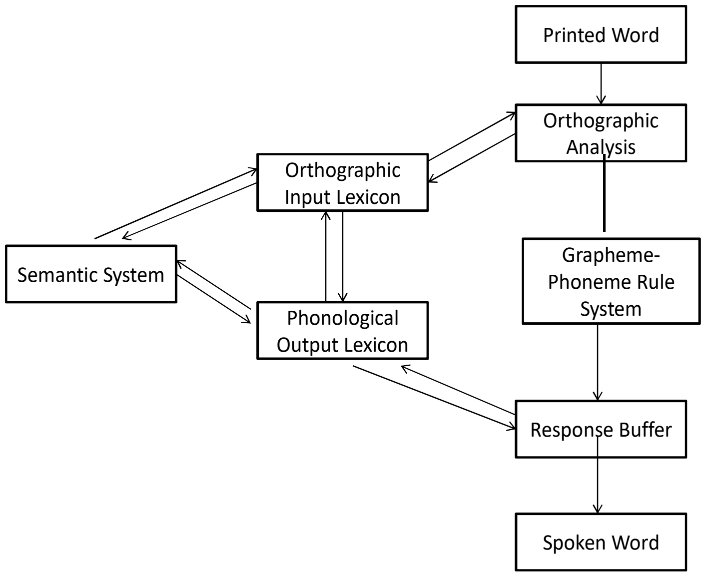


***Figure 2.1*:** **The Dual-route Cascade Model of Word Reading (adapted from Coltheart *et al.*, 2001, p. 213).**

Neuro-imaging studies by Hickok and Poeppel (2000; 2004; 2007) provide evidence to support a dual stream model of speech / language processing. These authors note that *"there are two functional distinct computational / neural networks that process speech / language information: one that interfaces sensory / phonological networks with conceptual semantic systems, and one that interfaces sensory / phonological networks with motor-articulatory systems"* (Hickok & Poeppel, 2007, p 401). Furthermore, while using fMRI, Saur *et al.* (2008) identify two distinct pathways for language processing. These authors indicate that performance in a pseudo-word repetition task taps a dorsal stream pathway in the posterior region of the frontal lobe. Additionally, performance on a sentence comprehension task taps a ventral pathway along the length of the temporal lobe. Figure 2.2 presents a diagram of the dual stream model of speech / language processing while Figure 2.3 presents the ventral and dorsal pathways for speech / language processing.

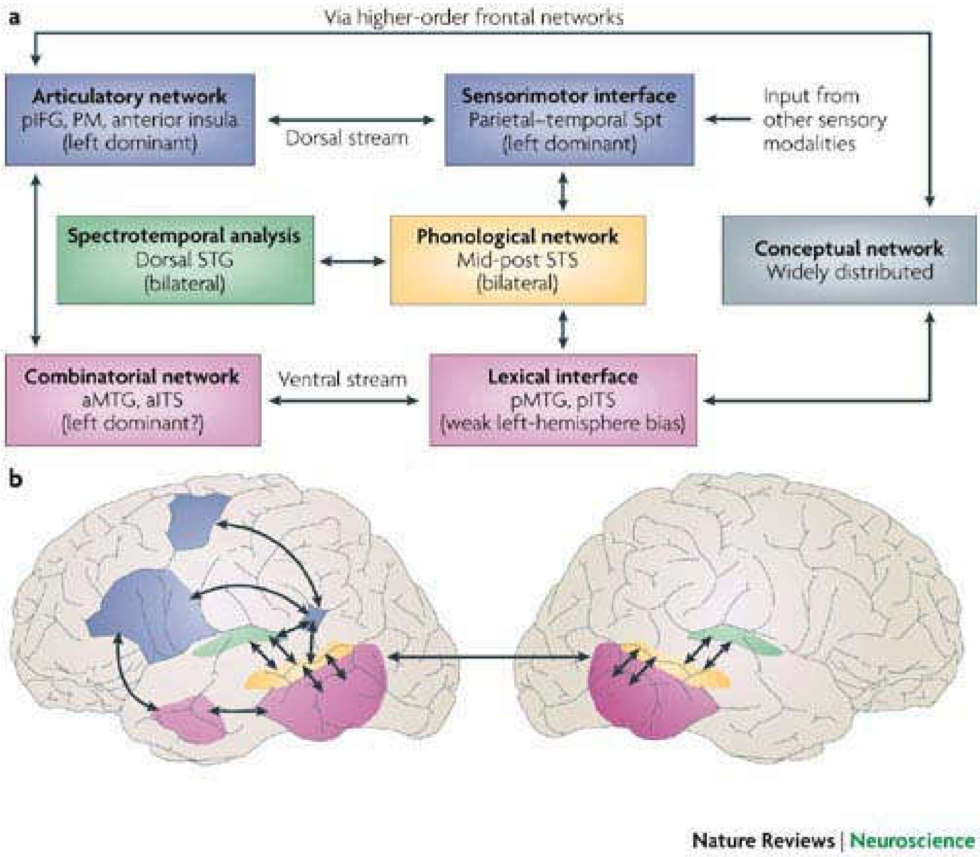


Figure 2.2**:** **Dual speech language processing model (Hickok & Poeppel, 2007, p. 401).**

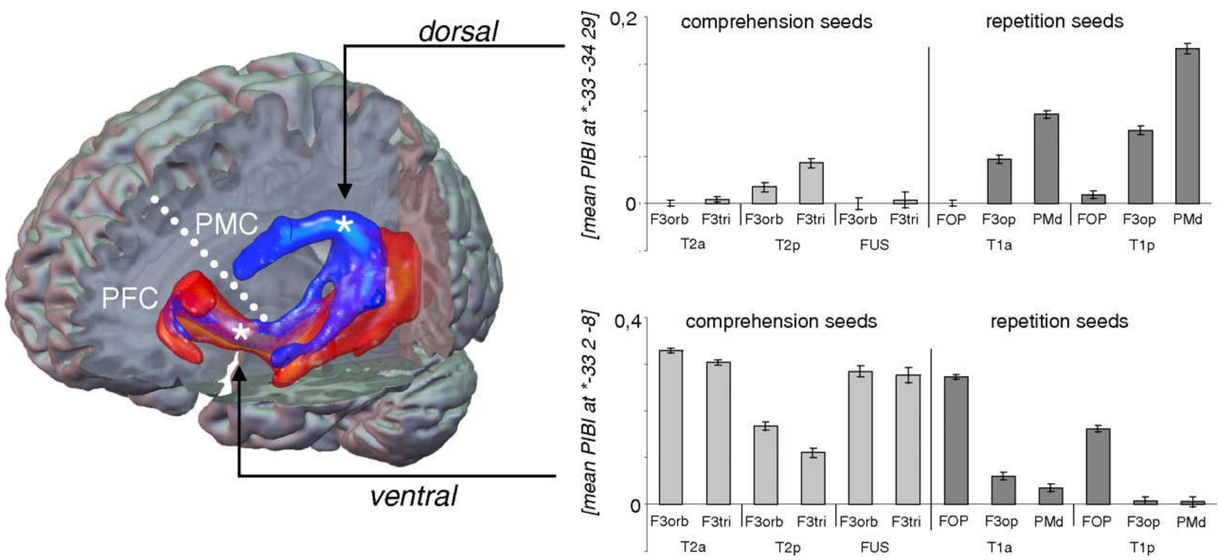


Figure 2.3**:** **Saur et al.'s (2008) ventral and dorsal pathways for speech/ / language processing.**

Although, dual-route theory accounts for the two pathways involved in reading, it does not explicitly demonstrate how these routes to reading develop. Frith's (1985) model of reading draws on dual-route theory but also conceptualises reading development as involving three distinct successive stages. The first stage ignores letter order and concentrates on salient graphic features of the whole word, utilising a *logographic stage* of direct recognition of entire words. The second stage involves an *alphabetic stage*, where graphemes form a one-to-one correspondence with phonemes, allowing children to recognise letters and convert them to sounds. In this stage letter order becomes significant, permitting a child to read new and nonsense words, although not always correctly. Lastly, the *orthographic stage* allows familiar groups of letters to be accurately and quickly recognised and combined to form words without the need for phonological conversion. Frith's (1985) model of reading development is important in explaining how children learn to read.

2.3.2 Double deficit theory

Wolf and Bowers (1999, cited in Coltheart *et al.,* 2001) have developed the double deficit theory. The double deficit theory argues that deficits in phonological awareness and working memory contribute separately to lack of reading success. Other researchers disagree arguing that phonological awareness and working memory jointly contribute to reading achievement (Kirby, Parilla, & Pfeiffer, 2003). Additionally, some children with phonological deficits do not show poor performance on working memory tasks but do so for phonological awareness tasks. Other children with a double deficit have difficulties with both phonological awareness and working memory and thus have difficulty with word reading and reading comprehension (Wolf & Bowers, 1999). Dual-route theory explains the components that makeup reading ability. Double-deficit theory describes basic cognitive processes that exist before the acquisition of reading and contribute to reading achievement alongside reading and writing instruction. Phonemic awareness and phonological decoding are considered co-requisites of alphabetic literacy, but Ehri, Nunes, Stahl and Willows (2001) state that the term *grapho-phonemic awareness* best captures the inseparability of the two. Several researchers have argued for the dependence of orthographic processing upon working memory by arguing that working memory is needed to process letter sequences that can then be recognised as orthographic units (Manis, Doi & Bhanda, 2000). Additionally, working memory can influence reading by means of attention in order for one to be able to comprehend what one is reading (Gathercole & Baddeley, 1991).

2.3.3 Semantic theories

Both the dual-route theory and the double-deficit theory highlight orthographic and phonological processes, while another group of theories emphasises the semantic or word meaning component. These theories place emphasis on the role of vocabulary and morphology in the development of reading processes and skills. According to Biemiller (2007), vocabulary contributes to reading ability in three specific and overlapping ways. First, vocabulary knowledge helps readers comprehend text. The meaning of a small number of words aids reading comprehension of the text as a whole. Second, vocabulary knowledge helps children recognise words they are sounding out based on a given word looking like a known word already in the child's word learning history or lexicon. Third, vocabulary relates to reading due to the link between vocabulary and verbal intelligence (National Reading Panel Report, 2000). The final theory that explains word reading, involves the role of morphology. Morphemes are units of meaning within words that provide cues to a given word's meaning and pronunciation. For example, the morpheme '-graph' is a visual cue for the child permitting him / her to read the word '*photo*graph' or '*phono*graph' (Deacon & Kirby, 2004). Morphological knowledge is related to vocabulary knowledge. Morphological knowledge has also been shown to contribute to both word reading and reading comprehension (Deacon & Kirby, 2004). The reading framework of Frith (1995) is broad enough to include different theories and cognitive processing skills to explain reading in young children.

The next sections look more specifically at the three main constructs underlying reading acquisition, namely: phonological awareness, vocabulary, and working memory in terms of their definition, measurement, and contribution to reading ability. Prior to presenting the aforementioned section it is important to point out that the previously discussed theories of reading have focused on the development of reading in English, and thus have specified stages or explanations of reading suited to a monolingual English child or a bilingual child taught to read in English. Emerging cross-linguistic research has provided evidence to suggest that the development of reading skills differs across languages thereby questioning the claim that the logographic stage applies to other languages and orthographies (Landerl, 2000; Sprenger-Charles, Siegel & Bonnet, 1998). For example, Sprenger-Charles, Siegel and Bonnet's (1998) longitudinal study of French children from early kindergarten to Grade 1 report no trace at any of the four points studied, of logographic reading strategies, operationalised as reliance on global word form and use of salient visual cues.

Similarly, Wimmer and Hummer (1990) operationalise logographic reading in German-speaking Austrian children as (a) failure to read non-words despite comparatively successful reading of familiar words and (b) production of real words visually similar to the target string. These authors' study of reading-delayed and normal-developing first-grade Austrian readers who had received eight months of reading instruction, showed no logographic strategies but showed alphabetic strategies. Wimmer and Hummer (1990) manage to induce partial alphabetic strategies by presenting words briefly for one second. Under these conditions, both groups revealed partial decoding of letters followed by guessing the word after it was removed from view. Although, the authors did not exclude the possibility that some German-speaking Austrian children may identify certain words logographically before exposure to reading instruction at school, on the whole they appeared to progress rapidly from non-word reading to well-established alphabetic reading with little need to develop logographic / partial alphabetic strategies.

Similar conclusions have been drawn from studies conducted in Italian (Cossu, 1999), Spanish (Goswami, Gombert & Barrerra, 1998), and Welsh (Spencer & Hanley, 2003). Therefore, logographic and alphabetic strategies for reading appear to be largely suited to English; a product of its orthography and teaching methods. Seymour et al., (2003) explain that the rate of reading in English is more than twice as slow as in transparent orthographies such as Spanish or German. These authors attributed this finding to the orthographically opaque nature of English involving the use of logographic and alphabetic strategies that require more than twice as long to establish than a single alphabetic strategy needed to learn to read an orthographically transparent orthography.

However, some research has found logographic and alphabetic strategies in the regular orthographies of Portuguese and Hebrew (Cardoso-Martins, 2001; Share & Gur, 1999). Cardoso-Martins (2001) provides evidence of partial alphabetic strategies among beginning readers of Portuguese taught via a whole-word teaching method, but not among a matched group taught via a phonics teaching method. Share and Gur (1999) provide evidence of logographic and partial alphabetic strategies among Israeli children who have not been exposed to reading instruction but no evidence of these strategies in a comparable group of Israeli first-graders. The role of logographic and partial alphabetic strategies in reading can be summarised as follows: "When children begin reading in Grade 1 they have an incomplete mastery of the spelling-sound system, owing to either an opaque orthography or to teaching methods that make the orthography functionally opaque. In these situations, transitional phenomena, such as logographic and partial-alphabetic reading, will be observed over an extended period and are much more likely to be accorded the status of a developmental stage. Such phenomena, however, appear to be far less prevalent in regular orthographies when a compensatory head start in reading is not necessary and when phonics is the teaching method" (Share, 2007, p. 599-600).

2.3.4 Reading in bilinguals

The question then arises as to whether effects of bilingualism on the development of reading will depend on the orthography that each language employs. The notion that differences in the orthographic nature of two languages places different demands on children's decoding of language in print and affects the ease with which children acquire reading skills is termed the *orthographic depth hypothesis* (Snowling, 2000). Additionally, it is common for bilinguals to have higher oral language and academic language proficiency skills in the first language than in the L2, and delayed development in both languages when the mother tongue is not supported pedagogically and does not provide an adequate basis for L2 learning (Figueroa, 1989). Bilingualism thus highlights the complexity of the human language faculty or as Bialystok (2007, p 394) eloquently points out:

"the study of bilingual children provides a perspective on language learning processes that is unavailable from studies of reading acquisition in monolingual settings where word and concept, language and thought, and performance and competency, are intrinsically intertwined. Introducing two languages provides a prism that allows one to filter out the influences of language and cognitive systems individually and thereby to more fully appreciate their structure and development".

Understanding how bilingualism affects children's cognitive development and reading competency requires an examination of the effects of language characteristics (levels of orthographic transparency and bilingualism, degree of bilingualism and cognitive abilities) on the relationship between cognitive processing skills linked to reading achievement. This includes the impact of variations in language in different groups of monolingual and bilingual children, and the social and cognitive dimensions of language development that fosters both balanced bilingual language proficiency and biliteracy (Bialystok, 2002, 2007; Schwartz *et al*., 2008). Differences in the orthographic transparency level of bilinguals' two languages work in conjunction with their level of proficiency in each language to influence brain regions activated during word reading and reading comprehensions tasks. What happens in the brain when bilingual individuals read in orthographically opaque English and orthographically transparent Spanish? What happens in the brain when bilingual individuals read in their less proficient language? Understanding these issues allows educational practitioners to develop teaching methods that facilitate bilingual children's learning to read in dissimilar orthographies or learning the curriculum in a second language and, at the same time, provides a window into the more general question of how the brain acquires language. Both of these language related variables have been studied in relation to the reading performance of bilingual Spanish college students (Meschyan & Hernandez, 2005).

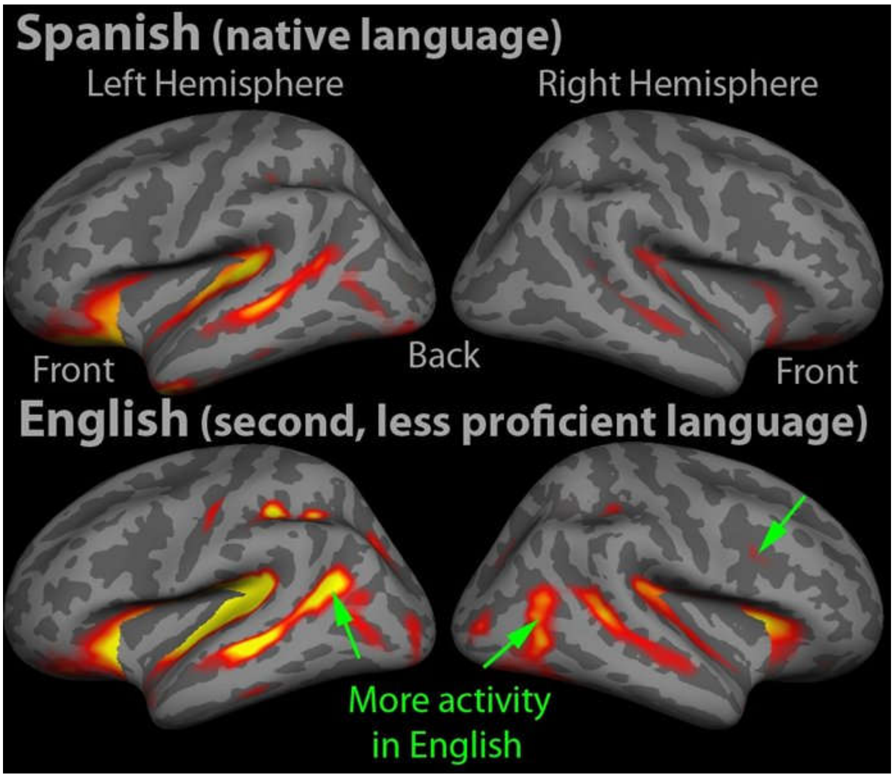


***Figure 2.4*:** **Impact of language proficiency and orthographic transparency on bilingual word recognition (Meschyan & Hernandez, 2005, p. 2).**

Meschyan and Hernandez (2005) observe that reading English words, but not Spanish words, strongly activate brain regions linked to translating speech-to-sound and areas of the visual cortex in the parietal lobes. Additionally, these authors show that when bilingual individuals process words in their less proficient language, in addition to well-known regions in the left cerebral hemisphere associated with language processing, (i.e. the Broca's area and Wernicke's area) bilingual speakers' less-proficient language recruits additional brain regions relative to monolinguals. These authors conclude that the recruitment of additional brain regions is a possible indicator of language inexperience or part of the language learning process in bilinguals when they perform cognitively demanding tasks. Figure 2.5 illustrates the impact of language proficiency and orthographic transparency on bilingual word recognition in Spanish-English bilinguals (Meschyan & Hernandez, 2005, p. 2). Understanding how two languages are processed by the brain can help educational practitioners to develop teaching methods to develop reading competency in dissimilar orthographies and teaching strategies to increase spoken and academic language proficiency in bilingual children in South Africa. Bialystok (2002, p. 159) points out that "bilingualism clearly affects children's development of literacy, but its effects are neither simple nor unitary." Figure 2.5 illustrates Bialystok's (2002) model of literacy development in bilingual children.

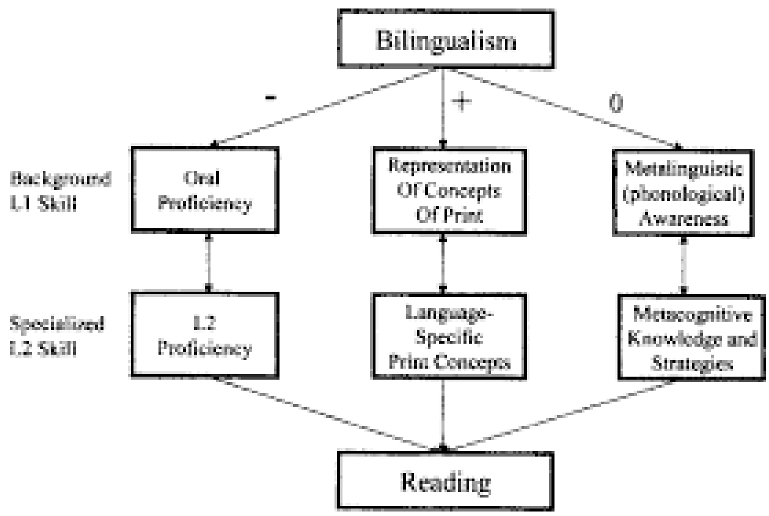


***Figure 2.5*: Bialystok's (2002,p.159) model of the relationship between first L1 and L2 literacy acquisition and bilingualism.**

Figure 2.5 illustrates the relationship between L1, L2, and cognitive and linguistic factors linked to reading in bilingual children. The bi-directional arrows point to a relationship between the two languages in bilingual children showing that these children may learn to read differently from monolingual children. While monolingual children need to develop oral language proficiency and associated cognitive processing skills in one language to facilitate reading development, bilingual children need to develop oral language proficiency in two languages. When monolingual children develop grapheme-phoneme correspondence rules in one language, bilingual children have to learn language-specific grapheme-phoneme correspondence rules. Therefore, although bilingual learners may share many characteristics of language acquisition with monolingual learners, a difference is also apparent. In bilingual children both languages are activated for the same concept. This process requires additional cognitive resources. This means that a bilingual speaker needs to select from a wider range of words than a monolingual speaker does to retrieve the correct words (representations of concepts of print), and therefore uses cognitive (executive) control mechanisms to a larger extent than in monolingual word retrieval and processing (meta-linguistic and meta-cognitive knowledge and strategies) (Bialystok, 2002; Meschyan & Hernandez, 2005).

This difference in cognitive control function arises out of the need of bilingual children to pay attention to different phonological and orthographic cues in different languages (Bialystok, 2002). Evidence from neuro-imaging research demonstrates that the brain adapts to bilingual input; children have the capacity to learn two languages from birth. From as early as three years of age, bilingual children are able to use both languages within the same conversation or even the same sentence (Paradis, Genesee, & Crago 2011). In bilingual speakers, learning different sets of language rules interacts during word processing, which may affect performance on tests of reading and cognitive functioning, but they do not necessarily indicate a delay or deficit in reading attainment if children have rich input in both languages. In reviews of literature on the effects of bilingualism on cognition, Diaz (1983), Bialystok (2002) and Conboy (2013) agree that across multiple domains, cognitive advantages of bilingualism are strongest when children are proficient in both languages, with no visible benefits when children's experience with one language or both languages is limited.

For example, Carlson and Meltzoff (2009) say that six months of experience in a dual language immersion preschool reading programme was not enough to demonstrate cognitive (executive) control advantages of dual language learning. This finding is consistent with other research showing that advantages in cognitive performance depend on the extent to which a child is bilingual (Bialystok & Majumder, 1998; Cummins, 1999). This finding is also consistent with other research showing that too early exposure to a literacy instruction in second language with inadequate proficiency and competency in the home language does not enhance bilingual children's language acquisition and cognitive functioning, because cognitive advantages of bilingualism are not yet developed. This requires providing bilingual children with high-quality language experiences in social settings in which children practice, interact, and speak with other proficient users of the language. Parents need to interact and speak with their child in the home language for their child to continue developing proficiency in the home language. At the same time, the school environment should further develop proficiency in the home language and provide experiences for the bilingual children to interact and speak with English speakers thereby providing opportunities for these children to develop English proficiency. High-quality interactions in English and the child's home language will lead to competency in both languages over time (Cummins, 1999). It is possible that environmental and social variables, including parent's attitudes toward language of academic success (English in most cases) are stronger influences on second language learning than the timing of second language reading instruction, yet these variables are often confounded in most studies. Thus, both parent's attitudes toward language and the child's level of language development need to be considered in any evaluation of his or her academic success (Cummins, 1999).

Additionally, differences in cognitive, language, and reading development may depend on which other languages a child speaks. For example, there are no general influences of bilingualism on decoding ability, but the relationships between children's level of proficiency in each language, their progress in reading attainment, and the relationship between the two writing systems (Bialystok, Luk, & Kwan, 2005) is critical. Thus, developing proficiency in two or more languages may not hurt a child's ability to read. In fact, there may be positive transfer effects when the two languages share a writing system because bilingual children develop general processing skills across languages, which are thought to be learned only once (Durgunoglu, 2002), such as in English and Spanish writing systems. However, some differences in how concepts are conveyed in a child's home language may lead to errors. For example, speakers of English typically have difficulty learning to distinguish *conocer* and *saber* in Spanish because both words are associated with the broader English verb “to know”, but children learning Spanish as a first language do not confuse these terms suggesting that language proficiency and language of schooling may contribute to bilingual children’s vocabulary performance (Barac & Bialystok, 2012).

Bialystok, Luk, and Kwan (2005) demonstrate that bilingual children who have either Chinese or Spanish as L1, transfer English (L2) reading skills across languages; word reading scores are positively related across languages, but differences in reading progress between the orthographically dissimilar languages are observed. This suggests that the similarity of grapheme-phoneme correspondence rules across the two languages permitted transfer of word recognition skills across languages. At the same time, different orthographies seem to require different processing strategies or different orthographies are related to different underlying cognitive processing skills (Geva & Siegel, 2000). Thus, when understanding the cognitive, language, and reading development of bilingual children, we need to consider a number of factors: the similarities between the two languages, the age of first exposure to English, the language of the child’s school experience, and the quality and quantity of the child’s exposure to each language.

Reading assessment in bilingual children must consider the impact of these factors to provide sufficient information about the child’s language environment to inform teaching practices to support language acquisition and promote academic achievement in young bilingual children in the early school grades. Individualised instruction, however, can be accomplished only through assessment practices that are fair, reliable, linguistically, culturally, and developmentally valid (Snow & Van Hemmel, 2008). Chapter 3 of the present study describes appropriate measures for accurately assessing reading attainment in monolingual and bilingual groups of children.

Bialystok’s (2002) model provides an explanation of orthographic and language proficiency factors that affect bilingual reading. However, it does not explain possible relationships between degree of bilingualism and performance on literacy tasks. In other words, it does not explicitly address whether degree or nature of bilingualism influences cognitive processing tasks linked to reading attainment, nor does it address whether different degrees of bilingualism result in different cognitive and reading profiles. These arguments are important to address as they may be relevant to an explanation of reading attainment in bilingual children in South Africa.

Cummins' (1976, 1979) *threshold model* postulates two thresholds of language proficiency. The first threshold is needed to avoid cognitive deficits; the second or higher level of language proficiency in both languages is required to gain cognitive benefits. It follows then that level of bilingualism seems important for determining the effects bilingualism will have on reading achievement. Absolute levels of first language and L2 proficiency provide information on what effects bilingualism has on the performance of literacy tasks. Relative proficiency would account for the sources of variation in performing literacy tasks by indicating in what way bilingualism affects cognitive development (Bialystok, 1988; Hernandez & Li, 2007).

Kim *et al.* (1997) show that individuals who learn a second language in childhood process both languages in roughly the same areas of the brain for producing speech, i.e. the brain of early learners responds almost identically when speaking either language. In later learners, processing of the two languages occurs in two scarcely overlapping areas, suggesting that later learners are less fluent in their second language, perhaps because the brain treats the two languages differently. Figures 2.6 and 2.7 illustrate the findings of Kim *et al*. (1997).

An equally important finding from the research of Kim *et al.* (1997) is that the age of acquisition or context in which each language was learned, reflected differences in the way in which the brain processed language, but only for aspects of language that involve producing rather than understanding speech. This finding suggests that the distributed nature of bilingual language processing means that superficial English language knowledge, indexed by receptive vocabulary measures, may not be sufficient for comprehending text in each language. Instead, information processing systems in the brain are established for each language based on experience with that language, which requires time, and rich language opportunities in each language (Kim *et al.*, 1997). Therefore, neuroimaging data supports the idea that partial and balanced bilinguals should show a different pattern of cognitive processing skills linked to reading.

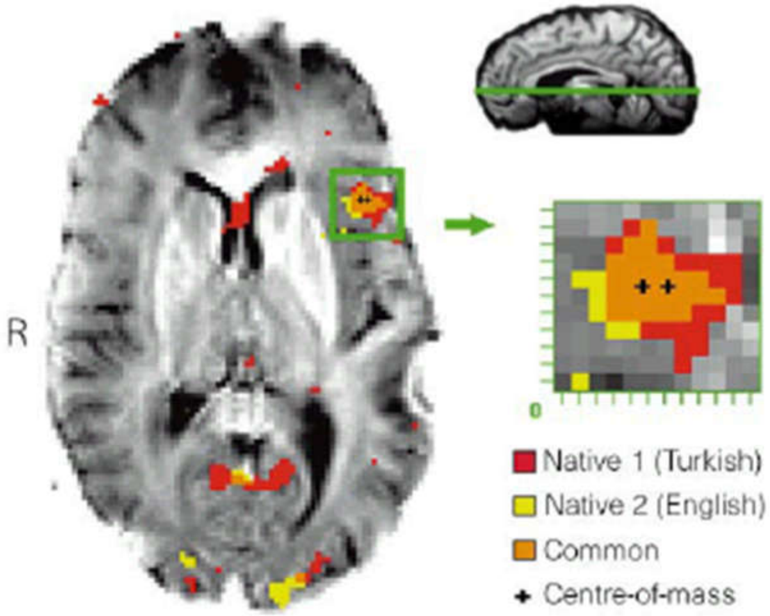


***Figure 2.6*: Word processing in biliterate Turkish-English bilinguals (Kim *et al.*, 1997, p. 172).**

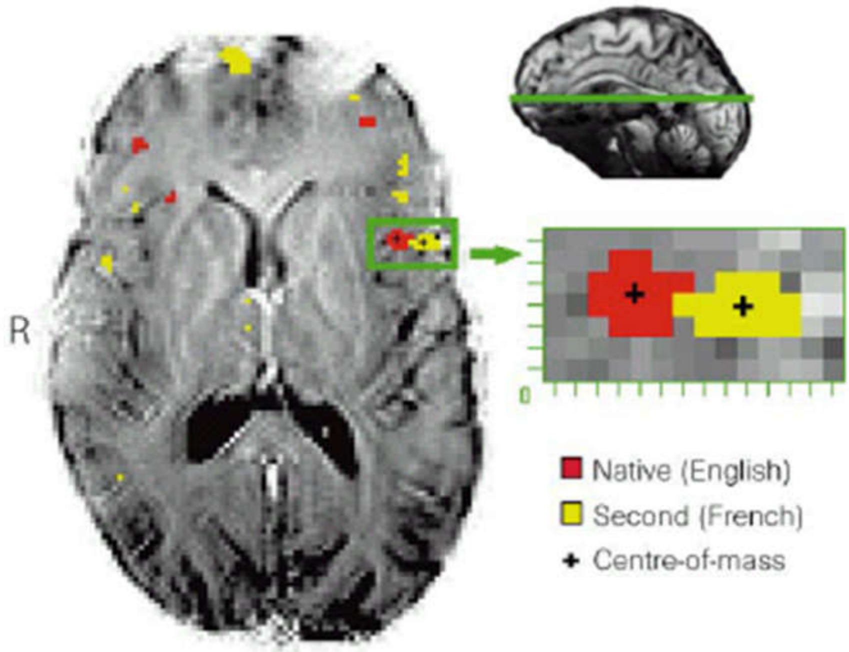


***Figure 2.7*: Word processing in emergent English-French bilinguals (Kim *et al.*, 1997, p. 172).**

If language experience influences the way in which languages are processed in the brain, then a language learning disability due to a genetic factor that alters early brain development can reduce a child's ability to learn from the environment, affecting subsequent learning- including reading development - widening the gap between the affected child and his / her peers (Frith, 1995). Similarly, the neuro-imaging research suggests that the developing brain could be altered by variations in language experience such as amounts or types of language input. In any group of learners (monolinguals, early or late bilinguals), differences in experiences should affect language processing and subsequent learning in each language. Thus, when children are learning two languages, differences in experience with each language could lead to different patterns of reading attainment for each language, affecting subsequent learning and reading ability in each language (Hernandez & Li, 2007; Kim *et al.*, 1997). In general, neuroscience research does not indicate that the brain is a limited capacity system. Educational practitioners can enhance the language learning of bilingual children by providing rich learning opportunities in each language.

However, Deutscher (2005, p. 215) points out "the most sophisticated MRI scanners do nothing more than show where the lights are on in the brain. The only thing they reveal is where there is increased blood flow at any given moment, and we infer from this that more neural activity is taking place there. Language is a complex cognitive function that relies upon various brain areas. We are nowhere near being able to understand what is "said" in the brain. We have no idea how any specific concept, label, grammatical rule, colour impression, orientation strategy is actually coded". It follows that we have to make indirect inferences of how the brain processes language by studying cognitive processes, which have some correspondence to the neurophysiological structure and function of the brain areas responsible for the perception of letters and words and visual recognition of words. In this process, we understand language acquisition and reading development as an output, or behavioural factor (Conboy, 2013).

The preceding literature on models of language and reading acquisition yields a model in which language and reading development involves a process of extracting patterns from linguistic data. This pattern extraction process is accomplished by the language acquisition device or innate language capacities that reside in the child's brain due to input from the environment that provides people with whom the child interacts and from whom he / she hears meaningful speech (Chomsky, 1965). Research dealing with this question has typically not taken into consideration the social context as a factor in language development (Bialystok, 2007).

Research on children's social environmental variables, including socio-economic status and parental education, in relation to their language and reading development has shown reliance on environmental support, but along different developmental paths at varying rates and with varying levels of educational success depending on the language experience and the print-rich, mentally stimulating environment provided (Duursma *et al.*, 2007). Research with bilingual children suggests that degree and type of bilingualism is a within-group factor in solving cognitive or linguistic tasks. The degree to which the child is bilingual determines which task may be solved more easily and determines the effects of bilingualism on cognitive functioning. In summary, the extent or degree to which social and linguistic contexts differ in how they meet the child, creates differences in language and reading development in different contexts (Bialystok, 2007).

In pursuing this comprehensive picture of environmental effects on language and more specifically reading development, research also needs to provide a richer description of the nature of children's language experiences, how they vary across social contexts, and what remains constant despite contextual variability (Bialystok, 2007). To this end, a systematic comparative study of children's experiences in different environments is required.

Single culture, ethnographic descriptions of environments demonstrate that linguistic and literacy-learning environments differ, but to properly test the hypothesis, requires a direct comparison of environments. This requires measures of children's cognitive development and reading experiences that can be applied within and across cultures and languages for comparing cognitive development and reading achievement across languages and cultures (Berry, 1989).

Such theoretical and empirical work has been done, including how to measure phonology, vocabulary and working memory across different languages and cultures (Geisinger, 1994; Huttenlocher *et al.*, 2002). The current study measured cognitive processing skills based on their documented contribution to the development of literacy across different languages and cultures in order to provide a meaningful comparison of literacy development in monolingual and bilingual South African children, including whether they provided similar levels of prediction of reading in different languages and first language and / or L2 learning contexts.

Cognitive / linguistic measures linked to reading are discussed next. Additionally, how linguistic and social environments support and shape reading attainment, experimental work on the relationship between language experience and reading competency and cognitive functioning is also addressed. This is because this type of research holds promise for a picture of how monolingual and bilingual children learn to read, supported by the varying social circumstances in which they develop (Bialystok, 2007).

2.4 COGNITIVE PROCESSING SKILLS AND READING PERFORMANCE IN THE L1 AND L2

The term *cognitive processing* describes a broad range of reading processes involved in thinking or acquiring knowledge. Several research studies have found that phonological awareness and phonological processing in working memory and phonological access in lexical memory are three cognitive processing skills related to reading performance in monolingual English speakers (Wagner *et al.,* 1994) in L2 English speakers, and in readers of other languages (Comeau, Cormier, Grandmaison, & Lacroix, 1999; Durgunoglu, 2002). Each cognitive processing skill contributes shared and unique variance to word reading ability. Phonological awareness is the most reliable predictor, followed by phonological processing in verbal working memory and phonological access in lexical memory. Phonological awareness is considered an explicit phonological process because it requires conscious manipulation of phonological components of speech. Phonological access in lexical memory and verbal working memory are considered implicit phonological processes because they are cognitive processes that implicitly involve speech codes (Gombert, 1992).

A close association between phonological awareness and the development of reading is well-established with L1 English learners (Goswami & Bryant, 1990), L2 English readers and readers of different languages (Seymour *et al.,* 2003). Swanson, Trainin, Necoechea, and Hammill (2003) report a correlation of .43 between phonological awareness and word reading based on 194 correlations in 35 independent samples of readers. Phonological awareness is predictive of future reading ability, even after controlling the effects of variables such as intelligence and socio-economic status. Early phonological awareness training also facilitates reading acquisition, and is causally related to reading success. Bus and Van

Ijzendoorn (1999) conclude from their meta-analysis that phonological awareness training improves both children's phonological awareness and reading ability (Cohen's *d* = .70). *Phonological awareness* refers to a child's knowledge that a word consists of smaller units that can be manipulated (e.g. segmented and assembled). It also implies an understanding that words can be divided into sounds; syllables and sub-syllabic units, namely onset, rime, and phonemes (Treiman & Zukowski, 1996). Its development entails the progression from simple syllable and onset-rime to the more complex phoneme level (Treiman & Zukowski, 1996). Children who perform well on tests of phoneme awareness are at an advantage in learning to read. The advantage it conveys is well-specified (segmental) representations that provide the basis for mappings between phonological (sounds) and orthographic (spelling) representations (Goswami & Bryant, 1990). Different phonological skills influence word recognition skills to varying degrees and exert their effects at different points of reading development (Snow, Burns, & Griffith, 1999). Simple, onset-rime level of phonological awareness is a pre-requisite for reading acquisition, while the complex phoneme level of phonological awareness develops alongside literacy instruction (Bradley & Bryant, 1985). Bus and Van Ijzendoorn (1999) state that phonological awareness explains approximately 12% of the variance of word identification skills. Based on the latter finding, phonological awareness constitutes an important, but not the only, variable involved in reading acquisition.

Phonological processing in working memory is another well-recognised cognitive skill involved in the acquisition of reading in L1 English readers (Gathercole & Baddeley, 1991). Studies of L2 readers have also indicated that L2 working memory is a significant predictor of L2 word recognition (Geva & Siegel, 2000). Working memory is viewed as a complement to long-term memory. It allows for short-term activation of information and at the same time manipulation of the information in question (Baddeley, 1986; 2003). Research has established a link between the efficiency of working memory and reading ability (Baddeley & Hitch, 1974). Working memory supports reading development by allowing for recoding and temporary storage and retrieval of phonological information, such as sound units-phonemes, to decode words (Gathercole & Baddeley, 1991). However, its predictive validity is debated. To illustrate, Wagner *et al.* (1994) have found that only phonological awareness accounted for variance in word recognition, since both phonological awareness and working memory are highly correlated suggesting they tap the same underlying phonological component. Other researchers have found that working memory contributes unique variance to word recognition, even after phonological awareness is taken into account (Nation &

Snowling, 2008). Thus, working memory is an influential predictor for early reading among novice readers for whom orthographic information is not well-established. The contribution of working memory should also be significant for readers of English when encountering an unfamiliar or phonologically opaque word (Nation & Snowling, 2008).

Another cognitive factor that has been shown to contribute to reading skill is *vocabulary knowledge or phonological access in lexical memory*. Researchers have argued that vocabulary is important for learning to read printed words (Nation & Snowling, 2008). Vocabulary influences word recognition by providing fast mappings between orthographic, phonological, and semantic representations of words (Biemiller, 2007). Strattman and Hodson (2005) studying L1 English Grade 2 children report that vocabulary knowledge explains an additional 2% of the variance in word recognition, after the effects of phonological awareness and working memory have been taken into account. Using path analysis, Muter *et al.* (2004) have found that in the first two years of formal education, word recognition is relatively uninfluenced by vocabulary knowledge. It has been suggested by Willows and Ryan (1986) that vocabulary knowledge may not be a strong predictor of word recognition ability when children are first learning to read, but as they encounter more unfamiliar words in the later school years, vocabulary knowledge becomes important for skilled reading and text comprehension. In support of this view, Willows and Ryan (1986) explain that children become increasingly sensitive to broader aspects of language, such as semantic and syntactical features, in reading tasks as they proceed from Grade 1 to Grade 3. Additionally, Geva and Siegel (2000) report that vocabulary knowledge has a significant lingering role for readers of English in order to develop full mastery over the set of letter-to-sound rules and rule exceptions, and this effect is evidenced even when children are using their first language. Geva and Siegel (2000) further emphasise that the development of L2 reading may be more dependent on L2 proficiency when a complex orthography, such as English, is involved.

Initially, both phonological awareness and vocabulary skills are lower in L2 English pre-school children when compared to their L1 English peers. This difference disappears by the end of Grade 2 (Lesaux & Siegel, 2003). Researchers explain this difference in terms of differences in level of oral language proficiency. In monolinguals, oral language proficiency precedes reading acquisition whereas in L2 readers the development of reading skills and oral language, develop concurrently (Chall, 1996). Although researchers do not seem to dispute the fact that bilingual and monolingual children differ in terms of access to cognitive processing skills associated with reading because of different levels of oral language proficiency, explanations of L2 reading development tend to use theories of L1 reading development to explain L2 or bilingual reading attainment. The assumption is that the same cognitive processing skills that underlie L1 reading development also apply to the reading processes and skills in a child's L2.

According to Bernhardt's (2003) review of L2 reading research, this assumption is faulty and often perpetuated by flawed L2 reading research. The latter studies fail to consider that L2 reading acquisition involves more than one language. Additionally, bilinguals, unlike monolinguals, have the advantage of transferring knowledge and skills acquired in reading in one language to reading in another. Furthermore, L2 reading research that concludes that L1 English children use similar processes to L2 English children (Lennox & Siegel, 2003) has not considered that an existing oral / written L1 has an effect on L2 reading attainment or that the bilingual children vary enormously in the rate at which they learn languages. Bernhard (2003, p. 116) points out that if L2 reading is only a combination of the pre-existing ability to read as the result of L1 reading instruction and L2 vocabulary knowledge, then *"we would observe consistently high comprehension performance on the part of second language learners. But we know this is not the case. Even among readers who do not appear to struggle, there are fluctuations in comprehension"*.

The speed of language acquisition depends on factors within the child and in the child's learning environment. The child's aptitude for languages and motivation interact with the quantity and quality of language inputs and opportunities for use to influence the rate and eventual fluency levels (Hakuta, Bialystok & Wiley 2003). As children acquire a second language, one language may be more dominant because they use that language more often than the other. If children are assessed in their least-proficient language only, their abilities will be underestimated. Often, children demonstrate a *language imbalance* as they progress toward full bilingualism. Depending on experiences and learning opportunities, children may not perform, as well as native speakers of each language in all domains (Hakuta, Bialystok, & Wiley, 2003). Hakuta, Bialystok, and Wiley (2003) have made a distinction between children who learn a second language *simultaneously* with the first language and those who learn one *sequentially* after learning the first language. When a child learns two languages *simultaneously* (e.g. during the first years of life), the developmental pathway is similar to how monolingual children acquire language. In contrast, the language development of children who learn a second language *sequentially* after the first language is established or from about three years of age onward, follows a different progression and is highly sensitive to the characteristics of the child, as well as the language learning environment. When oral language proficiency of the child's first language is established, children learning about the structure of one language must now learn the specific features — grammar, vocabulary, and syntax – of a new, second language. Thus, the second language reading attainment process is multi-layered in nature. To obtain a more comprehensive picture than provided by existing L2 reading research, Bernhardt (2003) recommends studying the interplay between oral and written language on L2 reading attainment. Relatedly, orthographic transparency should determine cognitive processing skills required for reading success in each language. This is because different orthographies require different cognitive-linguistic processing skills for reading success. This in turn points to the unsuitability of using L1 English models for explaining reading attainment in bilingual children (Share, 2007).

In essence, a child's limited second language skills are likely to affect performance in any cognitive and reading assessment. All bilingual children need specific, individualized instruction that bears in mind their stage of English language development and develops their vocabulary and oral language skills in order for them to make substantial academic progress in L2 English. To this end, young bilingual children must be assessed in both their home language and English. Additionally, research shows that when the child's achievements are examined in the home language, teachers can also make accurate predictions about the child's potential for learning in the second language (Gutiérrez-Clellen 1999; Gutiérrez-Clellen, Simon-Cereijido & Sweet, 2012). If the young bilingual child is able to learn age-appropriate concepts in the home language, it is highly likely that he or she will be able to transfer this knowledge to English language learning. In addition to variability in the amount and quality of English exposure, as well as home language development, young bilinguals show uneven progress between the two languages, depending on the language tasks involved. For example, a bilingual child may be proficient in one language for one task (e.g. letter naming) but not for another (e.g. reading comprehension). Another bilingual child may be able to hold a simple conversation in English but be unable to answer questions about a story or a sequence of pictures in that language. Because of this variability, it is impossible to obtain an accurate measure of reading progress without examining reading development and its composite skills in the two languages of bilingual children (Gutiérrez-Clellen, 1999; Gutiérrez-Clellen, Simon-Cereijido & Sweet, 2012).

Bernhardt (2003, p. 116-117) argues that:

> *The literacy community must begin to understand the complexities of reading in languages other than English as well as the complexities of learning to read in a language when another literacy or another oral language exists in cognition. We cannot make any genuine progress in the field until we conduct theoretically rich research. That research must be respectful of the fundamental nature of an array of languages. It must also acknowledge the nature of the reader's L1 literacy level and account for it. As the world becomes both more and less complicated and as English continues to grow in dominance on the world stage, risks become greater of peoples actually becoming more separate from than closer to one another. As English and English-speaking values grow in influence, the danger becomes one of losing culturally authentic interpretive abilities. It is through text and through text analysis in many languages that these abilities will be sustained. The cost of monolingualism and concomitant monoliteracy is great. A world in which expression is exclusively on the terms of and within the perspectives of the English-speaking world would be a boring and indeed dangerous place.*

In summary, a holistic approach to second language reading attainment requires understanding how linguistic and social environments affect bilingual children's literacy development. This includes the interaction between social and cognitive dimensions of bilingualism, such as whether reading strategies are transferred from one language to another, the direction of the transfer, as well as the effects of L1 oral vs. written language on a child's L2 reading development. Developmentally speaking, bilinguals are unique listener-speakers and not simply by-products of two monolinguals (Grosjean, 1982). In order to understand the dynamics between language and cognitive behaviour, such as reading, consideration must be given to the developing relationship between the two languages of a bilingual, as well as the cognitive demands of the task used to measure reading process and skills. Any potential language effects on reading attainment will depend on how each language of a bilingual is used / not used at home and at school daily. Research indicates that amount of input, frequency of use and parent's estimate of language ability are highly related to level of language proficiency, which, in turn affects how the brain processes language (Kim *et al.*, 1997). It follows that bilingualism should make the L2 reading acquisition process different to the L1 reading acquisition process (Berhnardt, 2003). In fact, children learn a second language faster when the reading instruction is provided in both languages (Schwartz *et al.*, 2008). This point is discussed in more detail in the next section.

2.5 BILINGUALISM AND LEARNING TO READ IN A DIFFERENT LANGUAGE: THE TRANSFER OF PHONOLOGICAL AWARENESS

Bilingualism is defined as the ability to speak two languages (Baker, 2000). In South Africa, bilingualism is an ever-present phenomenon, but different languages are used for different purposes. One often comes across a child who is learning to read English via English-only instruction with L1 Zulu oral language proficiency only (Buthelezi, 2003). It is also not uncommon to find Afrikaans-English bilinguals learning to read in both languages (Heugh, 2010). These differing environments are bound to influence reading attainment and related cognitive processing skills (Bialystok, 2007). Bilingualism is not problematic, because the brain has the capacity to learn and store many languages (Baker, 2000). However, research on bilingualism is limited because some researchers are solely interested in balanced bilinguals who acquire both languages early in life (simultaneous bilinguals) and are able to use them interchangeably. Others have not been interested in bilingualism, because they have assumed that native L1 processing is not influenced by L2 knowledge. In recent years, the situation has changed, and researchers have started to realize that knowledge of L1 has an impact on L2 processing (Brysbaert & Duyck, 2010). The following section will explore a field of bilingualism still in its infancy, but a field important for conceptualising reading acquisition in different types of children, and, explaining how L2 learners are initially limited in their access to written language, but over time this changes as a function of level of bilingualism (Bialystok, 1988; 2002; 2007; Cummins, 1981).

The first reason why we can propose that bilingualism influences the acquisition of written language concerns the cognitive processing skills that form the basis of reading attainment. Several studies have demonstrated that vocabulary influences reading development (Adams, 1990). Bilingual children, however, often have limited lexical stores in each of the two languages when compared with monolingual children. For example, a study of approximately one thousand bilingual Spanish-English children (Pearson, 2002) finds larger vocabularies in monolingual children relative to bilingual children, even after controlling for the socioeconomic level of each group. Thus, differences in the size of vocabulary may place bilingual children at a disadvantage when they are just beginning to access written language.

Very few studies have examined the development of phonological awareness in bilingual children. Two studies have reported a bilingual advantage for children at age 5; this advantage disappeared at age 6 coinciding with the onset of formal reading instruction (Bruck & Genesee, 1995; Campbell & Sais, 1995). Bialystok, Majumder, and Martin (2003) observed that in monolingual English and bilingual children aged 5–7 years, only bilingual children displayed an advantage in metalinguistic tasks, specifically phoneme segmentation. In this task the child is asked to replace the first sound in a target word with the first sound from another word to produce a new word. However, Bialystok *et al.* (2003) report that Spanish-English bilinguals score the highest on phonemic awareness when compared with Chinese-English bilinguals. These authors attribute this finding to the sound structures of Spanish and English that are more similar than those of English and Chinese. The evidence thus suggests that depending on the nature of the writing system, certain linguistic structures may be more salient in some languages than in others, and this may allow for easier access to common phonological awareness structures when both languages are alphabetic.

Level of cognitive proficiency, such as working memory, is recognised as being linked to the acquisition of reading skills (Gathercole & Baddeley, 1991). This is also partly the case in bilingual children. To illustrate, Geva and Siegel (2000) investigating bilingual children learning to read in English and Hebrew, report an interaction between working memory and word reading. This interaction varies between the two languages, with differences in letter-sound correspondences accounting for differences in the development of reading processes and skills between the two languages. According to the *script dependent hypothesis*, word recognition skills develop more slowly in opaque orthographies than they do in transparent orthographies. Transparent orthographies permit simple, direct one-to-one correspondence between letters and sounds. Less transparent orthographies, on the other hand, have more complex relationships between letters and sounds (Snowling, 2000).

Evidence to support the script dependent hypothesis has been reported. Investigations of children learning to read in transparent alphabetic orthographies, such as Turkish (Oney & Durgunoglu, 1997), German (Wimmer & Hummer, 1990) and Italian (Cossu *et al.*, 1998), have shown that reading skills develop rapidly, with children making relatively few errors by the end of Grade 1. Wimmer and colleagues (Wimmer *et al.*, 1991; Wimmer & Goswami,

1994) studied the development of children learning to read in the transparent language of German. Wimmer and Goswami (1994, cited in Share, 2007) report that in seven, eight, and nine-year old children, German children are better than English children at reading nonsense words because these utilise an alphabetic strategy. These authors interpret the findings as reflecting differential reliance of each language for early reading with German children utilising an alphabetic approach, while English children use a direct whole-word approach as most words in English cannot be decoded using spelling-sound correspondence rules alone. Geva and Siegel (2000) report that reading accuracy and type of reading strategy vary between the transparent (vowelled Hebrew) and less transparent (English) orthography. Improvements in reading accuracy were faster in Hebrew, the more transparent orthography, than in English. This pattern of findings was attributed to vowelled Hebrew being transparent and therefore easier to decode than English.

Wydell and Butterworth (1999) describe a child who show dyslexia in L1 English but not in Japanese (L2). Everatt *et al.* (2000) describe bilingual children who display word-reading difficulties in orthographically opaque English without comparable deficits in orthographically transparent Tagalog – a Fillipino language. Everatt *et al.* (2004) have found that different cognitive processing skills distinguish good and poor readers with different linguistic profiles. Phonological awareness could distinguish third grade children with good *vs.* poor English reading skills more than it could distinguish children with good *vs.* poor Hungarian reading skills. Smythe and Everatt (2004) emphasise that memory processes that distinguish children with good *vs.* poor reading skills vary as a function of the transparency of the orthography. Specifically, Hungarian children varied in their ability to process and retain non-word information, English children varied in their ability to process and retain familiar, as well as unfamiliar verbal information, and Chinese children varied in their ability to process and retain novel visual material. This pattern of findings was attributed to Hungarian being more transparent than English and Chinese being a logographic orthography that uses written symbols, rather than sound, to represent meaning.

Evidence, therefore, is found across cognitive processing skills and methodologies consistent with the script dependent hypothesis. This is an important issue to consider in South Africa, since both Zulu and Afrikaans are more transparent and easier to decode on the letter-to-sound level when compared with English. The latter language has many letter-to-sound rules that are often not predictable at the phoneme level (Botha *et al.*, 1989; Suzman, 1996). Phonological and orthographic differences between, Afrikaans, English and Zulu were presented in Chapter 1. Few studies have compared reading in different languages in South Africa. In the present study, comparable cognitive processing and reading tasks were developed for the current sample of biliterate Afrikaans-English bilinguals. Word reading was investigated to determine whether orthographically transparent Afrikaans and orthographically opaque English demonstrate distinct phonological and orthographical processes, as predicted by the script-dependent hypothesis.

In contrast to the script-dependent hypothesis, the *central processing hypothesis* proposes a universal approach to reading acquisition. Common underlying cognitive processing skills (i.e. phonological awareness, vocabulary knowledge, and working memory) are assumed to influence the development of reading skills in any language. Evidence for the central processing hypothesis has been reported. Geva (2000) describes case studies by Weiss (1987), Obler (1989), and Petrie and Geva (1991), which show that bilinguals demonstrate reading difficulties in two languages. Stevenson, Stigler, Lucker, Hsu, and Kitamura (1982, cited in Geva, 2000) observe that reading skills differ little between children learning to read in an alphabetic script and those learning to read in a logographic script. Rather, individual differences in cognitive processing skills linked to reading explain reading proficiency.

Gholamain and Geva (1999) have investigated the role of cognitive and orthographic factors in the concurrent development of reading in orthographically transparent Persian and orthographically opaque English in young bilingual children. These authors explain evidence for both script-dependent and central-processing hypotheses. That is, reading skills in English and Persian are positively correlated despite the orthographic differences between English and Persian, consistent with predictions of the central processing hypothesis. However, the authors also identify evidence for the script-dependent hypothesis. That is, children could read Persian easily and more quickly than English, consistent with predictions of the script-dependent hypothesis. Based on these analyses, the authors suggest that both script-dependent and central-processing perspectives could be combined to formulate a cross-linguistic theory of reading development in bilingual children. However, further evidence is needed across different languages / learning contexts to those already tested to inform the formulation of such a combined theory of reading development in bilingual children.

The present study, therefore, followed a similar format to the studies of Geva and colleagues (Gholamain & Geva, 1999; Geva & Siegel, 2000). In the present study, Afrikaans and English differ in terms orthographic transparency with Afrikaans, in contrast to English, having near perfect correspondence between a grapheme and the phoneme it represents (Botha *et al.*, 1989). This difference may lead to differences in the development of reading across the two languages and reduce the likelihood of finding common sound-based predictors of reading ability. The *script-dependent perspective* argues for faster rates of the development of reading skills in the orthographically transparent language (Afrikaans) than the orthographically opaque language (English). In other words, reading ability / disability in one language need not be accompanied by similar levels of ability / disability in another language if the two languages vary in transparency. The *central processing perspective* argues for common underlying predictors of reading attainment across languages and orthographies.

The present study measured potential predictors of reading attainment to determine whether they provided similar levels of prediction of Afrikaans and English reading. In contrast to the Gholamain and Geva (1999) study, where Persian-English bilingual children receive only three hours of reading instruction per week in their second language, the present study investigates reading acquisition in bilingual children who use both languages daily and are taught to read in both languages via dual medium instruction. These differences from previous studies, plus the dissimilarities in phonology / orthography between Afrikaans and English make this a unique study in examining the predictions of the script-dependent *vs*. central-processing perspectives.

The second reason why bilingualism may influence the development of access to the written language, is the transfer of skills across diverse languages. It has been found that young bilingual children who speak diverse languages can transfer specific types of reading related skills, such as phonological awareness and word identification skills from one language to another (French-English: Comeau *et al.*, 1999; Italian-English: D'Anguili, Siegel & Serra, 2001; Spanish-English: Durgunoglu, 2002; Portuguese-English: DaFontura and Siegel, 1995). These studies have argued that these findings provide support for Cummins' linguistic interdependence hypothesis (1981).

According to this hypothesis, *cognitive academic language proficiency (CALP)* is transferred from one language to another such that reading instruction in one language leads to a deeper CALP, which promotes literacy in a second language. Cummins (1981), furthermore, claims that the transferability across languages of many of the skills involved in reading is high. Research evidence demonstrates a relationship between phonological processing skills in both languages and L1 and L2 reading skills are equivalent in diverse authors, supporting a hypothesis that phonological processing skills transfer across diverse languages (Gholamian & Geva, 1999; Comeau *et al.*, 1999).

However, specific linguistic knowledge from the child's first language may interfere with reading development in the child's L2, implying language-specific processing skills. For example, L1 Chinese phonological knowledge interfered with phoneme identification and spelling tasks in the L2 English of Chinese-English bilinguals (Wang & Geva, 2003). Therefore, the debate as to whether L1 reading processes interfere with, or transfer in a positive manner to, L2 reading processes has not been resolved. Even among cognitive processing measures, the overlap between L1 and L2 is not perfect (Gottardo *et al.*, 2001). The extent to which positive transfer occurs across phonological awareness, vocabulary knowledge, reading and reading comprehension measures has not received much research attention (Uchikoshi, 2012). The present study examined the concurrent relationships between L1 and L2 cognitive processing and L1 and L2 reading in biliterate Afrikaans-English bilinguals.

Besides possible cross-language transfer and the linguistic characteristics of the written systems having an effect on reading processes and skills, research on bilingualism involves other language parameters, such as the age at which the L2 is learned. Simultaneous bilinguals learn to speak two languages at the same time, such as some biliterate Afrikaans-English bilinguals in the South African context. Sequential bilinguals speak one language at home and acquire the second language in the school setting, such as emergent Zulu-English bilingual children in the South African context (Lambert, 1975). These two types of bilingualism are often linked to two types of educational models. Simultaneous bilinguals are linked to additive bilingualism and associated beneficial effects on cognitive, linguistic, and academic language development. Sequential bilingualism may be linked to subtractive bilingualism if the L2 is acquired at the expense of the L1. According to the *threshold hypothesis* developed by Cummins (1981, p. 229), "*threshold levels of linguistic competence* [sic] *exist and bilingual children must attain language proficiency both in order to avoid cognitive deficits and to allow the potentially beneficial aspects of becoming bilingual to influence their cognitive growth*". Laurent and Martinot's (2009) longitudinal study of 44 emergent French-Occitan sequential bilinguals in Grades 3 – 5 (ages of eight and nine) provides evidence in support of the threshold hypothesis. Children have French as their mother tongue but they are also exposed, from age four to pre-school, in Occitan. They receive reading instruction half in French, and half in Occitan. Children are matched on non-verbal intelligence, home and social background factors, and teaching methods. The authors report a bilingual advantage in Grade 4 (i.e. only after five years of dual medium schooling) on tests of phonological awareness and reading, with this effect remaining significant a year later. These findings are attributed to the degree of bilingualism determining the effect bilingualism has on the development of phonological awareness and reading attainment. This is because bilinguals need to attain a sufficiently high level of proficiency in the two languages before they can capitalise on the full benefits from dual medium education. If we follow this line of reasoning, different degrees of bilingualism should have different effects on cognitive abilities.

This possibility is tested in a study by Bialystok (1988) who compares the performance of balanced French-English bilinguals, partial / emergent Italian-English bilinguals and monolinguals solving meta-linguistic problems. Balanced bilinguals perform better on meta-linguistic problems that required high levels of linguistic flexibility and analytic ability. However, several limitations are apparent in Bialystok's (1988) study. The two non-English languages (i.e. French and Italian) differ from each other in both spoken and written forms. This difference may have contributed to the balanced bilingual superiority on meta-linguistic tasks requiring high levels of analytic ability. Further research is needed to compare bilinguals from similar language backgrounds who are at different levels of bilingual proficiency to conclude that the more balanced the child's mastery of two languages, the higher the score on phonological awareness and reading tasks.

The linguistic proximity of French and Occitan in the study by Laurent and Martinot (2009), whereby Occitan is a dialect of French, limits any strong conclusion with regard to the relationship between bilingualism and the development of phonological awareness and reading ability. Thus, the findings of Laurent and Martinot (2009) may be pointing to the value of being bilingual in specific languages rather than absolute level of bilingual ability having a significant facilitating effect on second language phonological processing and reading ability in bilingual children.

To illustrate, a study by Bialystok, Luk, and Kwan (2005) compares Chinese-English bilingual-, Hebrew-English bilingual- and Spanish-English bilingual-first graders on phonological awareness measures and reading tasks. These authors pronounce that L2 English reading is facilitated by the first language; reading skills are transferred across languages, and word recognition scores are positively correlated across languages, but a larger bilingual advantage is found for the Hebrew-English and Spanish-English bilinguals whose two languages are written in the same language system than for Chinese-English bilinguals. Thus, it is important to consider the role of literacy background in a child's L1 writing system in considering the potential benefits of additive bilingualism. This in turn leads to the need for research to ascertain whether bilingualism *per se* or early (L1) literacy acquisition is the critical factor for enhancing L2 phonological awareness and boosting L2 literacy acquisition. Only one international study to date has addressed this issue. This study is discussed next.

2.5.1 Biliteracy benefits: bilingual advantage or orthographic insight (or both)

A longitudinal study by Schwartz, Share, Leikin, and Kozminsky (2008) investigate performance on tests of phonological awareness and reading tasks in four distinct groups of six to seven-year old children in Grades 1 – 2. All of the children are matched on socio-economic level, verbal and non-verbal intelligence. The four linguistic groups of children include:

- Biliterate Russian-Hebrew bilinguals (children literate in L1 Russian prior to learning to read in L2 Hebrew);
- Monoliterate bilinguals (with only L2 Hebrew literacy experience and L1 Russian spoken but not written language proficiency);
- Monolingual Hebrew children (schooled exclusively in Hebrew); and
- Early-learning monolingual Hebrew group (began to read before schooling).

These authors have found that biliterate bilinguals demonstrate superior levels of performance in phonological awareness and word reading tasks compared to those of monoliterate bilinguals and compared to those of monolingual Hebrew children. This effect remained significant a year later. This result is attributed to biliterate bilinguals having a phonological / orthographic awareness advantage due to being able to distinguish between letters representing consonants and letters representing vowels in the Russian orthography. This process facilitates the acquisition of Hebrew orthography characterized by a complex system of vowelisation.

Furthermore, when Schwartz *et al.* (2008) compare biliterate Russian-Hebrew bilinguals to an early-learning-to-read Hebrew group, the biliterate bilinguals also outperform this group on measures of word reading, thereby demonstrating their phonological processing efficiency. In other words, biliterate bilinguals outperformed the early-learning Hebrew group on a phoneme isolation task which mother tongue speakers have difficulty with and is only mastered from Grade 2 onwards. Therefore, Schwartz *et al.* (2008) conclude that there is a positive consequence of bilingualism in the form of orthographic insight, which facilitates L2 phonological awareness and boosts L2 literacy acquisition even when the two languages (i.e. Russian and Hebrew) belong to different linguistic families and have distinct orthographies.

The findings of Schwartz *et al.* (2008) relate to Cummins' (1981, 2000) CUP model. This is because *"instruction in a certain language is effective in promoting proficiency in that language*, *transfer of this proficiency to another language will occur provided that there is adequate exposure to that other language (either in the school or home environment) and adequate motivation to learn that language"* (p. 175). In other words, transfer may occur when the linguistic mappings required by one language already have a basis in the other and thus transfer in biliterate bilinguals can be expected to be bidirectional.

At the same time, the possible effects of partial / emergent bilingualism compared to balanced bilingualism and monolingualism have been overlooked. Wang and Geva (2003) report instances of negative transfer of reading skills acquired in Chinese interfering with reading in English in emergent Chinese-English bilinguals in Grade 2. However, De Sousa, Greenop, and Fry (2010) document instances of positive transfer of reading skills acquired in Zulu that facilitate spelling in English in emergent Zulu-English bilinguals in Grade 2. Kim (2009) reports first language to L2 transfer in emergent Korean-English bilinguals and bi-directional transfer on phonological awareness and reading tasks administered in Korean and English.

Therefore, transfer is a general outcome of bilingualism, but language proficiency and relative balance between the two languages for bilingual children is important for explaining L2 English reading success, and degree of bilingualism determines the nature and direction of cross-linguistic transfer across and between languages. De Sousa, Greenup, and Fry (2010) and Kim (2009) control for socio-economic factors linked to quality of reading instruction and demonstrate that bilingual experiences contribute to positive cognitive effects, and when socio-economic factors are not considered, poor L2 English reading performance results (Wang & Geva, 2003).

In reviews by Bernhardt (2003), Krashden and Mcfield (2002), and Mora and Wink (2001), bilingual education programmes reporting poor L2 reading outcomes in bilingual children are poorly designed. They do not consider the value of developing academic language proficiency in both languages, or the match between teachers' beliefs and actual classroom practices, in determining the effectiveness of a dual language instruction on L2 reading success. Further research is needed to explore these issues.

Prinsloo (2007), Henning and Dampier (2012) and Koch, Landon, Jackson and Foli (2009) point out that the case for dual language instruction or inadequate use of mother tongue medium of instruction in South Africa, has not been made. There is little appreciation of the magnitude of dual language programmes for L2 English reading success in bilingual children (Mothata & Lemmer, 2002). The present study will show that neglect of mother tongue instruction impacts on the cognitive development and academic success of bilingual children.

Bialystok (1988) reports that bilingual children perform better than monolingual children on meta-linguistic tasks requiring high levels of attention control (e.g. sentence segmentation or symbol-substitution) and that fully bilingual children perform better than partially bilingual children on tasks requiring high levels of analysis of linguistic knowledge and awareness of linguistic structures (e.g. conceptual tasks or grammatical awareness). Bialystok and Codd (1997) state that bilingual pre-school children perform better than monolinguals on quantity tasks requiring high levels of attentional control, and only balanced bilinguals perform better on quantity tasks requiring high levels of linguistic analysis.

Secada (1991) reports that native language is important for solving mathematical problems accurately. Mestre (1998) says that bilinguals solve mathematical problems incorrectly when mathematical problems are presented in their non-dominant language. Kessler and Quinn (1960) have found that certain aspects of problem solving might become more salient to bilingual children because their experience of two languages equips them with the ability to bring different perspectives to the problem. Kessler and Quinn (1960) report that when bilingual children are asked to write as many hypotheses as possible to solve a problem within a limited period of time, bilingual children perform better than monolingual children. Additionally, their hypotheses are both structurally and qualitatively more complex than those provided by monolingual children. Together, these studies show differences between monolingual and bilingual children in various linguistic and non-linguistic domains. The results also suggest that control of processing - an aspect of selective attention - is more fully developed in balanced bilinguals than in partial bilingual or monolingual children, with balanced bilinguals showing superior performance in solving problems requiring high levels of analysis regardless of domain. The present study examined the relationships between phonological awareness and reading differences between monolingual and bilingual children by considering both level of bilingualism and processing demands of the phonological awareness and reading tasks.

As pointed out in section 2.2, the contribution of vocabulary knowledge is poorly understood. The last decade has witnessed an important step forward in understanding this variable and its relationship with English reading (McBride-Chang *et al.*, 2006). It is now being recognised that vocabulary has a complex, multi-dimensional nature, including number of words known (breadth of vocabulary) and quality of representations of the words (depth of vocabulary) (Kirby, 2007). This understanding of vocabulary knowledge could be useful for demonstrating that L2 vocabulary acquisition differs to L1 vocabulary acquisition. Additionally, it provides insight into L2 reading success depending on a specific level of L2 proficiency. The distinction between breadth and depth of vocabulary could illustrate that bilingual children are a very heterogeneous group. In addition, it could help teachers understand that they need to target both breadth and depth of vocabulary to facilitate the acquisition of reading in L1 and L2 English. The relationship between breadth and depth of vocabulary knowledge and different aspects of reading is discussed in the next section.

2.6 VOCABULARY AND SECOND LANGUAGE READING DEVELOPMENT

Nation (2008) points out that vocabulary knowledge comprises three parts: Form (oral and written), meaning and use. This definition of vocabulary overlaps with the term lexical knowledge found in Perfetti 's (2007*) lexical quality hypothesis*. According to the lexical quality hypothesis, a reader's knowledge of a given word includes the word's form, meaning and knowledge of its use. An individual's vocabulary knowledge includes words of varying lexical quality. Some words have a high frequency and thus complete phonology, orthography, and meaning representations, while other words have low frequency and have either missing or incomplete information with regard to form (oral and written), meaning and use.

Following from this, individuals differ in the lexical quality they have for words, both in terms of size and in precision of a word's meaning, or context in which a word is used (Biemiller, 2003; 2007). Anderson and Freeman (1981, p. 93) state that vocabulary breadth refers to *"the number of words a person knows and significant aspects of a word's meaning"*, as illustrated in Figure 2.8. Vocabulary depth refers to *"the quality or depth of understanding."* as illustrated in Figure 2.9.

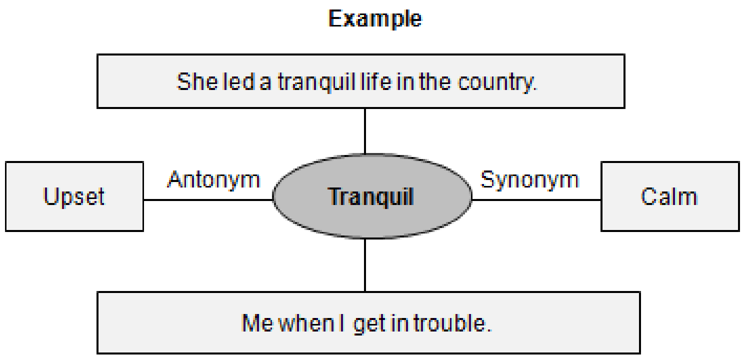


Figure 2.8: **Example of breath dimension of vocabulary (compiled from Kirby 2007 and Goldstein, 2011).**

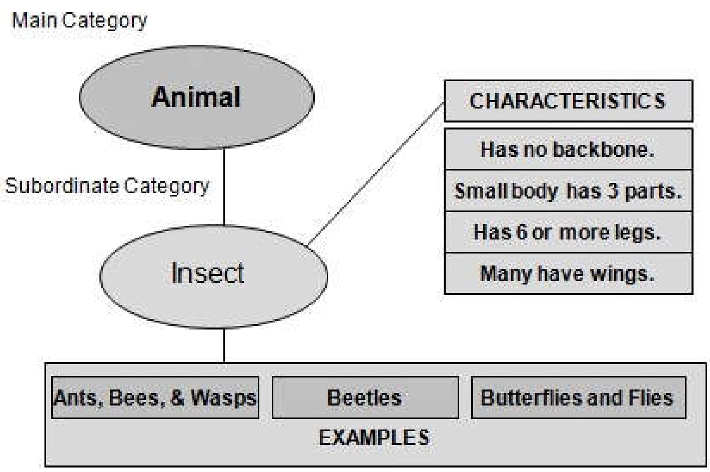


Figure 2.9: **Example of a concept map illustrating depth of vocabulary (compiled from Kirby, 2007 and Goldstein, 2001).**

2.6.1 Measuring breadth and depth of vocabulary knowledge

Breadth of vocabulary is measured using a variety of tests. Multiple-choice format tests involve synonym substitution, translation matching, or definition completion. These are easy to administer, but only measure whether the learner can identify the definition and not the context in which the tested words are used. Oral receptive vocabulary tests involve showing the learner several pictures and asking him / her to point to the picture that corresponds to a word spoken by the examiner (Peabody Picture Vocabulary Test; Dunn & Dunn, 1981). Oral expressive vocabulary tests (Vocabulary subtest of the Weschler Intelligence Scale; Weschler, 2003) ask the learner to orally define stimulus words presented by the examiner. Responses are scored on the basis of precise definitions (e.g. a coat is an item of clothing *vs.* a coat is worn on the upper part of the body). This type of vocabulary test is considered to be the best measure of breadth of vocabulary because it assesses pronunciation, as well as word use (Ukrainetz & Blomquist, 2002). The most frequently used type of measure for depth of vocabulary is a definition task, which asks learners for explanations of the meanings of specific words (Similarities subtest of the Weschler Intelligence Scale; Weschler, 2003). Responses are evaluated with scoring rules on the basis of an appropriate semantic category being identified by the learner. (e.g. an orange is a fruit *vs.* an orange can be eaten).

Breadth and depth of vocabulary have been shown to be interrelated and to facilitate one another. Vermeer (2001) reports correlations of (r =.85) between breadth and depth of vocabulary in monolingual Dutch children, and a correlation of (r =.76) between breadth and depth of vocabulary in Dutch bilingual preschool children. This finding suggests a large overlap between breadth and depth of vocabulary, implying there is no difference between the two dimensions of vocabulary knowledge. However, Nurweni, and Read (1999) argue that breadth and depth of vocabulary may converge in older English children but be more distinct in younger children at lower levels of proficiency. These authors point out, in early language development a small number of words are recognized and their meanings known; increased language experience results in increases in breadth of vocabulary, thereafter words are linked to other words in different contexts, facilitating the learning of new words, and growth in depth of vocabulary occurs. Therefore, breadth and depth are reciprocally related, both require extensive exposure to language. The relationship between breadth and depth of vocabulary also depends on how and when these two aspects of vocabulary knowledge are measured (Kirby, 2007)

Vocabulary acquisition begins early in the process of language development; infants at eight months of age begin to produce words. From 18 to 24 months of age, they have accumulated a large number of words, and by the time they have entered Grade 1 they have acquired 3,000 to 5,000 words (Nagy, Herman, & Andersen, 1985). Biemiller (2007) estimates that 80% of the words children have acquired by Grade 6 occurs though direct instruction, but this estimate decreases by 3 000 words a year by the end of high school. Although a large number of words are the result of direct teaching, extensive reading and use of context to estimate a word's meaning also play a role (Nagy *et al.*, 1985).

Previous research has shown that there is a positive relationship between L1 and L2 vocabulary. Established L1 vocabulary can support L2 vocabulary through positive cross-language transfer, because learners' L1 ability can be transferred to their L2 learning (Genesee & Jared, 2008). However, because bilingual children have two languages, L2 vocabulary learning consists of learning new conceptual meanings and new phonological / orthographic forms. This may not necessarily lead to a delay or deficit in early L2 language learning provided that L2 learners have many L1 lexical items and know their L1 equivalents. Then L2 learners only need to learn the new L2 phonological / orthographic forms. In this regard, Bialystok (1995) points out that L2 vocabulary acquisition involves a process of reconstructing L2 learners' original conceptual system from their existing L1 conceptual system.

But do L2 learners develop vocabulary in the same way as do L1 learners? According to Levelt's (1989) *model of word representation*, learning one word includes learning four types of information: phonology / orthography, morphology, semantics, and syntax. The phonological / orthographical comprises pronunciation and spelling. The morphological category includes word forms such as inflections, derivations and compound words. Semantic information includes word meanings and their associations. The syntactical category includes grammar. For L1 learners all these types of information are integrated and automatically available in words that have a high lexical quality (Perfetti, 2007).

In the case of L2 vocabulary, the situation can be different; depending on when and how the L2 is acquired. For L2 learners who acquire vocabulary at an early age, such as simultaneously with their L1, the L2 vocabulary acquisition process is similar to their L1 vocabulary acquisition. In contrast L2 learners who learn L2 later in life with insufficient exposure to L2, L2 vocabulary development is different. According to Levelt's (1989) model of vocabulary acquisition, there is an extra stage for L2 learners. This involves connecting the L2 word form to its existing L1 translation before phonological / orthographic, morphological, semantic, and syntactic information is integrated. In 1994, Kroll and Stewart presented a model of bilingual word processing. Figure 2.10 depicts Kroll and Stewart's (1994) revised hierarchical model (RHM).

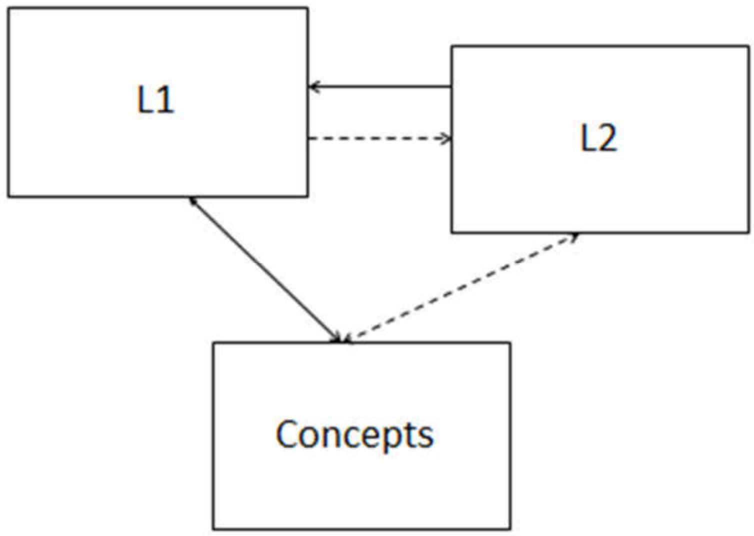


***Figure 2.10*: Kroll and Stewart's (1994) revised hierarchical model (RHM).**

Although this model can be applied to bilinguals acquiring reading skills in two languages simultaneously, it was primarily developed to explain language acquisition in sequential bilinguals, i.e. when L2 learning takes place after some level of mastery has been attained in the L1. According to the RHM model, two types of word representations exist. Lexical representations contain information about word forms, and conceptual representations contain information about word meanings. At the lexical level, two lexicons are apparent: one for words of the L1 and one for words of the L2. Translation equivalents in the two lexicons are linked via excitatory links, but with different strengths for L1 and L2. In the early stages of language learning, these links are assumed to be stronger from L2 to L1 than from L1 to L2. This is because L2 words are usually learned by associating them with their L1 translations. Both lexicons are connected to a shared conceptual system that comprises the meaning of words. Given that bilinguals know more words in their L1 than in their L2, connections between the L1 lexicon and conceptual system are assumed to be stronger than those between the L2 lexicon and conceptual system (Kroll & Stewart, 1994). Therefore, in the early stages of L2 acquisition, only the links between newly learned L2 words and their L1 translation are made, but as language proficiency increases over time, connections between L2 words and conceptual information develop. As a result, for fully proficient L2 readers the connections between the L2 lexicon and conceptual system may be as strong as those between the L1 lexicon and conceptual system.

Extensive evidence exists to support the RHM model's key assumptions of: (1) separate lexical and conceptual representations, (2) distinction between L1 and L2 lexicon including selective access, meaning that when a bilingual person activates or processes words in the L1 the L2 lexicon is deactivated or inhibited, (3) asymmetries between L1 and L2 processing including the idea that semantic information is easier to access from L1 input, and semantic word-word connections are more important for L2 word processing than for L1 word processing, and (4) how bilingual memory changes as a function of increased language proficiency (Brysbaert and Duyck, 2010).

McElree, Jia, and Litvak (2000) have studied conceptual retrieval in three groups of bilinguals, namely: Balanced Russian / English; Russian-dominant Russian / English bilinguals and English-dominant Russian / English bilinguals for whom English (L2) is their primary language. These researchers point out that conceptual retrieval is slower in the processing of the non-dominant language of unbalanced bilinguals reflecting that mapping from form-to-meaning is weaker in the non-dominant language. In contrast, conceptual information from L1 and L2 are equally available and accessible for the balanced bilinguals. The slower time course for the non-dominant forms is understood as follows: When form-to-meaning mappings are weak, (such as in less proficient bilinguals), conceptual information between each of their languages cannot be retrieved directly. The non-dominant lexical form is associated with its corresponding dominant lexical form to facilitate conceptual retrieval, resulting in a time delay. Similarly, Ardila (2003) pronounces that processing information in L2 is more demanding than in L1. In lexical decision tasks, there is a significant correlation between reaction time and word frequency. In unbalanced / emergent bilinguals, L2 words often function as low frequency words. Hence, language processing is slower and semantic search is less efficient than it would be for a monolingual or balanced / biliterate bilingual.

This time delay affects language understanding and hence reading comprehension (Ardila, 2003).

In another study, Tatsuno and Sakai (2005) compare two groups of adolescents, 13 and 19 years of age, on a past-tense verb identification task in their first language (Japanese) and their second language (English), which is acquired after the age of 12 years. The groups show similar activation in a left-hemisphere language region for the first language, but different activation levels for the second language. In the older group, who have achieved a high level of proficiency with English past-tense forms, there is greatly reduced activation, suggesting less effortful processing with increased proficiency. Therefore, some concepts are shared across a bilingual's two languages, but these are not equally accessible by L1 and L2 and depend of level of language proficiency (Kroll & Stewart, 1994).

The first language acts as a lexical intermediary between L2 and conceptual meaning. Lexical links from L2 to L1 are stronger than lexical links from L1 to L2, and conceptual links to L1 are initially stronger than conceptual links to L2. The ability to directly access L2 concepts, without the help of L1, is said to be acquired gradually, as the size of the L2 lexicon or word-learning history increases. As bilingual children become more proficient in their L2, the size of the conceptual set activated by L2 is comparable to that accessed by L1. At this point, the bilingual child is able to use L2 to directly access meaning. Furthermore, the bilingual will also be able to mediate access from L1 to L2 through shared conceptual representations (Dufour & Kroll, 1995). Therefore, it appears that the type of link, namely lexical and / or conceptual, between each of a bilingual's languages, as well as its strength, depends upon the degree of L2 fluency. Balanced bilinguals effectively access both lexical and conceptual links, whereas less fluent bilinguals rely heavily on lexical links from L2 to L1 (Kroll & Stewart, 1994).

Haritos and Nelson (2001) report that retrieval demands made on bilinguals when recalling stories in two languages are sensitive to previous language experience whereby memory tasks that take into consideration the amount of information bilingual children must encode, understand, store, and retrieve on a daily basis, result in better recall and general memory performance. Pearson (2002) provides evidence that bilingual lexical learning leads to initially smaller vocabularies in *each separate language* than for monolingual learners of those same languages, and that *total vocabulary sizes* (the sum of what children know in both their languages) in bilingual toddlers are similar or exceed that of monolingual toddlers.

Archila-Suerte, Zevin, Ramos, and Hernández's (2013) fMRI study demonstrates the use of different brain processes during a speech perception task in six- to 10-year old monolingual children and bilingual children who have begun to learn their second language between four and nine years of age. The bilinguals recruit areas of the brain involved in executive function (cognitive control) to a larger extent than the monolinguals do. This difference is noted as early as seven months of age (Kovacs & Mehler, 2009), even before vocabulary is developed, and therefore may develop due to bilinguals having to pay attention and to select from a wider range of words than monolinguals to retrieve the correct word. Furthermore, many of the differences in cognitive control functions across bilingual and monolingual populations show a cognitive advantage in favour of bilinguals e.g. phonemic awareness, semantic processing, and working memory (Bialystok, *et al.*, 2005; Ianco-Worral, 1977; Morales, Calvo, & Bialystok, 2013). Such advantages may be accessible to all children through dual medium instruction with its goals of developing learners' full conversational and academic language proficiency in both languages (Cummins, 2000).

Lexical and conceptual inter-language associations, are of particular interest with respect to the present study. Participants in the present study were emergent bilinguals with L1 Zulu spoken proficiency only and L2 English instruction, having acquired English at a later stage than L1. Another group is biliterate bilinguals, fluent in Afrikaans and English and attending dual medium instruction. Based on the aforementioned review of the literature, research evidence suggests that vocabulary plays a greater role in second language acquisition than in monolingual language processing, and developing proficiency in two or more languages will not affect a child's ability to read as what matters the most is the relationships between level of proficiency in each language. Thus, investigating level of bilingualism and level of vocabulary knowledge may provide a cognitive window into the nature and development of bilingual memory, extending existing bilingual word processing research.

2.6.2 The relationship between breadth and depth of vocabulary and reading achievement

Many studies have shown that vocabulary knowledge is an important skill for reading ability in both L1 and L2 learners (August *et al.,* 2005; National Reading Panel, 2000). Vocabulary helps support word reading in L1 learners, because if one knows the words, one is able to decode them accurately and quickly (Garlock, Walley, & Metsala, 2001). With regards to the relationship between vocabulary and reading ability in L2 learners, the evidence suggests that this relationship also occurs. For example, McBride-Chang and Kali (2002) compare 190 Hong Kong pre-schoolers who are L2 English learners to 128 American English pre-schoolers. These authors explain that like American English pre-schoolers, L2 English vocabulary is significantly correlated with L2 English word reading for Hong Kong pre-schoolers. This finding has been confirmed a year later (McBride-Chang *et al.*, 2006). However, most researchers have not distinguished between vocabulary depth and breadth when examining the relationship between vocabulary and reading ability. Only one study has done so. This study is discussed next.

Ouellette (2006) distinguishes between vocabulary depth and breadth when examining the relationship between vocabulary and reading ability in 60 L1 English children. Receptive vocabulary predicts word reading significantly after controlling for age, non-verbal intelligence, and depth of vocabulary. Depth of vocabulary measured by a word definitions task does not predict word reading ability. This author attributes this finding to a fairly shallow level of vocabulary knowledge being required to facilitate word reading ability in L1 English monolinguals.

Maureen and Geva (2009) report that breadth (assessed by means of a receptive vocabulary measure) accounts for 6.2% of unique variance in word reading in EL1 but not in EL2 children in Grades 5 and 6. In contrast, root word vocabulary (requiring extensive language proficiency in the form of morphological knowledge) predicts 7% unique variance in the EL2 group but not in the EL1 group. The bilinguals in Maureen and Geva's (2009) study are sequential bilinguals, who have acquired L2 at a much later stage relative to their L1. In keeping with the RHM model by Kroll and Stewart (1994), the ability of L2 learners to directly access concepts or use the L2 to directly access meaning, occurs as the size of the L2 lexicon increases and as bilinguals become more proficient in L2. Therefore, whether breadth or depth dimensions of vocabulary knowledge are used in reading depends on level of L2 language proficiency, nature or type of bilingualism (i.e. additive *vs.* subtractive), which, in turn, may differentially influence the relationship between vocabulary knowledge and reading attainment in different groups of bilinguals. Thus, instead of comparing vocabulary and reading profiles of EL1 learners *vs.* EL2 learners, a more nuanced approach to L2 vocabulary knowledge and L2 reading acquisition should focus on the within-group variability in English L2 children and how it relates to word recognition relative to L1 English children, as different types of bilinguals may use different dimensions of L2 vocabulary for L2 reading development.

The next section discusses the final cognitive processing skill investigated in the present study, namely: working memory. Working memory is considered to develop in the first years of life, but also can be trained and improved with experience (Jaeggi, Buschkuehl, Jonides & Perrig, 2008).

2.7 WORKING MEMORY AND (SECOND) LANGUAGE PROCESSING

> *Any intelligent agent incarnated in matter, working in real time, and subject to the laws of thermodynamics must be restricted in its access to information.*
>
> (Pinker, 1997, p. 138)

Pinker's (1997) words highlight that the main challenge faced by all language learners involves restricted access to information. Pinker (1997) further points out that language learners (including bilingual children) are *"agents incarnated in matter"* because their language processing is either facilitated or constrained by the quantity and quality of learning opportunities in the environment. This situation is further complicated by differences in mode and medium of instruction at school. Language learners follow the *"laws of thermodynamics"* because *biological / cognitive* factors influence the amount of language experience and nature of input that becomes available for children to process information at the *behavioural level* (Frith, 1995). The inter-language system is attention-limited, meaning that when language learners try to access or covey meaning in the L2 they may be constrained by the nature of their developing inter-language system, as well as by their speed in processing information or concepts in their presently accessible inter-language lexicon and phonology (Churchill, 2012). Besides the environmental factors of levels of orthographic transparency and bilingualism and nature or degree / type of bilingualism, all restrictions aforementioned concern language processing efficiency (Bialystok, 2007; Churchill, 2012; Conway *et al.*, 2007).

The construct viewed as central to language processing is working memory (Baddeley, 1986; Daneman & Merikle, 1996; Gathercole, Willis, Emslie & Baddeley, 1992; Alloway, 2007). Working memory is viewed as a dynamic complement to long-term memory. It allows for short-term activation of information and at the same time manipulation of the information (Baddeley, 1986). A well-established model of working memory is Baddeley's (1986, 2003) model of working memory, which consists of a central executive and two sub-systems, the phonological loop, and visuospatial sketchpad, a more recent addition. Baddeley's (2003) model of working memory is illustrated in Figure 2.11.

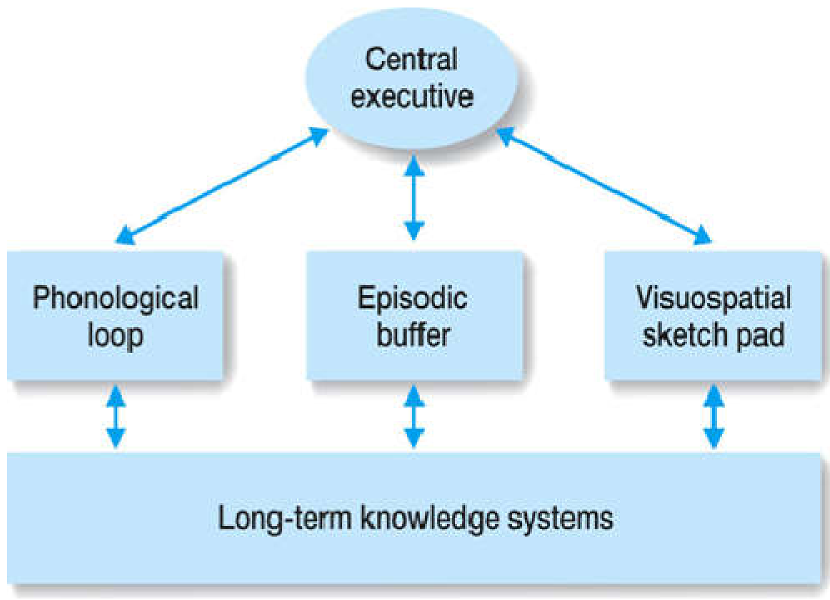


Figure 2.11: **Baddeley's (2003) multi-componential model of working memory (adapted from Goldstein, 2011, p. 132).**

Of particular importance to L2 acquisition are the central executive and the phonological loop aspects of working memory. The central executive is described as a domain-general attention control system. It involves control of attention, processing, and retrieving information from long-term memory. The temporary storage of information is mediated by two domain-specific components, namely: the phonological loop, which is capable of holding and manipulating language-based information as opposed to the visuospatial sketchpad, specialised for the maintenance and manipulation of visual and spatial representations (Baddeley & Logie, 1999). The fourth component, the episodic buffer, is capable of integrating information across information domains and immediate and long-term memory systems into integrated logical chunks increasing the capacity for efficient language processing (Baddeley, 2000; 2003).

Baddeley (1998) and other researchers (Daneman, 1991; Daneman and Carpenter, 1980; Gathercole *et al.*, 1992) have found that the phonological loop is important to reading and reading comprehension. Research on language comprehension in first language speakers has shown that individual differences in working memory affect the ability to integrate information, to monitor for semantic inconsistencies and extract the main theme of a text, to resolve lexical ambiguity, and to achieve a high level of performance on general measures of comprehension (Daneman & Green, 1986). In addition, working memory has been found to be important for the acquisition of new vocabulary, as well as a strong predictor of good performance on global measures of language processing. For example, Daneman and Green (1986) emphasise that working memory plays a significant role in determining how easily primary-school-aged children extract word meanings from text based on their use of contextual cues to aid their understanding of words they have not seen before. These researchers suggest that working memory facilitates vocabulary growth indirectly by means of partial phonological decoding. Indeed, the work of Gathercole and Baddeley (1991) shows that participants with a high-memory span are able to learn new word names in three trials whereas subjects with a low-memory span take longer (more than five trials) to learn new word names. In summary, there is convincing evidence for the significance of working memory to first language comprehension and reading acquisition.

2.7.1 Measuring working memory

Working memory is operationalised by means of a reading span test developed by Daneman and Carpenter (1980). Leather and Henry (1994, cited in Savage, Lavers, & Pillay, 2007) presented children with a listening task that asks them to listen to a series of incomplete sentences, then determine the last word of each sentence, and remember those words for later recall. These authors have found that performance on this complex task involving storage and processing aspects of working memory predicts unique variance in children's reading accuracy and reading comprehension over and above the contribution made by short-term memory performance and phonological ability. A meta-analysis from 77 studies on the relationship between working memory and reading comprehension by Daneman and Merikle (1996) indicates that reading span tests correlate with global measures of L1 reading comprehension ($r = .41$). Based on 2000 samples, Swanson, Trainin, Necoecgea, and Hammill (2004, cited in Savage, Laver & Pillay, 2007) report a correlation of ($r = .31$) between reading span and reading comprehension. Differences in these estimates may be due to a variety of reading span measures correlated (e.g. non-word repetition task, reading span test) and correlated with language tasks (e.g. reading comprehension, vocabulary tests, and general language proficiency measures). In essence, all involve measuring the ability to access words from memory, but different measures do so to different degrees (Savage, Lavers, & Pillay, 2007).

In a review by Savage, Lavers, and Pillay (2007) of studies that have used measures of working memory, these authors realise that while these studies purport to assess storage and processing dimensions of working memory, only storage scores are reported. Consequently, good performance on working memory tasks reflects good storage capacity and rehearsal skills, rather than switching between storage and processing functions characteristic of Baddeley's model of working memory. It follows then that the construct validity of complex span measures of working memory measures have been questioned. To address this issue, Savage, Lavers, and Pillay (2007) recommend that a comprehensive measure of working memory include a score for on-going storage and processing. The recently developed automated working memory assessment (AWMA) (Alloway, 2007) fulfils this criterion.

The AMWA is a complex span measure of working memory that provides both a separate score for storage, processing and combined storage-and-processing score. The AWMA is a computer-based version of the well-established Working Memory Test Battery for Children (WMTBC, Pickering & Gathercole, 2001, cited in Alloway, 2007).

Using the WMTBC, Gathercole and Alloway (2004) provide evidence that complex span memory tasks have strong associations with word reading ability and reading comprehension during the early years of learning to read with these relationships decreasing after age 14. The authors attribute this finding to the acquisition of literacy skills during the early years of schooling requiring the capacity to process and store material simultaneously and that by age 14 most children already know how to read so any differences found are attributed to differences in general cognitive ability. Similar findings have also been replicated in other studies (Gathercole & Alloway, 2004).

Prior to making any claims pertaining to the significance of working memory for language comprehension and the development of reading ability in L2 learners it is important to establish if working memory is independent from intelligence, L1 working memory, and general language proficiency. This issue is discussed in the next section.

2.7.2 Working memory and intelligence

Geva and Ryan (1993) report that correlations between two L2 working memory measures (an opposite word task and a listening span task) and L2 reading performance remain significant even after intelligence is partialled out in Hebrew-English children attending dual medium instruction from Grades 5 to 7. In another study, Ando, Fukunaga, Kurahashi, Suto, Nakano, and Kage (1992) assess working memory and reading in Grade 6 Japanese children. These children are not exposed to any English instruction. After exposure to an instruction programme that places emphasis on grammar, their L1 listening span predicts L2 post-test reading performance (r = .60), yet this is not the case for their intelligence scores as measured by the Raven Progressive Matrices Test. Similarly, Alloway (2007) reports that a mother's education level is significantly correlated with IQ scores as measured by the Wechsler Intelligence Scales for Children. This pattern is not the case for their working memory scores as measured by the AWMA. In sum, the evidence demonstrates that working memory is independent from intelligence for L1 and L2 learners (Alloway, 2007; Geva & Ryan, 1993).

2.7.3 L1 and L2 working memory

Harrington and Sawyer (1992) studying 34 Japanese adults, point out strong significant correlations between the L2 reading span and performance on a test of English grammatical language proficiency (grammar $r = .57$ and reading $r = .54$), whereas L1 and L2 working memory measures are only moderately significantly correlated ($r = .39$). Similar findings have been reported by Berquist (1997), as well as by Hummel (1998) in French first language speakers learning English. The findings provide evidence to support the independence of L1 and L2 working memory. However, another line of research suggests that L1 and L2 working memory and reading are highly correlated. In two studies involving four different languages, Osaka and colleagues (Osaka & Osaka, 1992; Osaka, Osaka & Groner, 1993) report high correlations between L1 and L2 working memory and between L1 and L2 reading spans ($r = .85$) in German-French bilinguals. They also emphasise high correlations in Japanese college students learning English at the "near bilingual level" ($r = .84$ for the L1 and L2 reading and $r = .72$ for the L1 and L2 working measure based on Daneman and Carpenter's (1980) span test).

These mixed results may be due to scoring methods. Studies reporting lower correlations between L1 and L2 all use a sensitive scoring criteria; a correct answer equals one point resulting in low correlations. On the other hand, the measurement criteria used in the studies by Osaka and colleagues would favour higher correlations; a 5-point scale based on meeting the criteria of three out of the five sets of sentences. When research participants only got two out of the five sets correct, they were given half a point. Thus, it is possible that the correlations found by Osaka and Osaka are artificially high and would have been quite different had they used the one-word-equals-one-point system of scoring. Therefore, it is likely that the correlation between L1 and L2 working memory is only moderate (.39 – .58) and that L2 working memory contributes independently to L2 reading comprehension.

2.7.4 Working memory and Language proficiency

Baddeley, Logie, Namio-Smith, and Brereton (1985) report that L1 working memory correlates with L1 reading comprehension as measured by the Nelson-Denny reading test ($r = 6$) in 51 adults ranging in age from 18 to 60. Using stepwise regression, Baddelye *et al*. (1986) show that L1 working memory contributes 10.6% to comprehension following a lexical decision task (26.1%). In a subsequent study, these authors find that the reading span test contributes 19.4% of the variance in reading after the effect of vocabulary has been removed. Similarly, Geva, and Ryan (1993), in the previously-mentioned study of young learners of Hebrew, report that a L2 working memory word opposites test contributes 6.8 % of the variance in L2 reading as measured by their cloze test after the effect of oral proficiency has been partialled out. Harrington (1992) has found that L2 working memory accounts for the variance in reading scores even after the effects of L2 vocabulary and grammatical knowledge have been removed. Evidence is provided that working memory contributes independently to the variance in proficiency.

2.7.5 Working memory and current theories of L2 acquisition

> *A working memory perspective shifts the scientific schema within which language and language behaviour have been studied to focus on the dynamics of language processing, in addition to its structural aspects.*
>
> (Carpenter, Miyake & Just, 1994, p. 1107).

As pointed out by Carpenter, Miyake, and Just (1994); when working memory can indeed be validated as an independent variable that accounts for language comprehension and language acquisition, then the question arises whether it fits into a theory of second language reading acquisition. There is a growing consensus that working memory is highly compatible with information processing models of L2 learning such as those proposed by Pienemann and Johnston (1987); Van Patten (1996); McLaughlin, Rossman, and McLoed (1983); and Hulstijn and Hulstijn (1984). To illuminate, it may be useful to look at a few of these models, because they are relevant for the model proposed in the present study.

Pienemann and colleagues (Pienemann & Johnston 1987; 1988; Meisel, Clashen, and Pienemann, 1981) have developed a L2 multidimensional model to account for observed stages of development and the variation between learners. In essence, developmental sequences in language learning reflect the systematic manner in which learners overcome processing constraints. Van Patten and Cadierno (1993) and Van Patten's model (1996) consider the role of processing from input to output in the following manner. The learner engages in linguistic processing, which is mediated by the limited capacity of the learner's L2 working memory. At the same time, there is a competition between the meaning and the actual word itself for the encompassing computational resources of the learner. Thus, the ease with which new information can be integrated into the developing inter-language system is influenced by a learner's ability to deal with the processing demands at the time the new information is encountered. Van Patten's portrayal sheds light on the process that may contribute to change in the inter-language system, suggesting that the capacity of working memory at a given time restricts the ability to acquire a linguistic form new to the interlanguage system. However, the question of what specific processes are involved in L2 working memory remains unanswered.

In this regard, we need to turn to Skehan's (1998) model, which explains the processes involved in L2 working memory by suggesting that working memory must be able to engage in a number of different tasks (Skehan, 1998). Skehan (1998) proposes that meta-processes operate in working memory permitting the development of the inter-language system of the learner. Because this model assumes that various processes in working memory operate independently we may infer that working memory is not a uniform construct.

However, Skehan's (1998) model does not address the competitive demands of the input that Van Patten and Cadierno suggest occur in the development of the inter-language system (Churchill, 2012). Skehan's model, however, according to Churchill (2012), might be able to accommodate this process in the following way. A learner notices the form in the input but without having a sufficiently well-developed system to maintain the form in working memory. In this way, the noticed item decays before it is actively processed in working memory. In this process noticing represents the interface between working memory and long-term memory (Churchill, 2012).

Combining Skehan's and Van Patten's models of L2 working memory, we can infer that features in the input compete for the language processing system's resources and cognitive mechanisms within working memory compete to interpret the input. According to Churchill (2014), this competition accounts for changes in the inter-language system in long-term memory over time (Churchill, 2012).

2.7.6 The nature of working memory

From the preceding discussion, Van Patten's model seems to assume that working memory is a unitary construct, while Skehan's model implies working memory is made of several subcomponents. A related issue is the developmental nature of working memory. VanPatten and Cadierno (1993) and Pienemann and Johnston (1987; 1988) argue that changes in the ability to process language result in developmental modifications to the inter-language system and that these processing capacities develop over time. Skehan's model does not address developmental changes in working memory. In order to better understand the nature of working memory and its development we need to look at literature in cognitive psychology and neuroscience.

Case (1987), and Turner and Engle (1989) view working memory as a unitary resource that is independent of task content. In these models, competition for this shared resource between the need to store information and the act of processing accounts for differential performance on tasks. On the other hand, a growing number of researchers are beginning to favour a multi-componential model that would be consistent with Skehan's (1998) and Baddeley's models of working memory. Some evidence for this prediction has been reported. Daneman (1991) reports that L1 reading span does not predict speech production well and thus concludes that working memory is not unitary. Furthermore, in a study investigating task effect, Towse, Hitch and Hutton (1998) do not find any consistent interference effects in their study and conclude that their results do not support a resource-sharing model. Rather a task-switching model is favoured, such that complex tasks extend processing time and thus are *"inclined toward a decay interpretation"* (p. 196).

Further support for a multi-componential model of working memory comes from research in the neurological sciences. Using neuro-imaging techniques (PET and fMRI) while subjects are performing working memory tasks, a number of researchers have shown that working memory consists of various components and that these are anatomically distinct. Paulesu, Frith, and Frackowiak (1993) demonstrate that the phonological store activates areas in the supramarginal gyri (BA 40), whereas the subvocal rehearsal system involves in phonological processing activates the superior temporal gyri (BA22 / 44). Shallice, Fletcher, Frith, Grasby, Frackowiak, and Dolan (1994) show that encoding and retrieval of information activate different parts of the brain (left dorsolateral, prefrontal and retrosplenial cortex *vs*. bilateral precuveus and right prefrontal cortex). D'Esposito, Detre, Alsop, Shin, Atlas, and

Grossman (1995) demonstrate neurological overlap between the central executive and slave systems (e.g. phonological loop). Cohen, Perlstein, Braver, Nystrom, Noll, Jonides, and Smith (1997) show that there is a complex relationship between the central executive system and the phonological loop, in particular a quantitative difference in the amount of rehearsal at lower and higher loads of information. This, they emphasise, *"raises the possibility of a disassociation between… explicit rehearsal, and other mechanisms for actively maintaining information that may reside within the dorsolateral PFC"* (p. 607). These neurological studies seem to concur with Skehan's (1998) and Baddeley's (2003) model that argues that working memory is multidimensional.

Evidence, therefore, can be found across research in cognitive psychology and neuroscience indicating that working memory is a multi-componential system. The question then arises whether future studies involving a variety of tasks, might show independent processing routines proposed by Skehan's (1998) and Baddeley's models of working memory. Such research holds promise for tracing the development of processing strategies in working memory as it develops (Churchill, 2012).

2.7.7 Developmental changes in working memory

The question of the developmental changes in working memory is of particular interest to the language teacher and learner. Few studies have specifically studied developmental changes in working memory and development of processing mechanisms within working memory over time (Berquist, 1997). The ability to hold verbal material in working memory has been shown to increase significantly between the age of four and adolescence. At this stage, the rate of increase levels off considerably and then declines again with older adults (Carpenter, Miyake, & Just, 1994).

In a longitudinal study of 80 children, aged four to age eight years of age, Gathercole *et al.* (1992) investigate children's ability to repeat non-words and correlate the scores on this task with vocabulary knowledge. Using a cross-lagged partial design these authors report that performance on the non-word repetition task is a better predictor of vocabulary for the ages four to six than *vice versa*. At later time intervals, however, this effect was not found. This leads Gathercole *et al.* (1993) to argue that the relationship between phonological retention and vocabulary acquisition is complex in nature. They suggest that the causal relationship between phonological retention and vocabulary acquisition changes during the early school years with linguistic knowledge, as measured using vocabulary tasks, positively influencing performance on the non-word repetition task. Thus, developmental changes in working memory cause an increased ability to hold phonological information, leading to gains in lexical knowledge, resulting in a basis for better retention of *"lexical and nonlexical sequences"* in the phonological memory system (p. 897).

The importance of phonological memory has also been demonstrated in L2 research. Service and Craik (1993) have investigated the L2 development of nine-to-eleven-year-old Finnish children learning L1 English assessed on a pseudo-word repetition task, a pseudo-word copying task and a syntactic-semantic judgement task. These authors establish that repetition accuracy of English pseudo-words is a good predictor of English learning during the first two to three years. The repetition task correlates highly with listening comprehension ($r = .62$), reading ($r = .74$) and production ($r = .58$). Using multiple regression of the three tasks across Grades 3 to 5, Service and Craik (1993) have found that 44% of the variation in English reading is accounted for by the repetition task, whereas only 6% and 3% of the variance is attributable to the syntactic-semantic judgement and pseudo-word copying tasks respectively. Based on their results, Service and Craik conclude that syntactic-semantic judgement and pseudo-word copying tasks rely on different processing resources, thus lending further support to the multicomponent model of working memory. Although Service and Craik (1993) do not discuss how the syntactic-semantic judgement task might be related to working memory, the weak correlation between the repetition task and English proficiency could be due to one of three factors. A rapidly fading phonological trace hampers the ability to reproduce the pseudo-words due to problems in encoding material in the phonological store or in the rehearsal process. Service and Craik (1993) note that such processes are involved in the learning of new words.

However, Service and Craik (1993) favour the notion of trace quality in the input store because it is *"related to durability and affected by long-term memory support, i.e. the familiarity of the material"* (p. 44). In terms of the role of working memory in the syntactic-semantic judgement task, one could infer that the role of syntax in predicting language learning would start exhibiting higher correlations with measurements of proficiency later in the learning process. Service's (1992) findings of a rising correlation between the L1 syntactic comparison task and English grade coupled with a falling correlation with the pseudo-word task is consistent with this view.

There are three possible reasons why this may be the case. First, phonological decoding processes would be most demanding of working memory resources early in the acquisition phase since there is a need to identify word boundaries before determining the order of words in the sentence. Second, only after phonological memory has become sufficiently developed to hold words in working memory, can these features of the language be used to determine word order. Finally, only after the learner's working memory has developed enough efficiency with the new phonology, can processing resources be devoted to analysing syntax quickly and easily. Evidence for these predictions has been reported.

For example, Van Patten (1990) examines the ability of 202 Spanish students to comprehend a listening passage while counting various parts of speech. The highest performance is found for the control group who has had no counting task; and this group's scores are not found to be significantly different from the group whose task it has been to count the occurrences of a lexical item. The group instructed to count a bound morpheme recall little of the listening passage compared to the group who focuses on comprehension alone. This difference is statistically significant between the two meaning-focused tasks, supporting the claim that the processing of syntax in working memory is difficult, since it demands a large amount of processing resources.

In a study that investigated the relationship between working memory and syntactic processing (Miyake & Friedman, in press), the listening span measure of 59 L1 Japanese university students is found to correlate with cue preference in an agent identification task (r = -.37) and a measure of syntactic comprehension (r = .52). Importantly, learners with high and low spans utilise qualitatively different strategies for interpreting English sentences. Learners with high spans use word order cues, while learners with low spans use lexical and semantic cues. Based on these findings, one could infer that a multi-component view of working memory with a change in processing strategies dependent on the resources available, is supported. In other words, learners with smaller spans might not be capable of holding word order cues in working memory long enough for syntactic processing. Thus, they make syntactical decisions based on lexical information within their current processing capacity, involving lexical and semantics cues that develop prior to syntactical processing.

From the aforementioned review of the literature on the developmental nature and changes of working memory, we can infer that because of a restricted L2 working memory capacity at the early stages of language development, learners first depend on working memory processes that focus on the phonological interpretation of the input. This is supported by high correlations between the pseudo-word repetition task and subsequent acquisition (Service & Craik, 1993). As more words are learnt, vocabulary knowledge starts to inform decisions made in relation to phonological input (Gathercole, Willis, Emslie, & Baddeley, 1992) and subsequently the learner begins relying more on semantic information for comprehension (Miyake & Friedman, in press). At the same time, this process results in different strategies used for reaching comprehension (Miyake & Friedman, in press). Thus, only when the processing of phonological and lexical information becomes more efficient, do processing resources become available for syntactical processing (Service & Craik, 1993). Each of these developmental changes in working memory suggests a multi-componential view of working memory, whereby there are developmental differences in the importance of the respective strategies that make up the system. This in turn means that there are different strategies in working memory and these strategies change over time. At the same time, all of these strategies work in cooperation and competition to derive meaning from information we process. The "restriction of access to information" noted by Pinker (1997) might be the motivation behind the competition between the various processes in working memory. As working memory is limited, there is an on-going need to clear working memory as efficiently as possible in order to have space for subsequent processing of information (Baddeley, 2003).

According to Churchill (2012, p. 5) a *"drive for efficiency causes developmental changes in the L2 working memory and this process drives the acquisition of language"*. This process is described as follows: Language input is broken down into certain aspects: Some aspects are unattended, while other features that are considered meaningful are attended in a way that is consistent with the child's current level of processing capacity as determined by their ability in phonological decoding and vocabulary knowledge to process the incoming language input. In other words, the working memory system operates in such a way that it processes and extracts as much information as possible from the incoming speech stream before the linguistic, semantic, and syntactic coding of the message is lost. To this end, the learner makes use of components processing mechanisms in working memory in a competitive manner to ensure efficient processing occurs. Phonological decoding involves matching of phonemes and sequencing of the phonemes. It is least demanding on available processing resources and a prerequisite for further processing, However, it does not access meaning directly and as a result using this strategy for comprehension is time-consuming. The exception to this is if the word is encountered for the first time; then this approach is required. A lexical recognition approach involves accurate and quick decoding words for fluent reading of text, and is thus favoured over the phonological approach for language comprehension or comprehending text. The lexical approach requires the learner to access knowledge and other relevant information in long-term memory (e.g. L1 syntax) in working memory to determine the role relationship between the recognized lexical items. This process requires attention in working memory, which could be otherwise devoted to the processing of subsequent input.

The recognition of syntax or whole sentences to aid comprehension of text requires the most resources, including matching of phonemes, recall of word order and comprehension of semantic clues within words. However, if it is operating efficiently, it greatly increases the speed with which the incoming stream of language is connected to ideas in long-term memory, thereby clearing workspace in working memory for subsequent processing. If this approach is not possible or fails, lower level lexical and semantic processing strategies would be used for language comprehension or comprehension of text. Competition between higher and lower level strategies results in qualitative and quantitative changes, dependent on the depth of processing in working memory, resulting in the developmental changes in working memory of the inter-language system over time (Service & Craik, 1993).

These considerations are mirrored in a quotation concerning the bio-ecological model approach to cognitive assessment, which argues for a: *"dynamically interactive between cognitive processes and experiences that are nested within developmental contexts that cannot be understood apart from each other. Behaviour may be described as 'intelligent' to the extent to which people are socialised require the exercise of these capacities"*. (Armour-Thomas & Go-Paul McNicol, 1997, p. 133). Churchill's dynamic, multi-componential model of working memory is illustrated in Figure 2.12. A few points are noteworthy. Firstly, attention is an essential aspect of working memory. Secondly, aspects of the incoming speech stream, such as syntax or word order, vocabulary and phonology are represented by a box inside of working memory. This is because Churchill (2012) views these processing skills as not forming part of the working memory construct. Instead, these are strategies in working memory, which together link information in short-term memory to and from long-term memory to access and extract meaning.

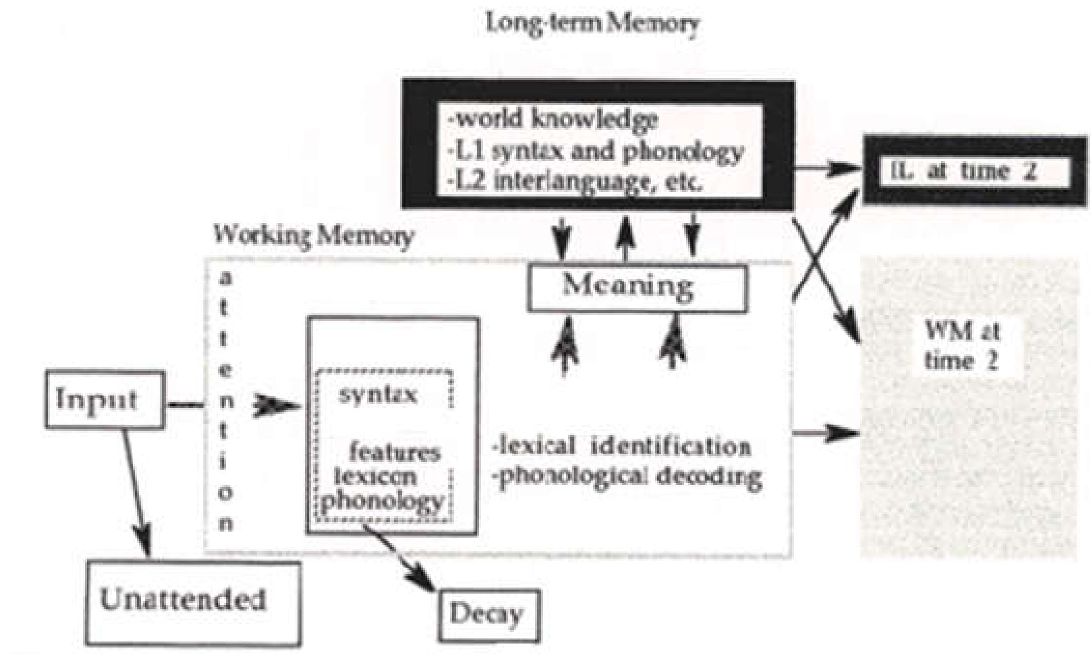


***Figure 2.12*: A dynamic multi-componential model of working memory (Churchill, 2012, p. 1).**

In summary, there are at least two interesting issues at stake here regarding the nature of L2 working memory. The first concerns the independence of specific strategies in working memory. The second is whether there are developmental changes in the use of these strategies over time. Jordaan (2010) compares the performance on the AWMA and the diagnostic evaluation of language variation (DELV) in a longitudinal study of South African L2 English children and establishes support for both of these claims. She emphasises a relationship on the AWMA (used as a measure of working memory) and on most of the language measures administered, with decreasing importance placed on phonological decoding processes, and an increasing importance placed on vocabulary knowledge followed by syntactical ability. Jordaan (2010) interprets these findings as reflecting the nature of working memory involving independent language processing strategies and developmental changes in the use of these strategies occurring over time, and thus providing evidence to support a multi-componential view of working memory.

The benefit of biliteracy instruction on working memory has received limited research attention. Morales, Calvo, and Bialystok, 2013 report that 5 to 7-year old biliterate bilingual children develop better working memory than monolingual children. Since working memory plays a role in reading comprehension (we need to associate successive concepts in text) (Alloway, 2007), research on the benefits of biliteracy instruction for reading achievement is needed to draw conclusions about the relationship between working memory and cognitive advantages of balanced bilingualism.

2.7.8 Biliteracy instruction and working memory

In classrooms where all-English instruction is the only feasible option, there are ways teachers can bring the home language into the classroom, such as providing opportunities for continued development of the home language or encouraging parents to contribute to developing their children's home language skills (Winsler, 1999). Slavin *et al.* (2011) explain that children in biliteracy instruction from preschool have no differences in English skills, compared to children who have been in an English-only literacy instruction programme. Barnett *et al.* (2007) reported that children in biliteracy instruction and children in English-only literacy instruction showed significant gains in language, literacy, and math, with Spanish-speaking children in biliteracy instruction showing greater gains in Spanish than their English-only peers, without negatively affecting their English language development. Five meta-analyses of biliteracy education in the early school grades have reached a similar conclusion (Goldenberg, Reese, & Gallimore, 1992).

It appears then, that bilingualism and biliteracy might convey cognitive advantages, and thus dual language learning should be supported and encouraged in the early school years. In South Africa, Koch *et al.* (2009, p. 107) eloquently state the following with regard to the cognitive and social benefits of an additive model of bilingualism in education:

> *as the additive model is rolled out in more schools there is a strong hope that the inequalities resulting from South Africa's colonial and political history will be eroded, as learners are given the opportunity to learn to high levels through their mother tongue and at the same time achieve high levels in English.*

However, critics of biliteracy instruction or an additive model of bilingualism in education, have suggested that the costs of training teachers to teach literacy skills in children's home languages, and costs in producing books in all 11 official languages in South Africa are too high (Heugh, 2010). What is overlooked, however, in Heugh's (2010) view is that the vast majority of this country's teachers cannot teach proficiently in English. Heugh (2010) argues that the costs of providing teachers with necessary English language upgrading courses to make English-only instruction feasible, might be even more expensive than adopting a biliteracy approach. Such an approach would involve re-deploying teachers who are L1 speakers of African languages to develop children's African first language, while beginning to acquire English language and reading skills. At the same time research confirming that biliteracy instruction can support the development of reading skills in both the mother tongue and English for bilingual children learning to read in South Africa, is needed.

Furthermore, the costs of English-only education can be seen in the frequently reported finding of poor L2 English literacy attainment in bilingual children who have L1 Zulu spoken proficiency and English-only instruction (Buthelezi, 2003). These findings, Heugh (2010) contends, are ignored by those in favour of English-only instruction when they argue that structured bilingual education found in dual medium literacy instruction programmes is not cost-effective. The work by Cummins (2000) and other researchers (Mortensen, 1984) consistently shows that children in biliteracy programmes acquire oral and written proficiency in L2 English skills that equal or exceed those of children taught through a second language only. Results of studies in other countries have replicated this finding (Modiano, 1968; Verhoeven, 1991). Therefore, English language proficiency is best acquired through maintenance and continual development of the mother tongue / home language alongside L2 English. However, the allocation of additional resources, in the form of training teachers to teach in more than one language or developing textbooks in more than one language would be feasible if it can be shown that biliteracy instruction leads to improved educational outcomes of bilingual children in South Africa (Heugh, 2010).

An immediate and pressing need of the majority of bilingual Zulu-English children in South Africa, is to correct the misperception that English-only and lack of L1 instruction is best for children's academic success. As Heugh (2002, p. 180-182) points out, *"it is unlikely that parents would opt for English as the medium of education if they were aware of the facts, if they understood that they can have both mother-tongue* [sic] *education and superior English language skills"*. This necessitates research on medium of instruction so that school language policies, and particularly parents, can make appropriate decisions that serve the educational needs of their children. It is not a choice between either English or an African language (including Afrikaans): Improved educational outcomes and linguistic, cognitive and academic growth are an inevitable consequence of using the mother tongue or biliteracy education. This is an important argument because children who suffer most from discriminatory language practices are from historically disadvantaged sections of the population (Heugh, 2002). To this end, the present study, hopes to show that children in biliteracy instruction have better vocabulary knowledge and reading skills than children who do not speak English as a first language but attend English medium-of-instruction schools.

2.7.9 Effects of bilingualism on cognition

The term *cognition* refers to high-level acts of cognitive behaviour, such as problem solving, reasoning, or reading. Cognition can also refer to more basic components of thinking or acquiring knowledge, including memory, perception, planning, and language. In general, development in one area of cognition affects others areas of cognition (Bialystok, 2002). For example, as children's planning skills increase, they become better at solving multi-step problems because they are better able to plan what their next steps will be. Similarly, as children's ability to understand words and use language to communicate increases, they gain the ability to acquire new knowledge. Researchers have begun to examine how learning multiple languages versus learning only one language affects cognition. The possibility that learning multiple languages versus learning only one may affect children's language and cognitive development has been an on-going concern for parents and educators (Bialystok, 2002). In general, research indicates that learning and speaking more than one language bestows a cognitive advantage in many areas of cognition, e.g. executive control and many aspects of language and literacy. This cognitive advantage is detectable as early as seven months of age (Kovacs & Mehler, 2009), can persist into adulthood, and even offers some protection against symptoms of Alzheimer's dementia (Craik, Bialystok, & Freedman, 2010).

In the next section, research on how biliteracy instruction affects general cognitive functioning, is examined. To date, there has been limited research on how learning in one or more languages relates to learning to read and working memory development (areas of learning that have a strong cognitive component), and most of this research has been conducted internationally. Neuro-imaging research studies of bilingual learning infants and children has shown that the brains of bilinguals are organised differently from those of monolinguals with changes in brain activity linked to experience with language and particular types of language processing emerging with increasing experience and skill with language (Mills, Plunkett, Prat, & Schafer 2005; Kim *et al.*, 1997). Therefore, in any group of learners (monolingual, partial, or balanced bilingual), differences in language experience will affect working memory functioning in the form of different strategies for word processing that in turn would affect subsequent language learning and reading development. In the present study, how certain experiences with language (i.e. bilingualism *vs*. monolingualism) affect working memory systems involved in language processing, is investigated.

Finally, if children in dual medium schools with biliteracy instruction demonstrate superior working memory functioning in comparison with bilingual children in English-only instruction, then such cognitive advantages might be made accessible to all children through biliteracy education. In fact, Heugh (2010) points out that biliteracy instruction does not exclude monolingual children, arguing that the Language in Education Policy (1997) explicitly expresses the intention *"to maintain home language(s) while providing access to and effective acquisition of additional languages (IV.A.5)*.

In addition, Brysbaert and Duyck (2010) contend that models of monolingual language processing share strong characteristics with bilingual language processing but monolingual models require adaptations to account for bilingual input and output. This argument is considered in the next sections of this chapter.

2.7.10 Why a working memory for verbal information?

Baddeley's (1986, 2003) model of working memory draws a distinction between verbal and visuospatial information, on which different memory processes operate. Evolutionary reasons have been used to explain the purpose of visuospatial (working) memory. Visuospatial working memory is important for survival because it allows for the retention of visual and spatial information when such information is no longer accessible from the sensory registers (Szmalec, Verbruggen, Vandierendonck, & Kemps, 2011). This memory system would allow an organism to remember its nest, to remember where prey is hiding or where predators may be hiding.

Researchers have sought reasons underlying the verbal part of (working) memory, which is concerned with the capacity to (briefly) retain speech-based information such as when participants are asked to recall lists of digits, syllables, telephone numbers, words or other artificial stimuli cognitive psychologists and neuroscientists are interested in (Szmalec *et al*., 2011).

Baddeley, Gathercole, and Papagano (1998) propose that verbal working memory primarily represents *"the processes and mechanisms by which the sound patterns of the words of the native language are learned by the child"* (p. 159). Although other perspectives on verbal working memory exist, for example, Martin and Saffran (1992) who suggest that short-term memory for verbal information is the result of temporary activation of linguistic information, Baddeley *et al.*'s (1998) model of working memory is more dynamic and open to individual differences, which would be important in investigating working memory in bilingual children.

2.7.11 Verbal working memory and the learning of new words

Baddeley *et al.* (1998) review a large number of studies of verbal working memory encompassing adults, children and clinical patients, and conclude that the role of verbal working memory is primarily a language learning device. Bowey (2001) reports positive correlations between measures of verbal working memory capacity, as assessed using non-word repetition tasks, and vocabulary knowledge in monolingual English children of various ages. Further experimental evidence for working memory as a language learning device is reported by Gathercole and Baddeley (1991) when they teach five- to six-year old children to learn unfamiliar names (e.g. Pimas) to name new toy animals. This operationalisation of working memory is considered to mirror naturalistic *word* learning ability, namely the mapping of a new word form to a referent in the real world. As expected, word-learning performance is lower for children with low non-word repetition scores than for children with high scores.

Duyck, Szmalec, Kemps, and Vandierendonck (2003); Papagno, Valentine and Baddeley, (1991) use dual-task methodology to show that constraining verbal working memory results in poorer learning of word-non-word pairs, such as finger-*vilsan* (in which participants have to name the non-word upon hearing the word, or *vice versa*), but not in learning word-word pairs (e.g. frog-nail), in both adults and 11- to 13-year old children. Other research examines patients with verbal short-term memory deficits, to see whether these patients find it hard to learn new vocabulary, while at the same time retaining the language capacities they have before the lesion. Baddeley (1993) reports a case study of such a patient, SR, who performs very poorly on a word new-word association task (pairing English with Finnish words), unless he could associate both words by forming very elaborate semantic associations. Research with children with specific language impairment has shown that these children have a reduced verbal working memory capacity and the latter is causally linked to language acquisition difficulties (Baddeley *et al.*, 1998). Therefore, there is evidence that the purpose of verbal working memory is primarily a language learning device.

2.7.12 The importance of serial order memory for novel word learning

More recently, research has focused on the question as to *what* must be learned in a word-new word association task (different from a word-word association task) and how working memory is related to this. Two issues are apparent. First, is verbal working memory critical for learning the new word form itself, which involves linking the old with the new word form? Or is verbal working memory important for mapping the semantic representation of the old word form to the new word form? Second, is the effect of verbal working memory on word - new word association because a new, conflicting name needs to be associated with existing information that already has a label? In the latter case, verbal working memory plays a role in language learning, but not in the learning of new names of new objects. To understand the acquisition of new names for new objects we need to consider Page and Norris's (1998) Primacy Model of Immediate Serial Recall.

This model can be summarized as follows: learning a novel word form, *artecey*, for example, consists of learning both a sequence of sounds (letters / graphemes) and the correct order of the phonemes: *ar, te, cey*. According to Page and Norris (2009), learning a novel word is similar to learning the sequence of letters in a letter span task (i.e., repeating the letters R T C in an immediate serial recall task). The Primacy Model of Immediate Serial Recall model contends that working memory mechanisms involved in immediate serial recall of letters are the same as those involved in the acquisition of novel word-forms. For example, if a baby repeatedly hears the sequence *ar, te, cey* in this specific order, he / she will develop a lexical representation for *artecey*. This will then be associated with a real-world referent in the environment when he / she hears this specific sequence of sounds. Page and Norris (2009) assert that the naturalistic word-learning process can be mimicked in a laboratory setting using the Hebb repetition effect. The Hebb repetition effect refers to when a particular sequence of digits / syllables is repeated across trials. Recall of the repeated sequence improves over time relative to that of unrepeated sequences. In working memory terms, information related to a sequence of items (like letters or syllables) in working memory gradually develops into a stable long-term memory trace that has the same characteristics as a newly acquired word form (Page & Norris, 2009).

Some evidence for Page and Norris's (2009) prediction has been reported. Mosse and Jarrold (2008) reported a positive correlation between the steepness of the Hebb learning curve and performance in a paired-associate learning task with non-words, in a sample of 5-

to 6-year olds. Szmalec, Duyck, Vandierendonck, Barbera Mata and Page (2009) presented adult participants with sequences of syllables in a standard Hebb learning paradigm (e.g. *zi-lo-ka-ho-fi-se-be-ru-mo*). Then, the same participants took part in a lexical decision experiment including non-words that were constructed with syllables from the Hebb experiment (*ziloka, hofise, berumo*). These researchers found that participants were slower to reject the Hebb-based non-words, compared to matched control non-words, suggesting that immediate serial recall of repeated Hebb sequences led to representations in lexical memory similar to those of existing words, similar to what happens when people acquire novel words. Research evidence in adults with dyslexia shows impaired Hebb learning across verbal and visuospatial stimulus modalities (Szmalec, *et al.*, 2011).

Based on these findings a new, memory-based account of dyslexia was proposed. According to Szmalec *et al.* (2011), dyslexia originates from an impairment involving learning the serial order information in memory, such as occurs with Hebb repetition learning. It follows then that, if a newly learned word-form is an ordered sequence of phonemes, then the Hebb learning account of dyslexia proposes that both the sequence of sounds and the correct order of phonemes are not optimally consolidated as a single entry in long-term memory. As a result, lexical access for the word in question during reading is impaired because the letter-to-sound mapping rules are disrupted (Whitney & Cornelissen, 2005).

Using a correlational approach, Majerus *et al.,* (2008) explores the contribution of three different short-term memory skills (short-term memory for serial order information, item recall, and item recognition) to novel word-form learning in clinical patients. Majerus *et al.* (2006) pronounce that only memory for serial order plays a role in acquiring novel phonological word forms. Using fMRI, Majerus *et al.,* (2008) state that memory for order and memory for items activate different brain regions. Order memory relies on the right intraparietal sulcus, the right cerebellum, and the bilateral premotor cortex, whereas item memory activates two regions associated with language processing, namely the superior temporal gyrus and the left fusiform gyrus. Taken together, the findings provide compelling evidence for a causal relationship between short-term serial recall and naturalistic word-form learning. Furthermore, the findings reinforce the idea that the primary purpose of human verbal working memory is to support the acquisition of language (Baddeley, Vallar & Papagano, 1998).

2.7.13 Verbal working memory and second language word learning

The findings described in the previous sections have implications for second language (L2) learning. One of the key requirements of L2 learning is the acquisition of new word forms, which initially are nothing but sequences of sounds and letters. Service (1992) was one of the first to specifically examine the relationship between non-word repetition and learning new words in the L2. She ran a longitudinal study of Finnish-speaking primary school children learning English. At the beginning of the study, a non-word repetition task was administered and the scores on this test were correlated with English performance levels nearly three years later. Service observed that the non-word spans were a significant, independent predictor of L2 proficiency. Cheung (1996) ran another early study. He correlated non-word span with the number of trials 7th grade participants from Hong Kong needed to acquire new English L2 words. Cheung found the expected inverse relationship (participants with higher non-word spans learned the words faster), at least for the participants with vocabulary sizes lower than average, in line with the idea that verbal working memory is particularly important for acquiring new words and less so for the processing of familiar words. The studies of Service (1992) and Cheung (1996) have since been replicated (see Hummel & French, 2010, for a review).

Evidence, therefore, supports the idea that verbal working memory is involved in the acquisition of L2 words as much as it is in the acquisition of new L1 words (Baddeley *et al.*, 1998; Szmalec *et al*., 2011). It also seems reasonable to assume that the working memory processes are involved in L2 and L1 word learning (Baddeley *et al.*, 1998), although fMRI evidence by Majerus *et al.,* (2008) suggests that for low-proficiency bilinguals, order encoding may be less efficient in L2 than in L1 word learning.

2.7.14 Working memory involvement in other aspects of language processing

So far, we have reviewed evidence that shows that verbal working memory (more precisely memory for serial order and item information) supports the acquisition of novel lexical forms in any language. It is important to point out, however, that working memory may be involved in the integration of individual words into coherent sentences and discourse representations. Daneman and Carpenter (1980), report a correlation between working memory span measures and reading comprehension. This finding points to the importance of working memory for comprehending text. This raises the question whether working memory is involved in sentence parsing (Just & Carpenter, 1992; Waters & Caplan, 1996).

Sentence parsing refers to the processes needed to organize the words of a sentence into a proposition (or set of propositions) summarising who did what to whom (Just and Carpenter, 1992; Waters and Caplan, 1996). It makes sense that verbal working memory (or the phonological loop in Baddeley's 1986 model) is needed to retain the surface structure of a sentence until the proper syntactic interpretation is made. Sentences can be syntactically complex with large distances between related parts (e.g. between the subject and the verb, as in "when the girl with the red hood, who was dancing in the wood, saw…"). Other sentences can be ambiguous and thus require some kind of new syntactic interpretation, such as in garden-path sentences, such as "the horse chased past the barn fell". For these sentences, participants are likely to experience parsing difficulties because the structure of the sentence does not agree with the first interpretation made (i.e., "the horse that was chased" *vs.* "the horse that was chasing"). Given the need to retain word order information until the correct syntactic interpretation is found, it could be hypothesized that individuals with a high verbal working memory capacity will perform better on sentence parsing than people with low capacity (Swets, Desmet, Hambrick, & Ferreira, 2007; Vallar & Baddeley, 1984).

A problem with this prediction is that research evidence shows that syntactical interpretation is affected minimally by neurological conditions that are associated with reduced verbal working memory capacity. Only for very complex sentences, is verbal working memory important for syntactical interpretation (Caplanand Waters, 1999). Based on these findings, Caplan and Waters (1999) assert that sentences are processed by a system independent of working memory (the so-called separate sentence interpretation resource), which in turn raises the question of whether or not verbal working memory as traditionally measured, is needed for sentence parsing (Lauro, Reis, Cohen, Cechetto, & Papagno, 2010).

In this context; O'Brien, Segalowitz, Collentine, and Freed (2006) establish that working memory capacity predicts the development of narrative and grammatical competency in L2 in the case of English-speaking adults learning Spanish. In general, the significance of a reduced memory span is more problematic for new word learning than for sentence parsing. This is because verbal working memory plays a greater role in learning new words than understanding sentences (Lauro, *et al.,* 2010).

In a review article on the relationship between working memory and language, Baddeley (2003) points out two possible roles of working memory in relation to language and reading development. First, visuospatial working memory could be involved in maintaining a representation of the page and its layout during reading. Readers are able to make regressions upon encountering a comprehension problem, in comprehending text. Accurate regressive eye movements require access to a spatial map of the text (Kennedy, Brooks, Flynn, & Prophet, 2003). Secondly, Baddeley (2003) proposes that visuospatial working memory could be involved in understanding of spatial information (e.g. grammatical structures involving spatial terms such as above, below, and shorter).

So far, we have reviewed research that shows that working memory is critically involved in language learning, reading development and comprehending text. Of equal importance is whether working memory's processing (executive control) and storage (span / capacity) functions are also influenced by language processing. Additionally, it is informative to know whether they remain unchanged in relation to stimulation from the environment - in this case, learning to read at school in a language that differs from the home language (i.e. subtractive bilingualism) or learning to read in two dissimilar languages simultaneously (i.e. additive bilingualism). With this in mind, the next section examines research on the consequences of bilingualism for executive control functions.

2.7.15 Executive control advantages in bilingualism

Recent studies point towards important cognitive benefits of being fully bilingual. Bialystok, Craik, and Freedman (2007), for example, report that the age of onset of dementia is on average four years later in bilinguals than in monolinguals. Cognitive advantages of bilingualism have been argued to come about due to continual control of the activation of lexical representations from the non-target language so that this language does not interfere with language processing in the target language processing occurring simultaneously (Green, 1998). In other words, both languages of a bilingual are always to some extent active in lexical memory and interact with each other (Brysbaert & Duyck, 2010). Van Assche, Duyck, Hartsuiker, and Diependaele, (2009) report that bilinguals reading in their first language read L1 words faster when the L2 translations are cognates. This effect is also observed when the participants are reading complete sentences in L1 (Van Assche *et al*., 2009).

In another study, Ivanova and Costa (2008) report that L1 speech production is slower in Spanish-Catalan bilinguals than in monolinguals. Similarly, Gollan and Acenas (2004) observe that bilinguals experience more tip-of-the-tongue phenomenon (i.e. instances in which one cannot retrieve the correct lexical entry for a concept) than monolinguals, which suggests that the languages of a bilingual are constantly in competition with each other about word forms. On the other hand, there is very little evidence of control failure based on very few switching errors made between languages when compared with more frequently occurring other types of errors and hesitations in speech. Therefore, evidence supports the idea that bilinguals have an efficient cognitive control mechanism to deal with the language competition by means of a highly interactive bilingual language processing system.

This in turn raises questions about the nature and the functioning of such a cognitive control system, and the extent to which it is specialized for language, or whether it generalises to other cognitive domains. The ground-breaking study of Meuter and Allport (1999) requires bilinguals to name pictures in the language indicated by an external cue over various trials. In one condition, the language is the same as in the previous trial, in the other, the language switches from the previous trials. These authors observe that bilinguals are slower in the switch trials than in the non-switch trials, and that the switching costs are larger when the language changes from L2 to L1 than *vice versa*, which they attribute to more inhibition of L1 being required when participants speak in L2 than the other way around.

Costa and Santesteban (2004) use a similar format to the work of Meuter and Allport (1999). They investigate second language proficiency in a group of Spanish-Catalan bilinguals. For partial bilinguals, Costa and Santesteban (2004) replicate the findings of Meuter and Allport (1999): A cost when switching languages and a larger switching cost when switching to the dominant language. In contrast, in balanced Spanish-Catalan bilinguals (who use both languages interchangeably and equally often), the language-switching cost is symmetrical, equally large in both directions. This effect remains the case even when participants are asked to switch between L1 and a much-weaker L3. Based on these findings, Costa and Santesteban (2004) argue that balanced bilinguals develop a qualitatively different mechanism of lexical selection.

In another study; Costa, Santesteban, and Ivanova (2006) find no asymmetrical switching cost in balanced Spanish-Catalan bilinguals who are switching between L2 and L3. These participants do show an asymmetry, however, when they are asked to switch between L3 and L4, leading Costa and colleagues to argue that there are limits to the extent to which the specific control mechanism can be applied. In general, the evidence seems to suggest that continuous language control and the repeated practice of language switching result in bilinguals possessing efficient control mechanisms. This in turn has led researchers to investigate whether bilinguals also perform more efficiently, compared with unbalanced bilinguals or monolinguals, in tasks that do not require verbal processing.

To this end, Bialystok and colleagues (Bialystok, Craik, Klein & Viswanathan, 2004) compare bilinguals with monolinguals on a wide variety of tasks tapping executive control, namely: The Simon-task. In this task, participants are required to make a spatial response (e.g. press the left or right key) to a non-spatial characteristic (e.g. the green or red colour) of a stimulus, which has a particular spatial position (e.g. left or right of the fixation location). The logic behind the Simon-task is that the irrelevant position of the stimulus interferes with the response, such that participants are faster to respond to congruent trials (pressing the left key to a stimulus presented left of fixation) than to incongruent trials (pressing the right key to a stimulus presented left of fixation). This is the term the Simon-effect.

Bialystok et al., (2004) report a smaller Simon-effect in English-Tamil bilinguals than in monolinguals. Similarly, Bialystok, Craik and Ryan (2006) report that bilinguals have less difficulty moving their eyes in the direction opposite to the where the stimulus appears (e.g. to move the eyes to the right when a light flash appears to the left; an anti-saccade task).

Emmorey, Luk, Pyers and Bialystok (2008) establish a comparable bilingual executive control advantage using a flanker task, in which irrelevant flanking stimuli need to be ignored for good task performance. These findings argue that balanced biliterate bilinguals show better performance than monolinguals on a variety of executive control tasks, suggesting that the cognitive benefits of bilingualism are not restricted to language control. Executive control advantages can generalise to other domains if good performance requires suppressing the dominant response.

The cognitive mechanisms underlying the bilingual executive control advantage are further explored by Prior and Gollan (in press), who manipulate the degree of language switching in their participants. They compared a group of balanced Spanish-English bilinguals who regularly switch between languages, to a group of balanced Mandarin-English bilinguals who switch between languages less often. Only the Spanish-English bilinguals show a reduced task switching cost. Based on this finding, Prior and Gollan conclude that only bilinguals who often switch between languages train their executive control capacities.

At the neural level, Abutalebi and Costa (2008) report that naming in the first language in a bilingual context (compared to monolingual contexts) increases activation in the left caudate and anterior cingulate cortex. These brain areas involve in such language switching tasks also highly overlap with the neural circuits identified in domain general executive control research (Brass & Von Cramon, 2002; 2004). Recent models of the anterior cingulate cortex assume that it is involved in conflict processing (Botvinick, Braver, Barch, Carter, & Cohen, 2001). In addition, the basal ganglia are known to be important for cognitive flexibility (Aron, Watkins, Sahakian, Monsell, Barker, & Robbins, 2003). In general, the findings point to cognitive benefits of being fully bilingual (i.e. those who used both languages interchangeably and equally often) resulting in improved task switching performance when processing words in both languages.

2.7.16 Working memory capacity and bilingualism

Another question that has been raised is whether bilingualism can boost total working memory capacity. Some research indicates that balanced bilingual adults have greater short-term memory and working memory spans (as measured with digit and non-word repetition) than IQ-matched monolingual participants. For example, Papagno and Vallar (1995) compare Italian polyglots and monolinguals on a series of tasks, including fluid intelligence (assessed using the Raven Progressive Matrices), L1 vocabulary (assessed using the WAIS subtest), auditory digit span, non-word repetition, visuospatial span (assessed using Corsi blocks), visuospatial learning (the number of sequences participants needed to learn a supra-span sequence on the Corsi blocks), paired-associate learning of words, and, paired-associate learning of words and non-words. Balanced bilingual adults have a similar performance to monolinguals on fluid intelligence, L1 vocabulary, visuospatial span, visuospatial learning, and paired-associate word-word learning. In contrast, they have a better performance in digit and non-word repetition and on paired-associate word-non-word learning than monolinguals. Furthermore, a principal component analysis indicates that the latter three tasks are part of the same component (i.e., the participants' scores on these tests correlated substantially).

Not all findings have shown a bilingual advantage, however, French and O'Brien (2008) assess Arabic and English non-word repetition before and after French-speaking children take part in an intensive English-as-a-second-language programme. They find that performance in the English non-words improves (as expected from the finding that the memory span is larger for meaningful words than for non-words), but no difference is observed for Arabic non-word repetition. Similarly, Vejnovic, Milin, and Zdravkovic (2010) compare reading spans of Serbian-English bilinguals in L1 and L2. They report that L2 span is significantly longer for high-proficiency bilinguals than for low-proficiency bilinguals. Given the limited number of studies in the area of bilingualism and working memory, more research is needed to draw a conclusion about whether bilingualism boosts or hampers working memory capacity. This type of research has implications in terms of whether working memory capacity is stable or can be increased with training. (Shipstead, Redick, & Engle, 2010).

Some findings suggest that training one cognitive ability may extend to other cognitive abilities and, hence, be beneficial to language learning in general. Jaeggi *et al.,* (2008) report higher fluid intelligence in participants who are trained in a working memory task which heavily relies on executive control resources. Other researchers, however, have identified several methodological concerns with these artificial training studies and claim that to date no study has convincingly demonstrated that cognitive abilities can be trained over and above domain-specific task improvements (Shipstead, *et al.*, 2010).

Relatedly, Vejnovic, Milin, and Zdravkovic (2010) illustrate that for the highly proficient L2-speakers, the reading spans are substantially shorter in L2 than in L1, and there are quite high correlations between the L1 and L2 reading spans. The latter finding is in line with the assumption that reading spans measure stable individual differences in working memory capacity. The former finding also agrees with the observation that L2 processing is more demanding than L1 processing, and that a shorter working memory span in the L2 than the L1 is likely to have implications for learning in the L2, because it may put bilinguals at the same disadvantage as monolinguals with a reduced memory span (Ardilia, 2003).

Hummel and French (2010) have proposed that one way to counter a shorter working memory span in the L2 than in the L1 might be to provide L2 learners with additional written support when spoken instruction is used extensively - such as teaching strategies used in dual medium instruction classrooms (Table 2.1 and Figure 2.13). These teaching strategies have been found to be effective for bilingual children (Silverman & Hines, 2009), perhaps because they address the working memory load for L2 learners. Some support for this view comes from Morales, Calvo, and Bialystok (2013). These authors present children with a spatial working memory task involving an array of 3-inch-by-3-inch squares that children are told represented different ponds. At each trial, a picture of a frog that, children are told, represents the frog jumping into the pond sequentially highlights three of the squares. The conditions varied in complexity: In the simplest condition, children need to remember only the actual order in which the frogs appear on the squares, while in more complex conditions, children are asked to recall the squares according to some transformative rule. For example, children have to recall the ponds in reverse order. In the simple condition, monolingual and bilingual children do not show any differences, but in the more complex conditions where the working memory demands are greater, the bilingual children outperform the monolingual children.

In another study, Kormi-Nouri, Moniri, and Nilsson (2003, cited in Share, 2007) assess monolingual Swedish and Persian-Swedish bilingual Grade 2 to Grade 6 learners on tests and find positive effects of bilingualism in tests of two types of memory. Episodic memory-memory for experienced events is tested by presenting children verbal statements or activities (e.g. hug this doll), and semantic memory-memory for ideas, concepts, and meanings are tested by having children encode word lists of common words. Bilinguals show a moderate advantage compared to monolingual children, thereby suggesting that bilingualism has a positive effect for children's long-term memory.

In sum, for verbal and non-verbal tasks that have high working memory demands, there might be an advantage for balanced bilinguals. Although the previously mentioned studies have not directly examined working memory and reading in bilingual children, because working memory and literacy development are intricately linked, one could infer bilingualism may have facilitating effects on children's working memory and reading development. Balanced bilinguals may acquire cognitive processing skills linked to reading development earlier, and presumably, more easily, than monolingual children do. At the same time, these processes may be delayed in unbalanced / partial bilinguals, as suggested by Schwartz *et al.* (2008). Partial Russian-Hebrew bilinguals are not able to "catch up" with their L1 or biliterate Russian-Hebrew bilingual counterparts, and this effect remains significant one year later. Therefore, knowing whether different language backgrounds and educational contexts produce differences in the rate and course of literacy development, will contribute to our understanding of the roles that language and culture play in cognitive functioning in monolingual and bilingual South African children.

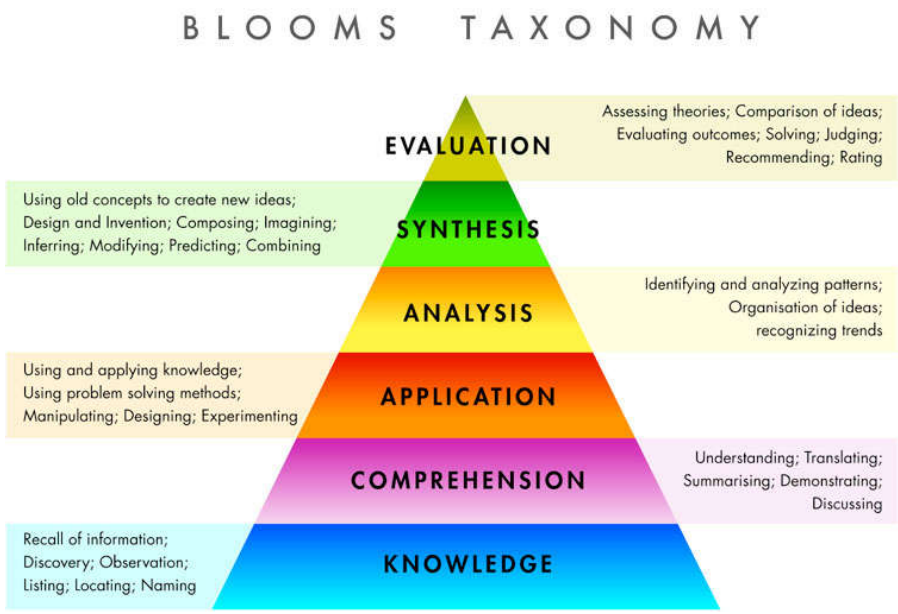


***Figure 2.13*: Bloom's taxonomy (adapted from Santrock, 2011, p. 1).**

Table 2.1: Types of questions recommended for teachers to help students learn in dual medium programmes (Department of New Jersey, 2012, p. 3).

Level	Example
Knowledge	What did Goldilocks taste?
Comprehension	Why did Baby Bear cry when he went into the living room?
Application	What do you think Goldilocks' mother will say to her when Goldilocks gets home?
Analysis	Do you think Mama Bear was angry when she saw Goldilocks in their house?
Synthesis	What do you think Goldilocks' mother will say to her when Goldilocks gets home?
Evaluation	Why do you think Goldilocks went into the house of the three bears?

So far, we have reviewed research that shows that the bilingual brain has greater mental flexibility. This mirrors the following quotation by Conway *et al.* (2007): *"The ability to mentally maintain information in an active readily accessible state, while concurrently and selectively processing new information, is one of the greatest accomplishments of the human mind; it makes possible planning, reasoning, problem-solving* [sic]*, reading, and abstraction. Of course some minds accomplish these goals with more success than others".* (p. 3).

In the present study, a comprehensive measure of memory skills, the AWMA is used to measure working memory, and thus, may be able to provide evidence to show that balanced Afrikaans-English biliterate bilinguals have higher levels of working memory functioning relative to their English L1 or emergent Zulu-English bilingual peers. This would provide evidence for the following quotation by Bialystok (2002, p. 192):

> *First, both the ability to read and some of the components of reading that prepare children for that ability transfer across languages. Therefore, children who have learned skill in one language can potentially benefit from that mastery by applying them to the other. Even though such transfer is neither automatic nor assured, it does happen, and the consequences are always salutary. Second, there are important differences in the way components of reading are acquired by bilingual children. Third, the differences between monolinguals and bilinguals that occur are invariably to the benefit of the bilinguals. Knowing more has never been a disadvantage when compared to knowing less.*

In sum, the inseparability of context and cognition or how social context shapes and supports of fails to support reading development in bilingual children hinges on parents' attitudes to languages, including which language is best suited as language of instruction. This is a central tenant of the bio-ecological perspective (Armour-Thomas & GoPaul-McNicol, 1997). Choice of language medium of instruction has been shown to impact on a child's level of academic achievement. For example, in the United States, children who have a weak command of English and acquire literacy through this language generally achieve lower levels of reading and reading comprehension then their English monolingual peers who receive reading instruction in the same spoken and instruction language (August and Shanahan, 2006). In Canada, Comeau *et al.,* (1999) found that English children being taught to read French were not different in terms of reading achievement from children in English-only classes. Genesee (1983, cited in Comeau *et al.,* 1999) found that first-grade bilingual readers demonstrated lower reading scores than English monolinguals, this gap narrowed in the second grade, and by the third grade there were no significant differences on reading achievement in bilingual French English children compared to English monolinguals. Explanations for these results included the motivation to learn French and English (both considered prestigious in Canada), and the possibility of transfer of cognitive skills underlying reading ability transferring from one language to another. A similar situation exists in South Africa, where Afrikaans and English are given equal educational status and are accorded approximately equal levels of prestige in dual-medium schools in Johannesburg.

In contrast, the language situation of the emergent Zulu-English is best characterised as subtractive bilingualism, where Zulu is given oral status and English (L2) educational status as a result of complex, historical, political, and social factors discussed in Chapter 1. Emergent Zulu-English children typically have weak command of English before beginning schooling in this language. With learners drawn from predominately one language and limited exposure to English, additive bilingual education that takes into account the child's L1 home environment an L2 English school environment seems a more suitable alternative to English only instruction. All of this suggests that literacy attainment cannot be separated from children's language of teaching and learning, level of language proficiency in specific languages, values, beliefs their parents have with regard to specific languages as languages of instruction. The mismatch between home culture and school culture has received limited research attention internationally (see August & Shanahan, 2006 for a review). In South Africa, few studies have considered the contextual differences underpinning literacy acquisition in monolingual and bilingual children. In the present study, quantitative data on monolingual and bilingual children's cognitive functioning and reading attainment is paired with qualitative data on the literacy-learning setting to investigate the effects of language-related factors on cognitive processing skills linked to reading achievement by means of qualitative descriptions of classroom observations, teacher interviews, and parental home literacy questionnaire data.

The following questions will be addressed:

1. What is the level of reading achievement in third-grade monolingual English children receiving literacy instruction in the same spoken and instruction language?
2. What is the level of reading achievement in third-grade emergent Zulu-English children receiving literacy instruction in English only?
3. What is the level of reading achievement in third-grade bilingual receiving literacy instruction in Afrikaans alongside English?
4. Does additive bilingual education result in high levels of L2 English reading proficiency?

The above research questions present a type of language background and learning context dependent view of learning to read in monolingual and bilingual children in South Africa. They attempt to establish the extent to which social contexts interact with the nature or type of bilingualism to determine successful academic outcomes for bilingual children in South Africa. Separating bilingual group in design and analysis is an important methodological step to understand how a child's level of bilingualism, the orthographic transparency of the language of instruction, and mode of literacy instruction are socially mediated, and, in turn mediate both cognitive development and cognitive-linguistic skills linked to reading achievement in bilingual children. This in turn determines the consequences of the bilingual experience on cognitive performance and reading success.

Previous research has demonstrated correlations between reading success and levels of phonological awareness, vocabulary, and working memory (see Share, 2007 for a review; Veii & Everatt, 2005; De Sousa *et al*., 2010; De Sousa & Broom, 2012; Wilsenach, 2013). However, the degree to which language, levels of proficiency in certain languages and reading achievement needs further research attention. How much bilingualism is required, what type of bilingualism, and what pairs of languages maximise cognitive functioning and reading success require more research attention in order to inform educational policies and practices within the multilingual South African context. The theoretical framework for the present study is based on theories of bilingualism, orthographic transparency, level of bilingualism, degree of bilingualism, and mode of literacy instruction, all language-related variables responsible for both cognitive and linguistic consequences of bilingualism, is presented next.

2.8 HOW COGNITIVE AND SOCIAL CONTEXTS INTERACT, SUPPORT AND SHAPE LITERACY DEVELOPMENT

The context-specific view [of cognitive skills and abilities] proposes that intelligence display and language use are dependent on the context.

(Mehan, 1984, p. 177, cited in Armour-Thomas & GoPaul-McNicol, 1997, p. 131)

2.8.1 Universal environmental supports for literacy development

All children can learn to read. This is possible as a result of innate biological capacities with available environmental supports for literacy development. Much of the research in literacy development rests on cognitive-linguistic processes that take input from the environment, which is followed by the ability to decode and understand language. This view is found in the cognitive-neuropsychological information processing approach, which emphasises universal cognitive processing skills that underlie reading ability (Coltheart, 1985). One way to conceptualise this view of reading is to utilise three routes to reading. First, phonological awareness permits phonological decoding, which, in turn, contributes to word reading ability. Second, working memory contributes to orthographic processing, which contributes to word reading ability. Third, breadth and depth of vocabulary knowledge contributes to word reading ability (Coltheart, 1985). One problem with this account is that there are many interconnecting, direct, reciprocal, and interacting paths that are not described. For example, vocabulary knowledge could contribute to phonological decoding indicating an interconnecting path by providing cues to pronunciation. Working memory contributes directly to word reading ability, independently of the path through orthographic processing. Increased phonological decoding may contribute to increased phonological awareness through a reciprocal path. Difficulties in phonological awareness and working memory may be worse in the presence of one another - indicative of an interacting path. Increased reading skill is likely to increase the amount of reading, which in turn boosts the underlying process. Given the orthographic complexity of English, it is likely that all of these processes are required for reading achievement (Coltheart *et al.*, 2001).

Language acquisition is also variable: children differ in the number of words they have in their mental lexicon and in the complexity of linguistic structures they produce. This variability has a genetic basis. Behavioural genetic studies of language acquisition estimate the heritability of language to be between 1 and 82% - depending on the method of study, the language outcome, and the age of the children (Stromswold, 2001). These findings suggest that the environment also plays a role in explaining individual differences. Therefore, children's language environments make literacy development possible and at the same time make literacy outcomes variable.

Social contextual variables operating at the level of the parent, teacher, or child are sources of variance in children's experience. Macro-level variables include culture and socio-economic status. Micro-level variables include multilingualism, schools, and the settings of parent-child interaction in child-directed speaking and reading (Bronfenbrenner, 1979; Duursma *et al.*, 2007). These factors, in turn, influence the way language is learned and used by young children and are highly likely to have a profound impact on children's social, cognitive and linguistic development (Bialystok, 2007). The ecological model of Bronfenbrenner's (Bronfenbrenner, 1995; Bronfenbrenner & Morris, 2006) provides a useful framework for considering multiple sources of environmental influences that exert their influence on literacy development.

2.8.2 Variability across environments in supporting literacy development

The ecological theory developed by Bronfenbrenner (1979) does not focus on the internal processes underlying language and literacy development. Instead, it places importance on the role of the social contexts in which children live (Bronfenbrenner 1979, Bronfenbrenner and Morris, 2006). Social contexts are described as a nested set of systems surrounding the child. Bronfenbrenner's (Bronfenbrenner, 1995; Bronfenbrenner & Morris, 2006) ecological theory consists of five environmental systems. The systems furthest from the child include culture and socio-economic status. These distal systems shape the proximal systems, which include schools, child-care settings, and peer groups. The proximal systems are sources of a child's direct interactions with the world, and these interactions are the primary *"engines of development"* (Bronfenbrenner & Morris, 1998, p. 996). The five systems are the microsystem, mesosystem, exosystem, macrosystem, and chronosystem as illustrated in Figure 2.14 and described in Table 2.2.

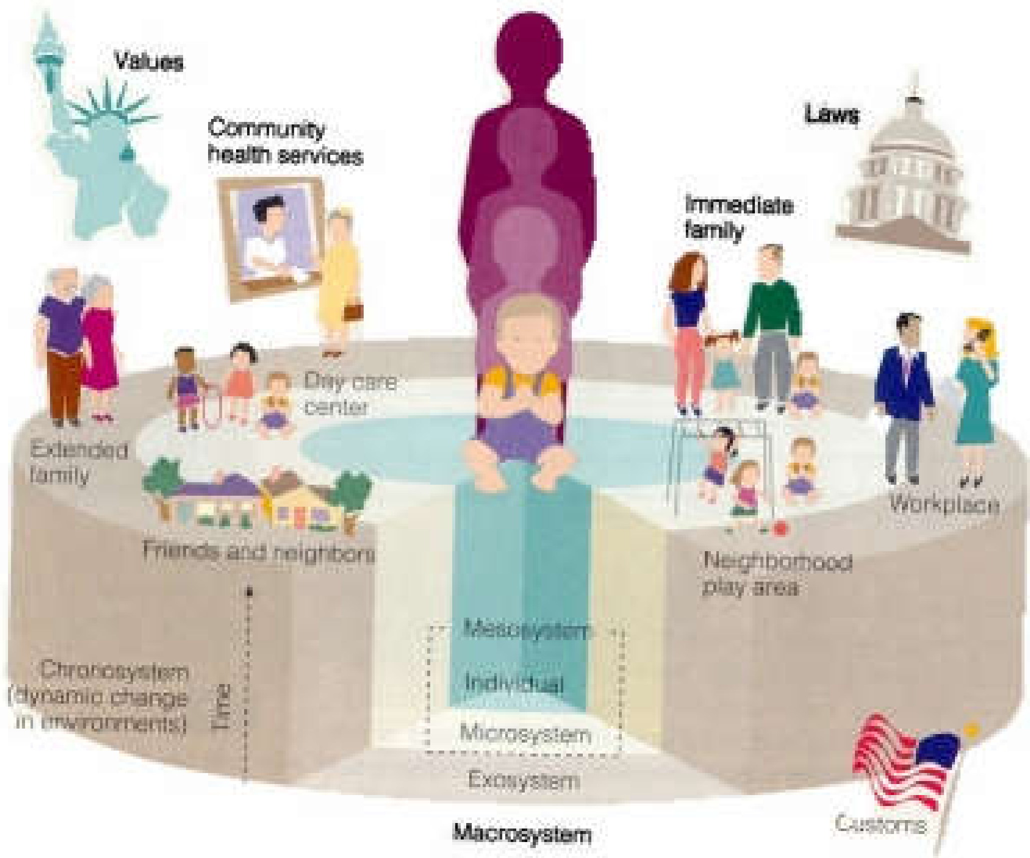


***Figure 2.14*: Bronfenbrenner's ecological theory of development (adapted from Santrock, 2011).**

Table 2.2: Apartheid effects on children's development through Bronfenbrenner's ecological theory of development (adapted from Hook & Cockcroft, 2001, p. 80-84).

Level	Example
Microsystem:	A *microsystem* is a setting in which the individual spends considerable time, such as the student's family, peers, school, and neighbourhood. Within these microsystems, the child has direct interactions with parents, teachers, peers, and others. Examples of this system in South Africa include a history of apartheid where the lives and upbringing of many Black children were affected by absence of parents due to working away from home (Hook & Cockcroft, 2001).
Mesosystem	The *mesosystem* involves connections between microsystems. Examples are the connections between family experiences and school experiences. Examples of this system in South Africa include poor Bantu education and White-job reservation, resulting economic disempowerment affecting the general development of many Black children negatively (Hook & Cockcroft, 2001).
Exosystem	The *exosystem* is concerned with experiences in another setting (in which the child does not have an active role) influencing what children and teachers experience in the immediate context. Examples of this system in South Africa include the language policy in education and its practical implementation. Literacy is acquired optimally through the medium of mother tongue instruction and if this process is disrupted, then literacy may never be adequately developed (Heugh, 2002; Hook & Cockcroft, 2001).
Macrosystem	The *macrosystem* includes culture. Examples of this system in South Africa include discourses of "the rainbow nation", of racial equality and tolerance towards diverse cultural beliefs. (Hook & Cockcroft, 2001).
Chronosystem	The *chronosystem* includes the sociohistorical conditions of children's development. Examples of this system in South Africa include a history of apartheid and democratic political change. The apartheid ideology emphasised racist values and inferior 'Bantu'. In contrast, South Africa's new constitution embodies racial equality and equal access to quality education (Hook & Cockcroft, 2001).

From Table 2.2, it is clear that the ecological model of development provides a useful framework for considering how multiple sources of environmental influence affect language development. Culture and socio-economic status (SES) provide overarching fundamental values and beliefs surrounding childrearing, discourse and ideology of language medium of instruction and modes of language use and interaction (Hook & Cockcroft, 2001). Lieven's (1994) review of cultural influences on language environments and language development demonstrates that when adults speak directly to preschool children, these children begin speaking by using single words followed by isolating words from the speech stream they hear and produce novel combinations of those words. On the other hand, for children who are talked to very little, language development proceeds less rapidly; they begin speaking by producing large memorized chunks of input, which they only later analyse into words and sounds within words. With respect to associations between SES and children's language, Hart and Rinsley (1995) report that SES-related differences in vocabulary size are noticeable from the onset of speech and increase over time. By three years of age, the mean cumulative recorded vocabulary for high SES children is more than 1 000 words and for low SES children it is close to 500; SES accounts for 36% of variance in vocabulary. Thus, rate of children's language development differs as a function of culture and socio-economic status.

Culture and socio-economic status also influence children's actual learning experiences through settings such as schools. The amount and quality of language input children receive has effects on children's literacy development. For example, in apartheid South Africa, Black children were exposed to Bantu education, which was designed to be inferior in quality to the education White children received. This led to Black children having low levels of literacy and only access to jobs that paid less, whereas their white peers had higher levels of literacy and access to well-paying jobs (Heugh, 2002). Furthermore, language related factors operating at the level of the individual mother, father, teacher, sibling, or other significant adults, are also sources of variance in children's experience that have consequences for their language or literacy development (Heugh, 2010; Hook and Cockcroft, 2001). Individual differences among parents are a source of variability in children's literacy experiences, which, in turn, correlates with variability in children's language development. For example, Akhtar, Dunham, and Dunham (1991) find measures of maternal behaviour and language use and amount of child-directed speech at one year, one month account for 60% of the variance in children's vocabularies at one year, 10 months. Furthermore, parents in high SES families read more to their children than do parents in low SES families, and thus literacy development in high SES children is further enhanced by literacy related activities that high SES parents choose to engage in with their children (Fletcher & Reese, 2005).

Post-apartheid South Africa has found it difficult to quantify the full extent of the damage of the apartheid's educational system for Black South Africans. Heugh (2002, p. 193) sums up the repercussions of the damage of apartheid's educational system on contemporary South African society as follows:

> *There is undoubted pressure to ignore / forego the mother tongue principle for 83% of pupils who mainly come from poor socio-economic backgrounds and who are mostly taught by teachers who themselves have usually struggled through Bantu Education. If we are to succumb to this pressure, then we need to be honest about the outcomes of a second language English school system. The false dichotomy of a choice between either English or mother tongue / African languages needs to be set aside. Bilingual education for each child within a multilingual education policy does not mean a choice between either English or an African language (including Afrikaans). It means both. It means developing the first language and adding a second language in the best possible manner to ensure the successful learning of the second language. Jettisoning the one for the other spells individual and societal disaster for the country. The country's political, economic and social future depends upon the successful education of its youth. If the majority of the youth continue to be failed, the socio-economic differences, which existed during apartheid will not change very much. The youth have been promised change and opportunities denied their parents. Their disappointment will inevitably turn to disaffection.*

South Africa represents a unique context in which to consider environmental sources of influence on reading development. It is important to note that the ecological model is not a model of language development but a model of environmental sources of influence on development. As a result, ecological theory does not address biological and cognitive factors in children's development or developmental changes that are the focus of cognitive-neuropsychological information processing theories. Although, Bronfenbrenner (2000) adds biological influences to his theory and subsequently describes it as a *bioecological* theory; ecological, environmental contexts still predominate, and it thus remains an ecological and not a true bio-ecological theory of development.

In contrast, the present research takes a true *bio-ecological perspective* to viewing reading development. Bialystok (2007) outlines a rationale for a bio-ecological approach to studying literacy development in culturally and linguistically diverse children. Bialystok (2007) argues that language and literacy development is the result of social and cognitive-linguistic processes within a child's social and cognitive-linguistic worlds. To the degree that contexts alter processes linked to language acquisition and language use, language and literacy development take different forms in different contexts. In essence, the mechanisms of language and literacy development are both social and cognitive-linguistic in nature. Cases of children who are social isolates, such as the ''wild boy'' of Aveyron (Lane, 1976; cited in Santrock, 2011) and Genie (Curtiss, 1977; cited in Santrock, 2011) demonstrate that in the absence of appropriate environmental support, optimal language acquisition does not result. In addition, research evidence of variability in the degree to which children learn language due to levels of orthographic transparency and language proficiency influencing the rate and course of their language development (Snowling, 2000; Cummins, 2000), reinforces the idea that processes underlying language and literacy development depend on environmental variables.

Moreover, research evidence of co-occurring variability in environmental support and language development, such as the cultural influences, as well as the social contexts in which cognitive and reading skills are demonstrated, also contributes to explaining individual and group differences in literacy development and cognitive functioning of linguistically diverse children. Dual medium instruction programmes may not be established unless parents want their children to become conversational and academically proficient in both languages through the use of both languages for instruction. As a result, L2 English children in English-only instruction may be denied high levels of academic achievement associated with these instruction programmes due to English-only imposed upon them by their parents (Heugh, 2010). Therefore, all learning environments enable children to read, but children in different environments will do so in different ways and to different degrees with consequences for the rate or course of literacy development. Understanding how social and cognitive-linguistic environments meet and interact requires an examination of the social and cognitive-linguistic dimensions of language development in different literacy-learning environments.

A *bio-ecological perspective* will be utilised in the present study to demonstrate a holistic approach to viewing learning to read in South Africa. The following section outlines this model of assessment which can take into account the roles that language and culture play in the reading and cognitive development of monolingual and bilingual South African children. It has two essential aims: first, to demonstrate that the relationships among cognitive processing skills linked to reading in monolingual and bilingual children vary due to different learning environments. Literacy development is the result of processes set in motion when the child engages and interacts with the social and cognitive/linguistic worlds. To the degree that contexts differ, literacy development takes different forms for different types of children (Bialystok, 2007).

Second, additive bilingualism affects children's development and determines how children's developmental capacities for reading achievement are enhanced through social contexts (Bialystok, 2007). In pursuing this picture of environmental effects on literacy development, we need to turn to Frith's (1995) framework for reading as a starting point to address the three levels that encompass reading (dis)ability. Figure 2.15 illustrates Frith's (1995) reading framework.

2.9 A FRAMEWORK TO CONCEPTUALISE READING

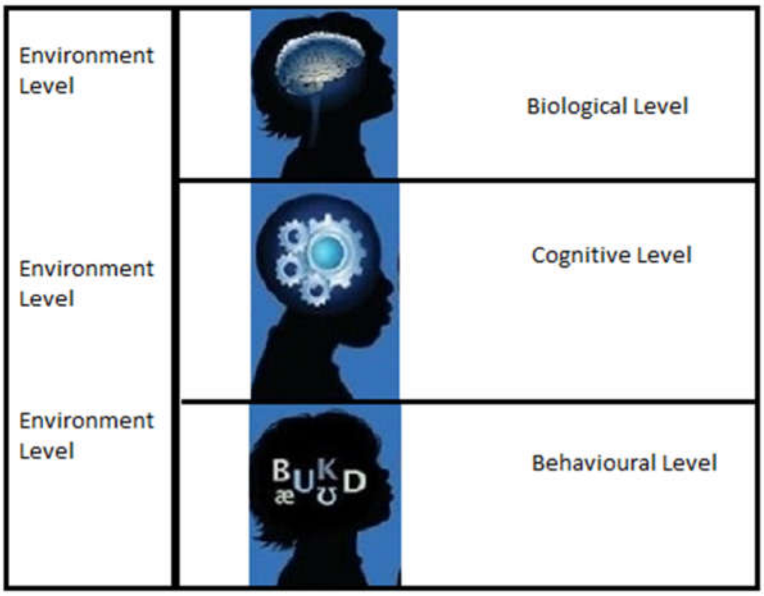


***Figure 2.15*: Graphic schema of the basic framework (adapted from Frith, 1996, p. 1).**

Frith (1996) argues that poor reading may be a consequence of a genetic abnormality that manifested at the *biological level*. Poor reading would lead to certain cognitive difficulties in phonological awareness, vocabulary knowledge and working memory at the *cognitive level.* These difficulties would manifest as behavioural symptoms at the behavioural level, such as poor performance on tests of reading attainment. Environmental variables at the *environmental level* may affect any one of the three levels. For example, poor reading performance at the behavioural level may be the result of low SES conditions that did not provide appropriate or sufficient opportunities to learn about language at the cognitive level. Therefore, genetic deficits and environmental variables may lead to behavioural symptoms of poor reading, but originating from different sources. This model was developed to explain reading development in monolingual children, although it is feasible to extrapolate to bilingual reading once some adaptations are made. The addition of a range of language related variables to the environmental level (i.e. level of orthography transparency, level of proficiency in certain languages, degree / type of bilingualism, monolingual *vs*. dual language learning) is needed to explain reading performance in bilingual children.

Figure 2.16 depicts language related variables at the *environmental level* influencing the other three levels. At the *biological level*, appropriate language exposure and absence of reading disorders is required for good brain development in monolingual and bilingual children learners. At the *cognitive level*, cognitive maturation and literacy instruction at school is essential for cognitive and reading abilities to develop in monolingual and dual language learners. Cultural influences and social contexts on language environment and literacy development encompass the *behavioural level*. Based on the literature review of this chapter, language related variables influence how the brain processes language, the development of cognitive processing skills and the act of reading at the *biological, cognitive and behavioural levels.* These considerations are mirrored in a quotation concerning the bio-ecological approach to cognitive assessment (Armour-Thomas & GoPaul-McNicol, 1997, p. 133).:

> *The bio-ecological approach to assessment suggests that a dynamically interactive relationship exists between cognitive processes and learning experiences nested within contexts. The expression of these capacities may be different to the extent to which social and cognitive / linguistic experiences within one context are different from other contexts. It is also possible that cognitive capacities required for cognitive behaviour in one context will be different from those in another. Consequently, the expression of these capacities may reflect the context in which they were socialised.*

Language related variables are, therefore, placed at all four levels in the revised model of Frith's (1995) reading framework used in the present study.

2.10 LEARNING TO READ IN MONOLINGUAL AND BILINGUAL CHILDREN IN SOUTH AFRICA: A BIO-ECOLOGICAL PERSPECTIVE

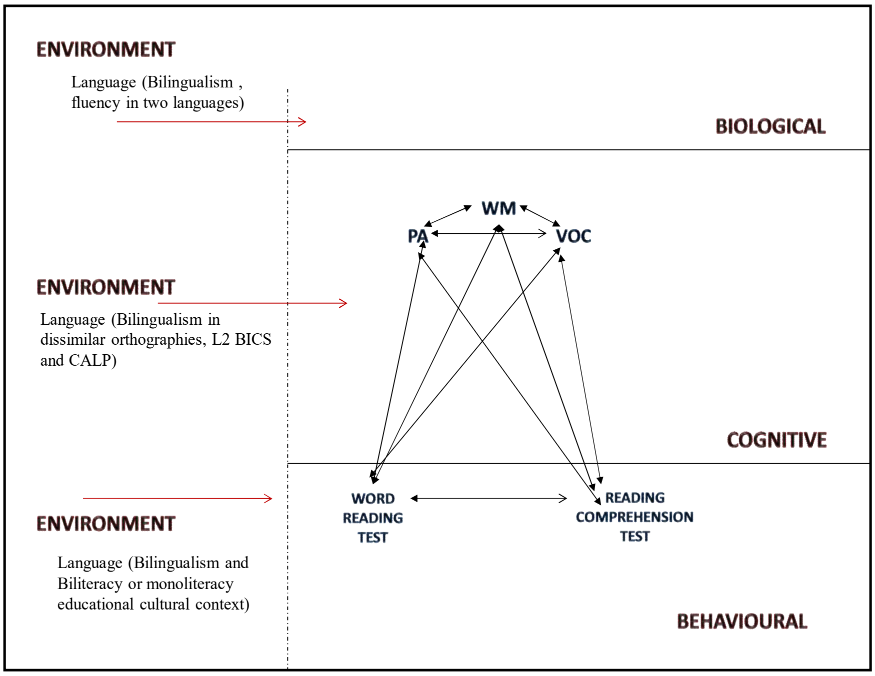


***Figure 2.16*: Revised summary of Frith's reading framework (1995) incorporating relationships assessed in the present study.**

It is important to note that a previous attempt to adapt Frith's (2004) model to explain reading development in L2 English, L2 Sesotho, and L2 Zulu-speaking children was proposed by Greenop (2004). Although this appears to address the role of bilingualism in literacy acquisition, it was generally concerned with a related but different issue, i.e. learning to read in the L2 and not bilingualism itself as the potentially significant development factor. Being bilingual makes it inevitable that learning to read includes learning to read in a second language. However, if we are to address the role of bilingualism, we must examine reading attainment in addition to the language in which reading is acquired as this research aims to do. In addition, understanding the acquisition of reading by bilingual children also requires examining the context in which literacy occurs, i.e. additive *vs.* subtractive bilinguals, which may facilitate or compromise children's ability to acquire literacy irrespective of language proficiency (Cummins, 2000). These issues are addressed in the present study.

The *bio-ecological* model presented in Figure 19 is an attempt to provide a framework for exploring group and individual differences in the rate or course of literacy development in monolingual and bilingual children in South Africa within a theory of literacy development. Such a model has the potential for providing a more complete picture of how children's efforts at learning to read are facilitated, or constrained, by the social contexts in which they live, contributing to our greater understanding of bilingualism, biliteracy, and learning to read in South Africa (Bialystok, 2007).

Table 2.3: A revised summary of Frith's (1995) reading framework incorporating language related factors proposed and addressed in the present research.

Factor	Description
Environmental level	Includes all variables external to the child e.g. socioeconomic status, and teaching practices. In this study, it was possible to select matched groups of monolingual and bilingual children, thus broadly controlling for socioeconomic status. Further, language related variables, including linguistic and educational contexts are placed here. For example, theories of bilingualism, orthographic transparency, level of bilingualism, degree of bilingualism, and mode of literacy instruction, Classroom and parent questionnaires were also used to investigate classroom practices and home–school connections. Teacher interviews were used to ensure that the monolingual and bilingual children were matched for curricula and broad instructional milieu.
Biological level	Includes brain-related processes, which are complex. It is difficult to establish their specific role in reading and spelling development and the impact that genetics and the environment may have on brain development (e.g. general intelligence is often seen as a biological factor). In this study, general intelligence was assessed only to ensure that the monolingual and bilingual children were similar with regard to general intelligence.
Cognitive level	Includes cognitive processing abilities that directly impact on the behavioural level, but when measured may only be inferred from test performance. In this study, phonological awareness, vocabulary knowledge and working memory skills related to reading development, are placed here. Tasks used to infer performance on the cognitive level include: onset and rime identification, phoneme deletion, expressive vocabulary, similarities, verbal working memory, visuospatial working memory, verbal short-term memory, visuospatial short-term memory.
Behavioural level	Includes the act of reading and reading comprehension. In this study, tests used to infer performance on the behavioural level include: word reading, spelling, reading-in-context, and answering comprehension questions based on a read text.

The following research hypotheses will be tested in the present study:

1. Phonological awareness and vocabulary skills in L1 (Afrikaans) will be related to word reading in L1,
2. Phonological awareness and vocabulary skills in L1 (Afrikaans) will be related to word reading in L2 (English),
3. Phonological awareness and vocabulary in L2 will be related to word reading in L1,
4. Phonological awareness and vocabulary in L2 (Afrikaans) will be related to word reading in L2,
5. Biliterate Afrikaans-English bilinguals will perform differently on measures of phoneme and word reading in L1 Afrikaans relative to L2 English, and
6. Biliterate Afrikaans-English bilinguals' phonological and vocabulary skills in L1 Afrikaans will make a positive contribution to L2 English reading performance.
7. The concurrent and predictive relationships between cognitive processing skills and reading will differ between L1 English and L2 English children, as well as for the L2 English among the emergent and biliterate bilinguals.
8. L1 Afrikaans and L2 English literacy developed in a dual medium instruction context will facilitate and promote high levels of cognitive functioning and reading achievement in both languages of the biliterate Afrikaans-English bilinguals when compared with L1 English monolinguals and emergent Zulu-English bilingual peers.

2.11 CHAPTER SUMMARY AND CONCLUSIONS

Chapter 2 focuses on providing a literature review of cognitive-linguistic processing skills linked to reading attainment in monolingual and bilingual learners. The present study uses a bio-ecological conceptualisation of reading attainment. This framework was explained and the roles that language and culture play on the cognitive and reading development attainment in children varying in language background and educational context, were outlined. Whether this model holds the promise of a more complete picture of how children learn to read, supported by the varying social circumstances in which they develop, is the broad objective of the present study. Research with children learning to read in another language than English, learning to read in a second language, and learning to read in a biliterate bilingual environment via dual medium instruction, was emphasised. A unique feature of the present study, relative to past studies, is the inclusion of many language-related contextual variables in a single cross-cultural and cross-linguistic study to examine the literacy achievement differences in monolingual and bilingual learners.

Direct comparative analysis of children's learning experiences in different environments entails a rich description of the nature of children's language experiences, including what varies across literacy-learning environments, and, what remains constant despite variations in context (Reese *et al.*, 2000; Goldenberg, Gallimore, & Reese, 1992). A rich description of the children's literacy-learning environments forms part of the next chapter to test the hypotheses presented in this chapter dealing with cognitive processing skills that underlie reading in all languages (Bialystok, 2007). Mixed-method designs hold the potential for a more complete picture of how children learn to read, supported by social and educational factors (Reese *et al.*, 2000). A few of these types of mixed-method studies already exist; their findings attest to the promise of this approach (Reese *et al.*, 2000; Goldenberg, Gallimore, and Reese, 1992). The next chapter presents the research method, sample characteristics, materials and apparatus, and data analysis procedures used in the present study.

CHAPTER 3:
METHOD

3.1 INTRODUCTION

To answer some research questions, we cannot skim across the surface. We must dig deep to get a complete understanding of the phenomenon we are studying.

(Leedy & Ormrod, 2005, p. 133)

Through research, professional practitioners, such as researchers in education and allied professionals, formulate scientific theories about phenomena that occur on a daily basis to shed light on phenomena that remained previously unexplained or little understood (Leedy & Ormrod, 2005). Multiple methods *"provide one way to estimate the degree of convergence between findings and theoretical interpretations for research problems where little is yet known or understood"* (Cook & Reichardt, 1979, p. 61). An "ecumenical" or "multiplist" approach can "*reveal unsuspected relationships; suggest unanticipated variables and effects and ground defensible interpretations of what may be true about the world"* (Houts, *et al*., 1986, p. 61). These efforts may lead to applications of newly acquired knowledge in teaching interventions and treatment of learning and educational difficulties that may reflect effective, evidence-based practice (De Vos *et al*., 2005). Meaningful, relevant research, is at all times carried out in a formal, accountable manner, where the aims of the study, the research design, population and sampling, materials and apparatus used during the research project, ethical principles followed, the procedures that were followed during the research project and the data analysis are clearly outlined (Leedy & Ormord, 2005). The aim of this chapter is to discuss the method that was followed in the present research in terms of the research design, populations and sampling, materials and apparatus used during the research project, the procedures that were followed, the data recording, the analysis and processing of data, and the ethical principles adhered to in conducting the present research.

Due to a shortfall in the knowledge base that focuses on monolingual and bilingual South African children's literacy development and literacy attainment, there is an urgent need for formal research that will lead to a better understanding of the strengths and challenges faced by this unique population of young learners (Henning & Dampier, 2012). The main aim of this study was to explore the effect of language related variables (levels of proficiency in certain languages and language of instruction at school) on reading attainment and its composite phonological processing skills in monolingual and bilingual children in a public school setting in South Africa.

In order to realise the main aim of this study, the following sub-aims were formulated:

Determine monolingual and bilingual participants' phonological ability in English as the LoTL by using the Bradley and Bryant (1983) sound categorisation test (BBSCT) and Rosner's test of auditory analysis (RTAA) (Rosner, 1979).

Determine monolingual and bilingual participants' breadth and depth vocabulary skills in English as the LoTL by using the Similarities and Vocabulary subtests of the Weschler Intelligence Scale for Children-IV UK Edition (WISC-IV) (Weschler, 2004: a, b).

Determine monolingual and bilingual participants' working memory processing ability in English as the LoTL by using the automated working memory assessment (AWMA) (Alloway, 2007).

Determine monolingual and bilingual participants' reading ability in L1/L2 English as the LoTL by using the single word English reading subtest of the Weschler Individual Assessment Test-II UK Edition (WIAT-II-UK) (Weschler, 2005) and the Neale analysis of reading analysis-revised (NARA-R) (Neale, 1989).

Determine the effect of orthographic transparency on phonological ability, breadth and depth vocabulary skills, and reading ability in biliterate Afrikaans-English bilinguals by comparing performance on Afrikaans tests adapted from the tests mentioned above.

Determine the concurrent and predictive relationship between language background and educational context and participants' phonological ability, breadth and depth of vocabulary skills, working memory processing ability and reading ability by comparing the results of all the tests mentioned above from L1 English monolinguals, emergent Zulu-English bilinguals with L1 Zulu spoken only and L2 English instruction and biliterate Afrikaans-English bilinguals receiving dual medium instruction.

The methodological approach adopted in the present study, followed the format of the studies of Reese and colleagues (Reese *et al.*, 2000; Reese *et al.*, 1999; Goldernberg, 1992), who used mixed methods reflexively and interactively and several samples to gain an understanding of Latino children's literacy experiences and literacy development. Specifically, the present research detailed in this chapter focused on the literacy attainment of South African children varying in language background and educational context.

Consistent with previous international research, differences in phonology and orthography (Geva & Siegel, 2000; Gholamain & Geva, 1999), and eco-cultural influences in the learning environment that enable or constrain literacy ability (see

Table 3.1), may lead to differences in literacy acquisition in first and second language English speakers, as well as increase the likelihood of finding different sound-based predictors of acquisition in different languages. Included in these views is a bio-ecological theory of reading development in bilingual children (Armour-Thomas & GoPaul-McNicol, 1997). However, further evidence, is necessary to illustrate how this theoretical framework can be used to pursue questions about language related influences on monolingual and bilingual children's literacy attainment n a public school setting in South Africa.

Table 3.1: Summary of selected contextual factors affecting literacy development and achievement (adapted from Goldberg, Gallimore, & Reese, 2001, p. 6-7).

Ecological / Cultural features	Selected findings
Family history background	Grandparents' and parents' literacy correlated with children's reading achievement (Reese *et al*., 2000).
Job - related constraints and enablers	Father's job-related literacy and education correlated with ratings of home literacy environment and child's reading achievement (Reese *et al*., 1999). Father's job-related literacy correlated with frequency of home literacy learning opportunities (Reese *et al*., 2000).
Home Literacy routines	Frequency of reported reading by parents correlated with high reading achievement (Reese, Goldenberg, *et al*., 1992). Home literacy practices predict early Spanish literacy development, which predicts 7th grade English reading scores (Reese *et al*., 2000).
Cultural Schema (parents' beliefs and attitudes toward	Parents see literacy development as beginning when children begin formal schooling; consequently, they do not typically create preschool literacy opportunities for children

Ecological / Cultural features	Selected findings
reading development)	(Goldenberg, Reese, & Gallimore, 1992)

According to a review by Barnes (2012, p. 468) *"mixed methods are under-represented in published African psychological research"*. Moreover, few studies have used mixed methods to gain an understanding of fundamental South African social justice-related issues by investigating the magnitude (using quantitative methods) and participants' perceptions of those issues (using qualitative methods). Examples of mixed-method studies include studies on intergroup contact and racism (Durrheim, Trotter, Manicom, & Piper, 2004), the Human Immunodeficiency Virus, and mental health (Kelly, Freeman, Nkomo, & Ntlabati, 2009), race, identity and geographical inequality (Van Ommen and Painter, 2005), and sexual harassment (Van Wijk, Finchilescu, & Tredoux, 2009). Now there is a need to understand the *magnitude* of inadequate use of mother tongue as medium of instruction, the advantage conferred by dual medium education on cognitive functioning and reading achievement in young bilingual children and to *qualitatively* understand values and beliefs surrounding right of choice of language medium of instruction as an significant influence on general academic underachievement of L2 English learners, as is current in the urban educational context in South Africa (Heugh, 2002; 2010).

According to Green and Caracelli (1997), mixed-methods have the potential to expand our understanding of children's literacy experiences and literacy attainment in ways that quantitative and qualitative methods could not do alone. Moreover, if children's literacy development occurs in a complex context due to a mix of interrelated language related issues (ecological and cultural factors) from a bio-ecological perspective, then mixed methods can provide a holistic understanding of children's literacy attainment and the contexts of children's literacy development (Armour-Thomas & GoPaul McNicol, 1997). These studies provide both the basis and justification for using a mixed-method research design in the present research and ultimately contributing to mixed method research on language and education in South Africa.

Furthermore, the Report of the National Literacy Panel on Language-Minority Children and Youth (August & Shanahan, 2006), found that many international research reports on the literacy development of English language / bilingual learners tend to ignore mode and medium of language of instruction-related issues, and the attitudes parents have in relation to language. At the same time, August and Shanahan (2006) state that a number of qualitative research studies often describe the context of bilingual children's literacy attainment with minimal data on their level of literacy attainment (Snow, 2006). Thus, research on children's literacy achievement and its development has been either quantitative or qualitative. There are exceptions to this generalisation, however, (Goldernberg, 1992) but even this research is not carried out on South African children. In this mixed-method study, quantitative data on monolingual and bilingual South African children's cognitive processing skills linked to literacy attainment is paired with qualitative data obtained from classroom observations and teacher interviews. In this way, we gain insight into language factors influencing children's literacy learning experiences to develop relevant teaching interventions for children to develop the knowledge and skills they need to succeed in school and in society (Bialystok, 2007). The next section summarises the research design, sample, and significant findings across quantitative and qualitative methods to address the gap in the knowledge base on monolingual and bilingual children's literacy attainment in South Africa (Henning & Dampier, 2012).

3.2 RESEARCH DESIGN

The research design followed a multiple comparison group and mixed-method research design that was exploratory, descriptive and contextual in nature (Cook & Reichardt, 1979; Greene & Caracelli, 1997). A combination of *quantitative* and *qualitative* approaches enabled the researcher to describe the results obtained. Combining research methods has the potential of minimising the chance of bias, and therefore maximising the quality of data collected (Graveter & Forzano, 2009).

The *quantitative approach* permits the researcher *"to answer questions about relationships among measured variables with the purpose of explaining, predicting, and controlling phenomena"* (Leedy & Ormrod, 2005, p. 94). Quantitative methods utilise inferential statistics to test hypotheses about generalizable findings (Sechrest & Figueredo, 1993). Standardised tests and tests adapted / developed by the researcher made it possible to determine certain relationships between measured variables (Graveter & Forzano, 2009). This enabled the researcher to provide information regarding the magnitude of the effects of language related variables on the cognitive functioning and reading competency of children varying in language backgrounds and educational contexts in the South African context.

A *qualitative approach* enables the researcher to gain a better understanding of contexts of development for monolingual and bilingual children's literacy development (Leedy & Ormrod, 2005). According to Peshkin (1988), qualitative methods permit a nuanced exploration into what people say, do, and think and the meanings they ascribe to their words, deeds, and thoughts. Qualitative interpretivist methods, such as open-ended items, or guided conversations, enabled the researcher to gain an understanding of the role that mother tongue education plays in bi- and multilingual contexts in the minds of parents of monolingual and bilingual children. They also helped understand how language related issues relate to each other when parents talk about the developmental pathways they hope their children will follow (Bialystok, 2007). Included in this view are the cultural influences and the social contexts in which reading skills are demonstrated. Furthermore, they provide the means by which to evaluate how a child's cognitive development and reading attainment is constrained or enabled through social context (Bialystok, 2007).

The method of the present research was exploratory in nature, aiming to explore a complex phenomenon about which little information exists, namely cognitive functioning and reading competency of monolingual and bilingual children in the South African context. Methods used in exploratory research include literature reviews, which lead to a better understanding of the topic investigated (Struwig & Stead, 2002). The present research included a review of the literature on phonological awareness, vocabulary and working memory as cognitive processing skills that underpin reading achievement in monolingual and bilingual learners.

The nature of the current study was also descriptive, where an in-depth description of groups of third grade learners' literacy skills and cognitive processing skills was possible. The research protocol consisted of a working memory test battery, tests of phonological awareness, tests of breadth and depth of vocabulary, tests for reading decoding and reading comprehension. The results of these tests, considered holistically, enabled the researcher to provide a detailed description of monolingual and bilingual participants' cognitive processing skills and reading ability in L1 / L2 English, as well as the cognitive processing skills linked to reading ability in the L1 Afrikaans and L2 English of biliterate Afrikaans-English bilinguals. In addition, the present study was contextual. The context in which this study was conducted is representative of the educational language policy currently followed in South Africa, with schools determining their language policy of monolingualism or multilingualism, leading to English-only and dual medium Afrikaans-English schools co-existing in this country (Webb, 2010; Heugh, 2010). In summary, the present research used a non-experimental, mixed group research design. Monolingual and bilingual groups were administered a variety of tests to assess their cognitive processing skills and reading ability. No variables were manipulated; existing measures of performance were assessed.

3.3 PARTICIPANTS

The sample comprised 300 South African primary school children in Grade 3. One hundred L1 English monolinguals, 100 emergent Zulu-English bilinguals, and 100 biliterate Afrikaans-English bilinguals. The sample was selected from three public schools, two schools with English as the language of instruction and one school with Afrikaans and English as the languages of instruction. All of the schools were within the same demographic area and school district in Johannesburg and implemented similar curricula and teaching methods for reading instruction stipulated by the South African government (Department of Education, 2004).

Language information and age was obtained by means of interviews with teachers and a home literacy and school environment questionnaire administered to the parents of the children, compiled by the researcher (Appendix G). This questionnaire was adapted from the research of Duursma *et al*., (2007) with Spanish-English-speaking children. It covers ecological and cultural factors influencing children’s literacy experiences and development, such as developmental and language history, home language use and exposure to the L2, parental education, parental involvement in children’s literacy-learning experiences, parental reading, parental income, books at home, and reasons for choice of the child’s LoTL. The use of self-report has been criticised for being dependent on social desirability in terms of estimates of language proficiency being influenced by the extent to which proficiency in a particular language is desirable (i.e. the social prestige of a language). However, research has generally shown that parent or teacher reports of a child’s exposure to language(s) and language use, predicts language production in monolingual and bilingual children (e.g. grammatical skills: Bus, Van Ijzendoorn, and Pellegrini, 1995; Scarborough and Dobrich, 1994; and semantics: Pena, Bedore, and Rappazzo, 2003). Responses from parents were also used to provide additional information for interpreting the findings of the present research on the cognitive functioning and reading attainment of children varying in linguistic background and educational context, as well as to determine whether a participant met the selection criteria described next.

3.3.1 Criteria for the selection of participants

The exclusion criteria from the current study included hearing, behavioural and / or learning disorders, neurological impairments, and reading or spelling problems. The children's teachers and school records confirmed this information. The following specific criteria were followed during the selection of participants.

3.3.1.1 Age and educational level

In terms of the educational system in South Africa, children enter school in the year they turn seven years of age. Participants had to be between the ages of eight years and 11 months and nine years and 11 months at the time of data collection. Third-grade learners were chosen, as it is the exit phase of the Foundation Phase (Grades one through to three), and thus results obtained at Grade 3 may be considered a measure of reading experience and its development. In Grade one and Grade two, there is still variation in children's literacy levels, but by nine years of age a significant amount of sight vocabulary should have developed and meaning should be easily derived from text (Department of Education, 2004). All participants were in the final school term of Grade 3 at the time of testing to ensure that all the participants were exposed to at least three years of formal reading instruction. This criterion is congruent with the broad aim of this study, which is to explore the development of literacy and its composite cognitive processing skills in monolingual and bilingual Grade 3-leaners in a primary school setting in South Africa.

3.3.1.2 First / home language(s) and Language(s) of Teaching and Learning (LoTL)

Table 3.2 summarises the main characteristics of research participants based on responses from parents on the home literacy and school language environment questionnaire.

Table 3.2. Language information for participants.

Language	Dual medium	English only	English only
Mother tongue	Afrikaans and English	English	Zulu
Medium of instruction	Afrikaans and English	English	English
Language taught as subjects	Afrikaans (HL) and English (FAL)	English (HL)	English (FAL)

Note. HL = home language, FAL = first additional language.

From Table 3.2 it can be seen that the entire curriculum and reading instruction was presented in English for both the L1 English speaking children and emergent Zulu-English bilinguals. Based on parental reports, the latter children had their first prolonged exposure to English at school and had spoken, but no written proficiency in Zulu (L1), whereas the former children had the same spoken and instruction language, and were not exposed to any other language than English. All of the Afrikaans-English-speaking children were exposed to Afrikaans and English from birth: both of these languages were used in the home. Moreover, the biliterate Afrikaans-English bilinguals were required to study the two languages from early schooling at a dual medium school. Based on parental reports, the bilingual Afrikaans-English children were similar in their degree of bilingualism: they used both languages daily, they were learning to spell in both languages, and their community was largely Afrikaans and English speaking.

3.3.1.3 Language proficiency and degree of bilingualism

Language proficiency is defined as "the degree of control one has over the language in question" (Hamayan & Damico, 1991, p. 42). English language proficiency in the three linguistic groups of this study was assessed by using the Peabody Picture Vocabulary-III-Form-L (PPVT-L, Dunn & Dunn, 1997). This test has two equivalent versions, namely Forms L and M. The PPVT-III- Form-L has been found to provide valid and reliable estimates of oral language proficiency equally in monolingual and bilingual children (Geva & Petrulius; Wright, 2000, cited in Geva, 2000). Norms provided by the PPVT-III- Form-L were not used because these are based on English-speaking children in the United States; rather raw scores for all three linguistic groups of South African children were calculated. This is a recommended procedure for testing linguistically diverse children (Figueroa, 1989). Mean scores (and standard deviations) on the PPVT-III-Form L were M = 18.22 (2.46), M = 17.89 (1.98), and M = 10.80 (2.85), for the English (L1) monolinguals, biliterate Afrikaans-(L1)-English-(L2), and emergent Zulu (L1)-English-(L2) bilinguals, and respectively. These means were significantly different, $F(2,297) = 19.56$, $p <. 001$. The English (L1) monolinguals and the biliterate Afrikaans-English bilinguals had the highest levels of English oral language proficiency relative to that of the emergent Zulu-English bilinguals.

A formal measure of language proficiency in the Afrikaans and Zulu languages did not exist at the time of testing, which led to the PPVT-III-Form M being translated into Afrikaans and Zulu. Qualified language specialists in the Afrikaans and Zulu languages translated this test. The use of norms with translated tests is problematic because lack of validation of the new language tests means that these tests in question may not measure the same skill as the original English version of the PPVT-III-Form M. However, this was not an issue for the present research as the original English norms were not used for deriving scores; instead raw scores on the Afrikaans and Zulu translated tests were used. Furthermore, the process of translation and pilot work and consultation with teachers ensured that the items were culturally appropriate for the children tested. These are recommended procedures for testing children with assessment tools in languages other than English (Geisinger, 1994).

The scores on the Afrikaans and Zulu translated tests were used as a broad measure to determine children's language dominance and degree of language proficiency in the two languages of the bilingual groups following Bialystok, Majumder and Martin's (2003) interpretive guidelines**.** The results indicated that the biliterate Afrikaans-English bilinguals were balanced bilinguals: that is, they were almost equally proficient in Afrikaans and English (M =19.11, SD = 2.36 for Form M in Afrikaans *vs*. M =18.89, SD =1.98 for Form L in L2 English). The emergent Zulu-English bilinguals were partial bilinguals: they had slightly stronger language proficiency skills in their L1 Zulu than in their L2 English, but generally demonstrated weak language skills in both English and the mother tongue (Zulu). (M =12.45, SD = 2.35 for Form M in L1 Zulu *vs*. M =10.80, SD = 3.50 for Form L in L2 English).

According to Ovando and Collier (1998, cited in August *et al.,* 2006) semi-lingualism, or inadequate language proficiency in both languages occurs because of low language proficiency in a first language as a result of not being taught in the taught in the first and being taught the second language. These children end up with limited language proficiency in both languages. This circumstance is consistently linked to high rates of academic failure among subtractive bilinguals worldwide (Cummins, 2000). In contrast, when both languages are integrated into classroom discussions in a way that promotes the child's mother tongue skills while fostering mastery of the second, the second language is acquired easily in additive bilinguals (Collier, 1992; Krashen, 1999; Krashen & Macfield, 2005; Ramirez *et al.,* 1991).

3.3.1.4 General intelligence

A standardised control measure of non-verbal intelligence, the Raven's Coloured Progressive Matrices (RCPM, Raven, Raven & Court, 1998), was used to establish that the three comparison groups were similar with regard to general cognitive ability. The RCPM is a culturally reduced test as it has been found to predict intelligence equally in children from culturally and linguistically diverse environments (Raven, Raven & Court, 1998). This task consists of 36 trials. Each trial is composed of an array of abstract patterns. A number of alternative patterns are also presented. Only one of these alternative patterns correctly completes the sequence and the child's task is to identify this correct alternative. This task has been used as a measure of non-verbal reasoning across several language contexts (Everatt *et al.*, 2000). Mean ages (and standard deviations) were $M = 25.45$ (1.39), $M = 24.54$ (2.24) and $M = 25.39$ (1.25), for the English (L1) monolinguals, emergent Zulu (L1)-English-(L2) bilinguals, and biliterate Afrikaans-(L1)-English-(L2) respectively. These means were not significantly different, $F(2,297) = .56$, $p > .05$.

Table 3.3: Biographical data of learner participants in the present research.

Total Sample ($N = 300$)	EL1 ($N = 100$)	EL2 (ZL1) ($N = 100$)	EL2 (AL1) ($N = 100$)
Mean Age (SD)	9.40 (.72)	9 34 (.60)	9 45 (.85)
Education level	Grade 3	Grade 3	Grade 3
Home Language	English (opaque)	Zulu (transparent)	Afrikaans (transparent) and English (opaque)
Language of instruction	English	English	Afrikaans and English
English language proficiency	18.22 (2.46)	10.80 (2.85)	17.89 (1.98)
Degree of bilingualism		51.88% L1, 45% L2	79.63 L1, 74.54% L2
Gender	(47 M,53 F)	(58 M,42 F)	(57 M, 43 F)
Non-verbal intelligence	25.45 (1.39)	24.54 (2.24)	25.39 (1.25)

Note: EL1 = monolingual L1 English speakers, EL2 (ZL1) = L1 Zulu spoken proficiency only and L2 English language of instruction, EL2 (AL1) = L1 Afrikaans and L2 English and dual medium instruction in both languages, L1 = first language, L2 = second language, *SD* = standard deviation, and M = Male, F = Female.

Table 3.3 shows the biographical data of the 300 participants that participated in the present study. All of the participants that were selected met the set criteria (specified in section 3.3. 1). That is, all of the participants were in the age range of 8 years and 11 months to 9 years 11 months, and were in grade three and did not differ in general cognitive ability. Of interest to the present study is the fact that the three linguistic groups differed in general English language proficiency, and the bilingual groups differed in degree, or nature of bilingualism.

3.3.1.5 Classroom observations and teacher interviews

To determine equivalence of the teaching environment for participants from English-only instruction and Afrikaans-English dual medium instruction schools, the Early Language and Literacy Classroom Observation (ELLCO, Smith, Dickinson, Sangeorge, & Anastasopoulos, 2002) was administered. This measure has been shown by previous research to offer consistency in observation of quality of teaching environment and classroom supports during reading instruction, such as organisation of the classroom, number of books in the classroom, frequency of reading behaviour, and opportunities for writing, across time and grade levels; from pre-school through to Grade three (Smith *et al.,* 2002). The ELLCO consists of items measuring literacy environment, general classroom environment, as well as language, literacy and curriculum checklists. Data from both the English-only and dual medium schools exceeded the ELLCO standard for teaching practices that support the development and of language and reading attainment in young children (Table 9). A one-way analysis of variance (ANOVA) did not reveal a significant difference for teaching environment across ELLCO items across the three linguistic groups and within schools of the current sample, $F(2,297) = 2.19$, $p > .05$, as shown in Table 3.4. Teachers were interviewed to ascertain their level of teaching experience, amount of reading instruction in the classroom, and their degree of language proficiency.

From Table 3.4, it can be seen that both the monolingual and bilingual children were taught to read by teachers, with 10 years of teaching experience and received the same percentage of time allocated to literacy instruction. Furthermore, teachers providing Afrikaans and English literacy instruction were experienced bilingual teachers who spoke Afrikaans and English and reported that they spent 50% of the day in Afrikaans and the remaining 50% of the day in English. Hence, it is possible to investigate the effects of language variables; level of orthographic transparency, level of bilingualism, and language of instruction at school on cognitive functioning and reading attainment in monolingual and bilingual children matched for broad instructional milieu and educational background.

Table 3.4: Characteristics of teachers of participants in selected schools.

School / teacher	Teachers of the EL1 group (*N* = 3)	Teachers of the EL2 (ZL1) group (*N* = 3)	Teachers of the Bilingual Afrikaans-English Group (*N* = 3)
Language of Instruction	English	English	English and Afrikaans
ELLCO Literacy Standard Score: 24	22	22	24
ELLCO Classroom Environment Score: 24	22	22	24
ELLCO Teaching Language and Literacy: 30	30	30	30
Years' experience	10	10	10
Years at 3rd grade	10	10	10
Language proficiency	L1 English speaker	L1 English speaker	Fully bilingual Afrikaans and English speaker
Minutes per day in literacy instruction	120 minutes	120 minutes	120 minutes for each language
Ratio of L2 to L1			50/50

Note: LoTL = language of teaching and learning, ELLCO = the Early Language and Literacy Classroom Observation, EL1 = monolingual L1 English speakers, EL2 (ZL1) = L1 Zulu spoken proficiency only and L2 English language of instruction, EL2 (AL1) = L1 Afrikaans and L2 English and dual medium instruction in both languages, L1 = first language, and L2 = second language.

Teachers received one 20 – 45-minute classroom observation where field notes were taken of how reading processes and skills were being taught using classroom materials and displays. Next, teachers in English-only schools were interviewed to find out about any challenges they face in teaching L2 English children alongside their L1 English peers, as well as their reflections on assessment practices that could aid improving language proficiency and reading success in L2 English learners. Teachers in dual medium schools were interviewed to find out about successful bilingual classroom practices that aid the development of language proficiency and reading success in Afrikaans-English learners. Responses from teachers were coded and reveal descriptive patterns, which are discussed next.

1. What challenges do you personally face concerning teaching L2 English children?

- I feel my biggest challenge is how to address each learners needs when my class has learners at different levels of language and reading development within each group that increases each year.
- The question of what help to offer when a growing number of children have no reading skills in their first language and come into English-only classrooms as many people feel that English should be the only language offered and all speakers of other languages should have to learn to read English.

2. How important are the National Literacy Assessment test scores to you?

- As teachers in a government school, we do not really have a choice but to take the National Literacy Assessment test scores very seriously and do all we can to prepare our learners for them. They are very important to me. I want L2 English learners to be able to perform, as well as their L1 English-speaking classmates.

3. What are some recommendations for closing the existing academic achievement gap between L1 English and L2 English learners?

- Teachers need specific training on what helps L2 English learners learn better for them to perform better on literacy tests.
- I think L2 English learners need specialised teaching programmes until they are at the same level as their L1 English speaking classmates.
- I don’t think the National Literacy Assessment Tests are not an accurate measure of the level of language they need to be successful English readers. Many of them can easily pass the National Literacy Assessment Test, but then are not able to score sufficiently on tests of English fluency and accuracy, grammar, and reading comprehension.

4. What are some successful strategies that teachers in dual medium schools are currently utilizing to improve language proficiency and reading achievement on a daily basis in bilingual children learning to read in two dissimilar languages concurrently?

- Content needs to be altered to meet L2 English learner needs, including:
    - Teaching basic vocabulary, explaining and contrasting language structures and grammatical rules between the L1 and L2,
    - Introduce a story by drawing out key concepts / themes in child's native-language; next apply same strategy in English until learners have grasped reading comprehension strategy, and conclude by writing practice in both languages.
    - Use illustration and context cues to deduce meanings before directly teaching vocabulary. In this way reducing cognitive demands in L2 English reading and scaffolding reading of a new text.

In summary, teacher interview data highlighted that teachers need to know differences between L1 and L2 English learners, as this affects teaching strategies aimed at moving BICS to CALP and advancing CALP and CUP so that L2 English learners can achieve similar levels of academic language proficiency to their L1 English-speaking classmates (Cummins, 2000). Cummins (2000) explains *common underlying proficiency* (CUP) as the academic proficiency that benefits performance in both languages. That is, bilingual children can learn content knowledge in either language and it benefits CUP. CUP is most effectively acquired by learning in the L1 and transferring this knowledge to an L2 (Cummins, 2000). Teachers in English-only schools need training in teaching methodologies so that they can better understand L2 English leaners' language acquisition, as this affects L2 English reading achievement. Finally, teachers in dual medium schools spoke of teaching strategies that followed the curriculum, but made adaptations according to their learners' language and literacy development needs and L1 backgrounds. As a whole, the data demonstrates teachers from each schooling type had unique experiences. These experiences are important for the design of better language education policies and teaching interventions.

3.3.1.6 Home language use and literacy practices and notions of literacy development and language education in the multicultural, multilingual South African context

Longitudinal research has shown that home language use and literacy practices predict general reading achievement in monolingual and bilingual children (Bus, Ijzendoorn, & Pelligrini, 1995; Duursma *et al.*, 2007; Goldenberg, Reese, & Gallimore, 1992; Scarborough, Dobrich, and Hager, 1991; Snow, Burns, and Griffin, 1999). Family socio-economic status (parent's education and income) predicts L1 and later English reading achievement in Spanish-English bilingual children (Reese, Garnier, Gallimore, & Goldenberg, 2000). Reese and Gallimore (2000) find that age of first exposure to the L2 reading is related to general reading achievement with Spanish-English bilingual children exposed to English early in life (as early as age two) having better English skills than those introduced to L2 English reading at age 10. Following from this, successful reading depends on parents supporting their children's learning to read by reading to their children. The role that parents play in their children's reading development is likely to have a positive effect on both monolingual and bilingual children's reading attainment. Furthermore, in bilingual children, the role that parents play in their children's reading development is crucial because when parents read and supervise homework in their children's home language and language of instruction, bilingual children can achieve high levels of bilingualism and biliteracy (Cummins, 2000; Ramirez *et al.,* 1991). Using causal modelling, Scarborough, Dobrich, and Hager (1991) and others (Senechal, Lefevre, & Thomas, 1998) have found that home language use and literacy practices are linked to reading achievement, resulting in the universal acquisition of language but along different developmental pathways, at varying rates, and varying outcomes depending on the nature of language experiencing and the learning model (i.e. opportunities about learning about print) provided.

Although research on home language use and literacy practices in South African monolingual and bilingual children is very limited, there is no indication that these same factors are not also relevant for general reading achievement for both monolingual and bilingual children in South Africa. To illustrate, Greenop (2004) reports that the presence of children's books in the home emerges as a predictor of reading in 10-year old Zulu- and Sesotho-speaking children. This author points out that this finding illustrates advantages that children from high literacy-oriented families may have over lower literacy-oriented families.

That is, children from low literate families do not have *"opportunities to learn about language and print, someone to emulate in terms of reading, someone read to them"* (Smith & Elish-Piper, 2002, p. 157, cited in Duursma *et al.,* 2007). In this study, a four-page questionnaire, adapted from that of Duursma *et al.* (2007), was used to collect data on family socio-economic status and parents' education, language use and exposure at home, literacy practices and support in Afrikaans / Zulu and English where applicable (i.e. frequency with which parents read to their children, parents' attitudes and beliefs about shared parent-child reading), and number of books in the home in the three groups making up the sample of the present study (Appendix G). A 100% response rate was achieved across all three groups.

In the parent questionnaire, a measure of family *socioeconomic status score* was calculated by taking the mean of the income range selected and dividing it by the number of family members reported to live at home. The mean for maternal and parental education was similar; thus a *combined score of maternal and paternal education* is reported. Language use- and exposure-related variables were scored using a 5-point scale as follows: *5 = only English, 4 = mostly English, 3 = equal amounts of English and Afrikaans / Zulu, 2 = mostly Afrikaans / Zulu and 1 = only Afrikaans / Zulu.* Parents were asked to calculate approximately the number of books at home, using the following possible ranges: *1-10, 11-20, 21-30, 31-40, 41-50, and over 50*. A measure of books in the home was calculated by taking the mean of the range selected and dividing it by the number of family members reported to live at home. Parents were asked to indicate the frequency with which they read to their children, *where 30 = daily, 12 = three times a week, 8 = twice a week, 0 = never.* For bilingual children, parents were asked to indicate and explain any kind of literacy support provided in their child's first and/or L2.

Table 3.5 presents summary data for responses on the parent questionnaire for the three linguistic groups of the present study. This data shows a number of contextual factors influencing monolingual and bilingual children's reading achievement in South Africa. These include the influences of social, cultural, and school factors; collectively known as a child's "eco-cultural niche"—the constellation of proximal influences in the child's day-to-day life that shape developmentally significant child experiences (Gallimore, *et al*., 1989, p 216). Conceptualising influences on children's reading achievement in terms of eco-cultural niche provides a way of "unpacking" proxy variables correlated with reading achievement, such as SES, parent-child shared-reading opportunities activities, and age of exposure to literacy-learning activities, to help identify specific niche features that enable or constrain children's learning literacy experiences and reading achievement (Goldenberg, Reese, & Gallimore, 1992). This issue is important for understanding how to help children succeed in school in general and how to assist their reading development in particular (Goldenberg, Reese, & Gallimore, 1992).

Table 3.5: Home language and literacy practices data in EL1 and EL2 groups

Variables	EL1		EL2 (ZL1)		EL2 (AL1)	
	M	SD	M	SD	M	SD
Family SES	2.52	.60	2.50	2.48	2. 48	.65
Parental Education	11.31	.40	11.45	.30	10.50	.27
Parental Reading	19.52	11.09	19.41	11.01	22.31	10.60
Language Use and Exposure	5.00	.00	1.00	.69	3.40	.56
Parental Literacy Support in Child's L1	12.0[a]	6.53	6.09[b]	8.50	13.52[a]	7.21
Parental Literacy Support in Child's L2	-	-	11.00[a]	6.53	14.42 [b]	7.59
Age of First Exposure to Literacy Activities	3.21 [a]	1.44	7.30 [b]	.58	2.86[c]	.96
Word Reading (L1:L2)	73.69%		L2 52.01%		L1, 84.04% L2, 73.52%	
Reading Comprehension (L1:L2)	61.50%		L2 40.36%		L1,76.10%, L2, 67.13%	

Note: M = Mean, *SD* = Standard Deviation, SES = socio-economic status, No. = Number, EL1 = monolingual L1 English speakers, EL2 (ZL1) = L1 Zulu spoken proficiency only and L2 English language of instruction, EL2 (AL1) = L1 Afrikaans and L2 English and dual medium instruction in both languages, L1 = first language, and L2 = second language. Letters (a, b and c) are used to represent the results of post-hoc Tukey multiple comparisons test. The means of groups with the same letter are not significantly different.

From Table 3.5 it can be seen that all of the families fell in the middle-income category, earning between R25 000 – R50 000. Parents across the three linguistic groups had received a high school education and some form of tertiary education. On average, families of monolingual English (L1) reported having around 50 books at home. Families of the emergent Zulu-English bilinguals reported having around 45 books at home. Families of the biliterate Afrikaans-English bilinguals reported having around 50 books at home. No information on the language of the books in the home was available. The mean for frequency of reading for both parents was very similar within and amongst each linguistic group. Therefore, the three linguistic groups can be considered to be equated on these variables.

However, there were significant differences with regard to the frequency and kinds of literacy support provided, age of exposure to literacy activities linked to reading achievement - a particularly interesting finding in light of the different socio-linguistics statuses attributed to each of these languages in the South Africa context. English and Afrikaans hold a higher social prestige relative to Zulu (Heugh, 2010). This finding illustrates that a complex relationship exists between language and literacy development and language-in-education policy in practice, and thus has implications for teaching, learning, and current debates on use of African languages as languages of teaching and learning, alongside English, in the Foundation Phase (Heugh, 2010). In this country, Ramadiro (2012, p. 75) states:

> *the psych-linguistic aspects of reading are shaped by and interact with larger societal factors that inform contexts, opportunities and purposes of learning. These include sociolinguistic factors and factors operating at the home and school levels. These societal factors position readers in different but specific ways in relation to the acquisition and use of literacy; what people read, if indeed they read, how often, how much, where, with whom, in what languages(s). Moreover, what they ultimately 'get' from reading is enabled or constrained by larger societal factors.*

The next section considers parent-child literacy activities, values and beliefs surrounding literacy experiences and reading attainment, and the effect of language of literacy instruction on reading achievement, all of which define the learning environment in which monolingual and bilingual children develop cognitive and reading skills in the South Africa context.

Parents from the monolingual and bilingual groups reported information regarding the frequency and kind of literacy support in their child's L1. The mean frequencies of reading in the child's L1 (and standard deviations) for the monolingual English (L1) families, the emergent Zulu-English bilingual families, and the biliterate Afrikaans-English bilinguals were 12.00 (6.53), 6.09 (8.50), and 13.52 (7.21) respectively. These means differed significantly, $F\,(2,299) = 25.67$, $p < .001$. A post-hoc Tukey test showed that, with alpha at .05, means for monolingual English (L1) families and biliterate Afrikaans-English bilinguals formed homogenous subsets; the mean for emergent Zulu-English bilingual families showed a significant difference.

On the one hand, L1 book reading support and helping with homework were the kinds of literacy support reported in both monolingual (L1) children and families of biliterate Afrikaans-English bilinguals. On the other hand, oral storytelling in Zulu was the only form of literacy support reported. None of the latter learners had been exposed to print materials in Zulu nor had they received any reading instruction in Zulu. This pattern of findings replicates previous findings of Alexander (2005, p. 1) and Rose (2003, p. 1). According to Alexander, there is the lack of a reading culture in the African languages and *"poor availability of fiction texts at intermediate and senior levels and non-fiction, reference and school texts at all levels in African languages"* (Diallo, 2006, p. 1). Furthermore, Rose (2003, p. 1) points out oral stories *"link children with their culture and help them build a strong identity, but the typical patterns of meaning of oral stories are quite different from those of written stories. The elaboration of characters, events, and settings, and the relation of illustrations and text are highly distinctive in written stories".* Cumulatively, these language-related factors present obstacles to preparing emergent Zulu-English bilinguals to develop cognitive skills that make the acquisition of reading possible, evidenced by poor scores on the reading measures in Table 3.5

Parents from the emergent Zulu-English and biliterate Afrikaans-English bilingual groups reported information regarding the frequency and kind of literacy support for their children's L2 English in both bilingual groups. The mean frequencies for reading in the children's L2 (and standard deviations) for the emergent Zulu-English bilingual families, and the biliterate Afrikaans-English bilinguals were 11.00 (6.53) and 14.42 (7.59) respectively. These means differed significantly, F (2,299) = 8.19, $p < .001$. Families of the biliterate Afrikaans-English bilinguals reported playing a more active role in providing support in their children's L2 relative to that of families of emergent Zulu-English bilinguals. These former families reported using literacy practices that motivated and enriched their children's L2 learning experience. They used English in everyday interpersonal communications and rated themselves as having good English reading proficiency. They also reported reading many English books for pleasure and encouraging independent reading in their children's L2. In addition, they reported using phonological, visual and semantic strategies to monitor and improve their children's level of reading comprehension in both languages during parent-child reading activities, as is current in dual medium classroom practice world-wide (Krashden, 2003; Schwartz, 2002).

These literacy practices were not evident in the responses of the families of the emergent Zulu-English bilinguals. These families did not encourage independent reading nor did they utilise any strategies to monitor and improve their children's level of English reading comprehension in parent-child reading activities. Furthermore, the emergent Zulu-English bilinguals are learning to read alongside their L1 English peers in classrooms that utilised a literacy curriculum that does not emphasize building vocabulary or reading comprehension skills (Nel, 2011). This is because in monolinguals, unlike in bilinguals, BICS and CALP are linked and do not develop separately. Past research has shown that bilingual children who are not exposed to a print-rich, mentally stimulating environment that builds L2 vocabulary knowledge, demonstrate low levels of L2 word reading ability. This in turn affects their level of reading comprehension (August *et al.,* 2005). Successful reading comprehension in L2 English learners depends on breadth and depth of vocabulary knowledge. The amount of exposure to a specific language is associated with vocabulary growth in that specific language (Pearson, 2002).

The results clearly show that home literacy practices linked to reading achievement interact with social factors that inform learning opportunities and purposes of learning, which in turn affect reading achievement. It follows then that additive *vs*. subtractive contexts are important variables to consider in relation to L2 English reading achievement if we want to develop a comprehensive understanding of the relationship between oral language proficiency and reading proficiency in English language learners. This study explores this issue (Chapter 4 elaborates on research hypothesis 1). The results also imply that different degrees of bilingualism may have different effects on the acquisition of reading and use of cognitive processing skills linked to L2 English reading attainment. This study explores this issue (Chapter 4 elaborates on research hypothesis 2). Moreover, if biliterate Afrikaans-English bilinguals exposed to double reading instruction in home-school settings show advanced levels of reading achievement relative to a L1 English comparison group, then a more detailed examination of the relationship between the level of bilingualism and reading competency, as well as how degree of bilingualism contributes to acceleration in cognitive and reading development, is needed. This study explores this issue (Chapter elaborates on research hypothesis 2).

Parents reported information about the age at which children are exposed to literacy activities. The mean ages (and standard deviations) for the monolingual English (L1) families, families of the emergent Zulu-English bilinguals, and the families of the biliterate Afrikaans-English bilinguals were 3.21 (1.44), 7.70 (2.86), and 2.86 (.96) respectively. These means differed significantly, F (2,299) = 25.67, p <.001. A post-hoc Tukey test showed that, with alpha at .05, means for monolingual English (L1) families and biliterate Afrikaans-English bilinguals formed homogenous subsets; the mean for families of emergent Zulu-English bilinguals showed a significant difference. This analysis demonstrated that in monolingual English (L1) families and families of biliterate Afrikaans-English bilinguals, home literacy activities that involve reading to their children and using pictures in texts, build context and confidence that could be expected to prepare these children for formal literacy instruction once they enter school. Families of emergent Zulu-English bilinguals however, employed practices consistent with a cultural model of reading that assumes that literacy acquisition develops after children enter school and that before that age, they are not able to understand texts. More importantly, this variability, in turn, may be influenced by socio-historical factors going back to these children's parents' and grandparents' generation.

To explore this possibility, an open-ended question was used to understand parental reasons for choice of LoTL in the three linguistics groups of this study. Responses were analysed using thematic content analyses. Themes were noted as they emerged, grouped into categories and then analysed quantitatively by calculating the frequency with which themes occurred (Neuman, 2000). Another research assistant then reanalysed data on the open-ended question and extracted themes. The correlations between rater 1 and rater 2 ranged from .895 to 965 as measured by Cohen's kappa- a measure of reliability that corrects for chance agreement (Cohen, 1960). The level of agreement obtained was acceptable following Cohen's (1960) guidelines. Broad themes are illustrated in Figure 3.1. HL refers to home language.

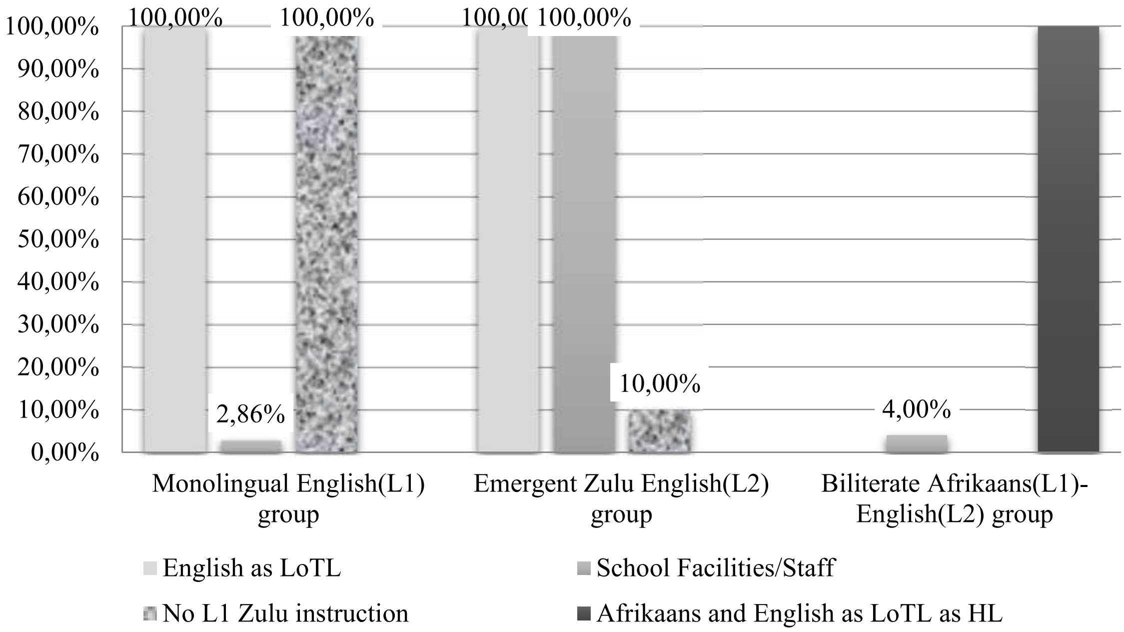


***Figure 3.1*: Choice of language of teaching and learning in monolingual English (L1), emergent Zulu-English (L2), and Afrikaans (L1)-English (L2) children.**

From Figure 3.1, it can be seen that parents of L1 English children and parents of biliterate Afrikaans-English children prefer the use of their own language(s) as the medium of instruction. Reasons for this included parents own education and successful learning experiences in the same English-only / Afrikaans-English school their child was currently attending. All of the parents of emergent Zulu-English bilinguals pointed out being reluctant to accept schooling in the mother tongue because they know of people who have had unsuccessful job interviews because they could not express themselves well in English. Previous research by De Klerk (2000, cited in Heugh, 2010) also found that African language-speaking parents think that if their children are not fluent in English, they will not get good jobs, because English is the language of business and opportunity. Thus, parents of emergent Zulu-English bilinguals will not accept Zulu as medium of instruction, unless perceptions about English supremacy change, or if they were aware that they could have both Zulu instruction and superior English skills. This point is illustrated by good performance on reading tasks by the English monolinguals and the biliterate Afrikaans-English bilinguals in Table 3.5. This finding is attributable to English being the first / home language of both groups, and dual medium instruction providing continuing instruction in English alongside Afrikaans instruction in the biliterate bilingual children's. Dual medium instruction shows promise in promoting academic achievement and high levels of biliteracy since both Afrikaans and English reading tasks were achieved at a high level in biliterate Afrikaans-English bilinguals as shown in Table 3.5.

Taken as a whole, the findings illustrate that parents of emergent Zulu-English bilinguals want their children to do well, succeed in school, and send their children to schools that provide greater opportunities than they felt they themselves had. At the same time, these families do not exhibit plentiful home literacy opportunities, as tended to be the case in L1 English monolingual and biliterate Afrikaans-English bilingual homes. Reese and Gallimore (2000) state that parents' cultural view of reading, influences how literacy materials are used in the home which influences reading achievement. In the emergent Zulu-English bilinguals, limited daily reading, absence of a culture of reading that sees reading as beginning after formal schooling through repeated contact with texts and neglect of mother tongue instruction means that L2 literacy instruction is not likely to be fully successful for L2 English reading achievement, placing them at a disadvantage in relation to their L1 English monolingual and biliterate Afrikaans-English bilingual peers.

These findings have implications for teaching and learning that effectively support the learning and development of young bilingual children at the Foundation Phase. Parents need to see the value of learning more than one language, need to be informed that the brain can handle learning more than one language at a time, and can enhance language, literacy, and cognitive development. Providing continuing support for children's home language as they learn English is critical, as home language proficiency is foundational for learning and development across all domains including English-language development (Cummins, 2000; Bialystok, 2010). The findings also reinforce the benefits of using quantitative and qualitative methods reflexively, and interactively, to uncover the cultural schema surrounding literacy experiences and academic achievement consistent with other studies that attest to the value of the mixed-method approach (Reese *et al.*, 2000; Reese *et al.*, 1999; Reese, & Gallimore, 1992).

The evidence suggests that stimulation from the environment and opportunities for speaking and learning about print, drives the language and literacy development process. At the same time, a language model at home and school together with the circumstance of exposure to a second language for bilingual children, serves as data for the cognitive processing skills linked to reading attainment. Different environments do so to different degrees, thereby producing group and individual differences in the rate and course of language and literacy development (Bialystok, 2007; Hoff, 2006). A rich description of the environment and its effects is important for an understanding of how the environment supports and shapes language / literacy development. Empirical work comparing how the relationship between language, cognitive processing skills and reading attainment across languages and cultures, is shaped and supported by the varying linguistic and social circumstances in which they live is the other component needed for a more complete picture of how children learn to read. The next section presents a discussion of the measures that allow for comparing cognitive and reading development across languages and cultures. In essence, certain experiences with language should affect the cognitive processes linked to reading attainment and suggest the extent to which bilingual children use both languages interchangeably and equally often determine the effect bilingualism will have on cognitive and reading development.

3.4 MATERIALS

A schematic representation of the different tasks used in the present research is provided in Figure 3.2. Next, a short justification for the specific tests in terms of area of evaluation is provided, together with evidence of reliability and validity for tests in question. Each test is illustrated in Appendix H. The order of the tests does not reflect the sequence in which they were administered; rather the ability or skill being measured.

Culturally and linguistically, appropriate Afrikaans, Zulu and English versions of phonological, vocabulary and reading tests were developed for use with the sample tested. Cross-language test adaptations were performed by native speakers who are familiar with teaching and assessing reading skills in South Africa. Pilot work and consultation with teachers ensured that the items chosen were culturally appropriate for the current sample. The phonological, vocabulary, working memory, and reading skills of the Afrikaans-English speaking and Zulu-English speaking children were tested in one or both languages, depending on whether children appeared to have minimal fluency in the language being tested. This approach was followed to minimise anxiety experienced by the child by avoiding assessing a child in a language he / she could not comprehend or in which he / she had limited proficiency. Working memory was assessed in English for a number of reasons. First, L1 and L2 working memory is moderately correlated and L2 working memory contributes independently to L2 reading achievement (Daneman & Carpernter, 1980). Second, guidelines for identifying language impairment in bilingual children indicate that L2 working memory measures are valid and reliable estimates of language development in bilingual children (Veii & Everatt, 2005). Finally, previous cross-linguistic research carried out internationally using the automated working memory assessment (AWMA) (Alloway, 2007) used in this study has indicated that this measure is developmentally and culturally appropriate for children with different language backgrounds (Alloway 2007; Engle & Gathercole, 2011).

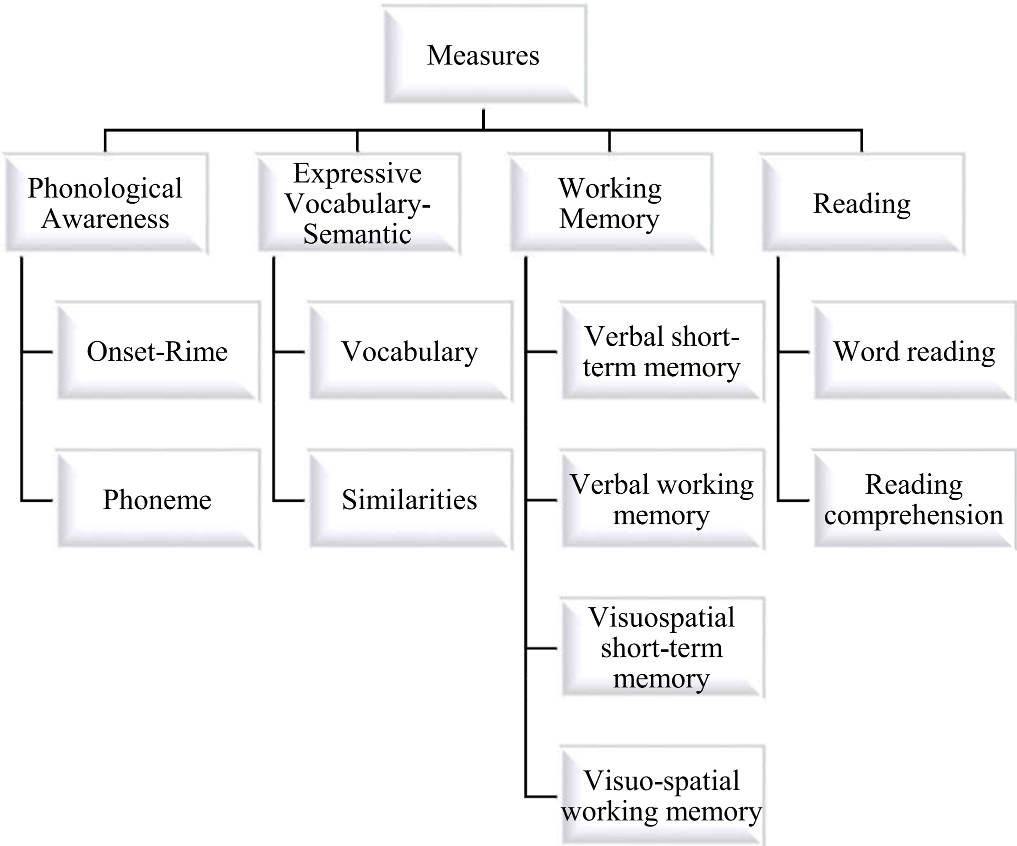


***Figure 3.2*:** **Outline of measures administered in this study.**

3.4.1 Phonological awareness

Tests of onset-rime awareness and phonemic awareness are well-established predictors of reading in English (Ehri *et al.*, 2001), and in other alphabetic orthographies (Spanish: Goswami, Gombert, & Barrera, 1998; French: LaFrance & Gottardo, 2005; German: Wimmer & Hummer, 1990; Sesotho and Zulu: Greenop, 2004) in English L1, English L2, and in bilingual literacy learning contexts: NELP, 2000). Bradley and Bryant's (1983) sound categorisation test (BBSCT) and Rosner's test of auditory analysis (RTAA) (Rosner, 1979) are well-established measures of onset-rime and phonemic awareness, respectively (NELP, 2000). Internationally, LaFrance and Gottardo (2005) report Cronbach's alpha reliability co-efficient of α = .86 and of α =.85, for L1 French and L2 English versions of BBSCT in Grade 2 biliterate French-English bilinguals. Winskel and Widjaja (2007, cited in LaFrance and Gottardo, 2005) report Cronbach's reliability co-efficient of α = .96 in an Indonesian version of the RTAA. Previous research in the South African context (Greenop, 2004) using tests based on both the BBSCT and the RTAA in Afrikaans, English, Zulu and Sesotho (Greenop, 1997; 2004)' reports good levels of reliability (.70 and above). Both of these measures of phonological awareness, therefore, were reliable to use with the current sample of monolingual and bilingual children. Cross-language differences have been found on these tasks in some studies (Cossu, 1999; Spencer & Hanley, 2003; Wimmer, 1996; Wimmer & Goswami, 1994; Wimmer & Hummer, 1990). In a study by D'Anguilli, Siegel and Serra (2001) focusing on the acquisition of reading in Italian-English bilingual children, exposure to Italian - a language with predictable grapheme-phoneme correspondence rules -is associated with enhanced phonemic skills in Italian and English.

BBSCT measures the ability to identify the word that sounds different to the other two presented by the examiner. Each trial consists of a string of three words. For example, in the onset awareness test, *the examiner says "rot, rod, box", child says "box"*. Similarly, for the rime awareness test, *the examiner says, "mop, hop, tap", child says" tap"*. This task requires the child to recognise that language sounds differ rather than identifying where the difference lies as in RTAA discussed next. Differences between good and poor readers have been found on this relatively simple level of phonological awareness (Sprenger-Charolles, Siegel, & Bonnet, 1998).

Ten English onset and 10 English rime items were administered to each monolingual and bilingual child. In addition to the English version of BBSCT the biliterate Afrikaans-

English bilinguals were assessed on 10 Afrikaans onset and 10 Afrikaans rime items that followed a similar format to BBSCT. The position of the odd-word-out in both language versions of BBSCT was controlled. In addition, items in both language versions of BBSCT were matched along a variety of dimensions, including word length, word frequency, syllabic length and structure. These procedures are discussed more in detail in Section 3.5. A practice item was administered in both language versions of BBSCT to ensure that the child understood what was required. One point was allocated for a correct response and zero for an incorrect response for each language version of BBSCT.

RTAA assesses the ability to delete syllables, phonemes, phoneme-in-a-blend from a word to make a new word. It requires the child to listen to a word, hold it in memory, and manipulate it to produce a new response. For instance, the examiner says to the child *'say sunshine without the 'shine'* and the child should respond *'sun'*. In addition to RTAA, the biliterate Afrikaans-English bilinguals were assessed on their ability to segment syllables, phonemes, phoneme-in-a-blend in Afrikaans. The words used in the Afrikaans version of RTAA were not always direct translations of the English words, particularly when the translated word was not phonologically equivalent across languages. However, Afrikaans version of RTAA did contain items based on reading lists taken from the early schooling grades that would lend themselves to syllable or phoneme deletion. These procedures are discussed in more in detail in section 3.5.1. Both language versions of RTAA had 15 items. A practice item was administered in both language versions of RTAA. One point was allocated for a correct response and zero for an incorrect response for both languages versions of RTAA.

3.4.2 Vocabulary knowledge

Tests of breadth and depth of vocabulary are valid and well-established as predictors of reading in studies across several languages (McBride-Chang & Kai, 2006), and L1 and L2 English contexts (Ouelette, 2006). In this study, there were two types of tests used to measure vocabulary knowledge: a similarities test and an expressive vocabulary test adapted from the WISC-IV (Weschler, 2004a, 2004b). Weschler (2004a) provides good reliability, construct, concurrent, and predictive validity for both these subtests across children with clinical diagnosis and normal achieving children in Black, Hispanic and White population groups (Weschler, 2003b). Weschler (2004b) reports a Cronbach's alpha reliability co-efficient of $\alpha = .88$ in a normative sample of 200, nine-year-old children stratified according to the 2000 United States Census data; namely age, gender, race, parent education level, and geographic region. Such measures have been used as an indication of the size of an individual's lexicon and his / her knowledge of words (Ouelette, 2006), and are viewed as indicative of language experience other than what is explicitly taught at school (Frederickson, Frith, & Reason, 1997). Both the similarities and the expressive tests of vocabulary knowledge provide norms to convert raw scores to standard scores. However, in this study only raw scores are reported in order to avoid any potential bias derived from norms that exclude South African children.

An English vocabulary test based on the expressive vocabulary test of the WISC-IV (UK edition) (Weschler, 2004a, 2004b) was used to assess vocabulary breadth in the L1 English, emergent Zulu-English bilinguals and biliterate Afrikaans-English bilinguals. This task consisted of 20 items with a maximum total raw score of 36. Specifically, items 1-4 have a maximum score of one, whilst items 5-20 have a maximum score of two. This task required the child to provide oral definitions of words that increase in difficulty and degree of abstractedness. Testing stopped when the child committed five consecutive errors. Degree of knowledge of a word's definition determines the score; any recognised meaning of a word receives a score of two. If a child shows a vague knowledge of a word's definition, a score of one is given, and no real understating of a word's meaning receives a score of zero (Weschler, 2004a). The biliterate Afrikaans-English bilinguals were also assessed on 20 items based on the English vocabulary test. Pilot work and consultation with teachers ensured that item pairs were culturally appropriate for the monolingual and bilingual children tested. These procedures are discussed in more in detail in Section 3.5.1.

An English similarities test based on the similarities test of the WISC-IV (UK edition) (Weschler, 2004a, 2004b) was used to assess vocabulary depth in the L1 English, emergent Zulu-English bilinguals and biliterate Afrikaans-English bilinguals. This task consisted of 12 items with a maximum total raw score of 20. Specifically, Items 1 and 2 have a maximum score of one, whilst items 3-12 have a maximum score of two. This task required the child to detect and describe commonalities between two words. Testing continues until 5 consecutive scores of 0 are achieved. Degree of abstraction is an important determinant of the score. A response that reflects a major classification and pertinent characteristic of both members of an item pair, such as *"An apple and a banana are both fruit."* received 2 points, whilst a minor or less pertinent similarity of an item pair, such as *"An apple and a banana both taste sweet.",* receives one point. Any property that the child mentions that is not part of both members receives a score of zero (Weschler, 2004a). The biliterate Afrikaans-English bilinguals were also assessed on 12 item pairs based on the English similarities test. Pilot work and consultation with teachers ensured that item pairs were culturally appropriate for the monolingual and bilingual children tested. These procedures are discussed in more in detail in Section 3.5.

3.4.3 Working memory

Tests of working memory are valid and well-established predictors of reading, as reading-disabled children have been found to be deficient in this cognitive factor (Alloway, 2007). In addition, one study has reported a benefit of childhood bilingualism on working memory performance (Feng, Bialystok, & Diamond, 2009). The effect this might have on bilingual children's language development, in the context of their levels of proficiency in the first and second languages, on L2 reading achievement by using a comprehensive measure of working memory should also be addressed. In this study, working memory was assessed using the Automated Working Memory Assessment, which is based on Baddeley's (2000) model of working memory (AWMA) (Alloway, 2007). This model has received extensive research with typically developing children and children with learning difficulties (Alloway, 2007). Alloway (2007) reports that in 116 children aged six to 10 years, 75% of children with poor working memory as determined by the AWMA also obtain standard scores of 85 or less on the WISC-IV ^{UK} Memory Index. Furthermore, studies using the AWMA have shown it to be highly effective in discriminating between good and poor readers across the full range of school years (Alloway, Gathercole, Willis, & Adams, 2004; Gathercole & Alloway, 2004). Alloway *et al.* (2006) report that the test-retest reliabilities of the AWMA subtests range from $\alpha = 0.64$ to $\alpha = 0.84$, with most of the subtests in the .80s.

According to Alloway (2007), accurate and valid assessment of a child's working memory functioning is essential to individualising instruction and improving the quality of education they receive. Individualised instruction in preschool enhances the learning opportunities of young children and promotes the important developmental language outcomes identified in the South African Department of Education's (2004) Foundation Phase Curriculum. Individualised instruction, however, becomes possible only through comprehensive assessments that are fair, technically adequate, and developmentally valid so that we can determine if children are making progress toward the intended language outcomes (Snow, 2006). In other words, individual child assessments must be linguistically, culturally, and developmentally appropriate in order to know how children are progressing and what educational decisions need to be made. The AWMA has been shown to be a comprehensive measure of working memory functioning in children with various European languages and a wide variety of sociocultural milieu. The AWMA has been successfully administered as a measure of working memory to samples of children in the United

Kingdom, Pakistan, Bangladesh, China, North Africa and the Caribbean with evidence of cross-cultural reliability and robustness of the factor structure in culturally different populations (Alloway, 2007). Alloway and Alloway (2010) report that scores on the AWMA at the start of schooling are a more powerful predictor than intelligence of future academic achievement in reading, spelling and math six years later. These authors also find that as opposed to IQ, working memory, unlike intelligence, is not linked to the parents' level of education or socio-economic background.

Few studies have used the AWMA to determine working memory functioning as it relates to reading in South African children (Alloway & Cockcroft, 2010; Jordaan, 2010). Jordaan (2010) shows that when normal-developing L1 and L2 English South African children are compared in groups, L2 English speakers score below their monolingual English-speaking peers on the AWMA. The poor academic achievement of emergent bilingual children clearly reveals the need for improved instruction for these children (Henning & Dampier, 2012). Moreover, when L2 normal-developing English South African children are compared to monolingual English children from the United Kingdom on the AWMA, the findings were more nuanced. Alloway and Cockcroft (2012, p. 21) report that South African children do better than same aged British counterparts on working memory tasks, as assessed using the AWMA. These authors conclude, *"the EL1 SA group showed the highest levels of performance possibly due to the benefit of exposure to multiple languages (giving them an advantage over the EL1 UK group)"*. These findings are consistent with native English speakers in dual language programmes in the United States (Lindholm-Leary, 2001).

However, further research is needed to understand the roles that language and culture play in the working memory development and functioning of bilingual children in South Africa in order to design the most appropriate and effective teaching interventions. The AWMA provides a comprehensive picture of learners' strengths and weaknesses, on which appropriate support can be based (Alloway, 2007; Gathercole & Alloway, 2008). A study of working memory functioning in different types of children, (English monolinguals, emergent Zulu-English bilinguals, and biliterate Afrikaans-English bilinguals) would also be useful for informing assessment practices by shedding light on important linguistic, cultural, social and educational factors that influence performance on working memory and reading tasks in linguistically diverse children. In this way, we could implement an assessment model that could better serve the educational needs of such children, including individualised literacy support to enhance the learning opportunities of linguistically diverse children and promote the important literacy outcomes identified in the South African curriculum for language development.

Conway (2003) recommends using computerised tests that have an automated score-oriented approach to optimally assess children's developing cognitive ability. The AWMA is a computerised tool for assessing working memory in children aged four to 11 years. This measure consists of 12 subtests; six subtests involve storage-plus-processing components and are collectively termed working memory tasks. Three of the six measure visuospatial working memory ("Odd one out", "Mister X" and "Spatial Span") and the remainder measure verbal working memory ("Listening Recall", "Counting Recall" and "Backward Digit recall"). Table 3.6 contains a description of all of the AWMA subtests. The testing sequence is pre-set with the difficulty of each task increasing proportionally to a child's correct response.

Table 3.6: Description of AWMA (adapted from Alloway, 2007).

Verbal Working Memory Measures	
Listening Recall	Child listens to a series of individual sentences and judges if each sentence is true or false, and then recalls the final word, in the correct order. No. of statements per list increased with each successive block.
Counting Recall	Child is asked to count the number of dots in a series of arrays, and then recall the tally of numbers in sequence. Number of dot displays increases with each successive block.
Backwards Digit Recall	Child hears a sequence of digits, and then recalls each sequence in backwards order. Number of digits per list increases with each successive block.
Visuospatial Working Memory	
Odd-one-out Task	Child views three shapes, each encased in a square presented in a row, then determines the odd-one-out shape, and next recalls location of each odd one out shape, in the correct order, by tapping the correct square on the screen. Number of shape sets increased with each successive block
Mister X	Child views a picture of two adjacent Mister X figures. The one on the left wears a yellow hat and the one on the right wears a blue hat. Each of them holds a ball in one hand. He / she must first identify whether the Mister X with the blue hat is holding the ball in the same hand as the Mister X with the yellow hat. The Mister X with the blue hat may also be rotated. Child's task is to recall the location of each ball in the correct order, by pointing to a picture with eight compass points. The number of Mister X pairs increases with each successive block.
Spatial Span	Child views a picture of two adjacent shapes where the shape on the right has a red dot on it. Child's task is to judge whether the shape on the right is the normal or mirror image of the shape on the left. Thereafter, he / she is asked to recall the location of each red dot on the shape, in the correct order, by pointing to a picture with eight compass points. The number of shape pairs increases with each successive block.
Verbal Short-term Memory	
Digit Recall	Child hears a sequence of digits and he / she is asked to recall each sequence in the correct order. The number of digits per list increases with each successive block.
Word Recall	Child hears a sequence of words and he / she is asked to recall each sequence in the correct order. The number of words per list increases with each successive block.
Non-word Recall	Child hears a sequence of nonsense words and has to recall each sequence in the correct order. The number of nonsense words per list increases with each successive block.
Visuospatial Short-Term Memory	
Dot Matrix	Child is asked to recall the position of a red dot in a series of four by four matrices. Thereafter, he / she is asked to recall which squares the dots appeared in by tapping squares on the screen. The number of consecutive matrices presented increases with each successive block.
Maze Memory	Child views a maze with a red path drawn through it. Child's task is to trace in the same path on a blank maze presented three seconds later on the computer screen. The complexity of the mazes increases with each successive block.
Block Recall	Child views a series of blocks being tapped. Thereafter, he / she is asked to reproduce the sequence in the correct order by tapping on a picture of the blocks. The number of blocks tapped increases with each successive block.

Administration and scoring of all subtests on the AWMA is fully automated. Children sit comfortably in front of a computer; instructions are offered via sound files while the computer screen is blank. After initial instructions, practice trials are administered and once these are completed, the child starts the actual test items. The researcher records the child's answer using (->) for correct answers and (<-) for incorrect answers. If a child makes three or more errors on the actual test, the programme ends the task and returns to the main menu, after which the next task is administered.

Although Alloway (2007) points out that the AWMA provides norms based on males and females, as well as ethnic minorities from United Kingdom, Pakistan, Bangladesh, China, North Africa and the Caribbean, in the present study raw scores were not converted to standard scores because South African children were not present in the norming sample. This absence could lead to systematic bias when assessment results for the current sample are interpreted. As Snow and Van Hemel (2008, p. 252) state:

> *Assessment tools and procedures should be aligned with the cultural and linguistic characteristics of the child. Moreover, in the case of norm based tests, the characteristics of children included in the normative sample should reflect the linguistic, ethnic, and socioeconomic characteristics of the child.*

The AWMA represents a reliable and valid tool for teachers to assess English language development during the school years. The AWMA provides teachers with how to use results obtained on the AWMA for educational planning, improving targeted instruction for individual children, as well as for improving the quality of services for groups of children. However, it does not provide specific guidance on how to determine if children are progressing at age-appropriate levels in their home language. For example, some subtests in the AWMA domain describe development related to specific features of language (such as sentence comprehension, grammar or phonological awareness) in English, which may or may not be applicable to development in other languages. In addition, current research on the AWMA does not account for cultural variation in how young children learn. For example, degree of exposure to English and degree of support in home language have been shown to influence reading success in bilingual children (Cummins, 2000). These may be important language related variables that need to be considered when interpreting the working memory profiles of bilingual children in order to help differentiate instruction for these children.

3.4.4 Reading and reading comprehension

An Afrikaans single word reading test was administered to the biliterate Afrikaans-English bilinguals. This task used words selected from reading books prescribed by the South African education department for use in the primary school grades. These words were selected so as to vary their length and their frequency of occurrence in early or later graded South African readers. Words at the start of the test were typically short words and frequently used in early reading books (Grades 1 – 3), whereas words at the end of the test were typically longer and found predominantly in later graded reading books (Grades 4 – 5). The order of the words in the Afrikaans word-reading test was the same as in its English version. These procedures are discussed in more in detail in Section 3.5.

The English word-reading test was based on the word-reading test of the Wechsler Individual Assessment Test-II (WIAT-II-UK) (Wechsler, 2005), to provide a basis on which to vary complexity of items across the test. English words conformed to reading books prescribed by the South African education department in the same way as the Afrikaans words. This ensured that the words were relevant to the cultural background of the children tested. The English reading test was administered to the L1 English children, the emergent Zulu-English bilinguals and the biliterate Afrikaans-English bilinguals. There were 84 words for both Afrikaans and English versions of the task. The Afrikaans words were presented on one card and the English words on a different card. Children were required to read aloud as many words as they could in the language represented. Testing stopped after the child had made seven consecutive errors. The total number of words read correctly provided the measure of performance for both language versions. This task was used to assess children’s basic reading skills in terms of recognising and correctly naming individual words, providing a means to distinguish between good and poor early readers.

Reading comprehension skills in English were assessed in the L1 English children, the emergent Zulu-English bilinguals and the biliterate Afrikaans-English bilinguals by using the Neale analysis of reading ability revised (NARA-R) (Neale, 1997). The NARA-R has been shown to discriminate between “backward readers” and “retarded readers” over a five-year follow-up period (Neale, 1997). Reliability figures in the range of .89-.91 have been reported for children aged seven to 13 years (Neale, 1997). The NARA-R consists of six prose passages with an accompanying picture suitable for children aged six to 13 years. After each passage a number of comprehension questions were presented by the examiner for an oral response by each child. The prose passages increase in difficulty, length and vocabulary complexity. Three passages with eight questions each were used to assess reading comprehension in English.

Similarly, three passages with eight questions each were developed by the researcher to assess Afrikaans reading comprehension in the biliterate Afrikaans-English bilinguals. Pilot work and consultation with teachers ensured that passage content was culturally appropriate for the current sample, as well as matched their English versions in terms of word length and word frequency. These procedures are discussed in more in detail in Section 3.5. Passages were available for reference when asking the comprehension questions for both language versions. Testing stopped when the child made 16 consecutive errors in both language versions of the tasks. The total number of questions correctly answered provided the measure of performance on this task in both language versions of the tasks. This task was used to assess children's ability to comprehend text in a meaningful context, providing a means to discriminate between good and poor readers of connected text.

3.5 PROCEDURE

Procedures for test development, data collection, recording and analyses are described next.

3.5.1 Procedures for translation/adaptation of assessment tools

Geisinger (1994) provides specific guidelines for adapting or translating existing measures into different languages. These guidelines recommend a multi-step process that includes (a) translating the tests, (b) piloting and field-testing the tests (c) developing a test manual and training test users. Translating a test into a different language occurs by translating test items either individually or by translating the actual concept. Whichever approach is used, a translator needs to meet the following criteria: have fluency in both languages, have knowledge about the cultures of both languages, and have an understanding of purpose of the measure (Geisinger, 1994). Translators consulted in this study were a qualified primary school teachers fluent in the target languages and familiar with research work in literacy teaching / assessment in South Africa.

Items used in the English and Afrikaans tests of phonological awareness, vocabulary knowledge and reading were matched to represent language-equivalent tests in terms of various psycholinguistic characteristics such as spoken frequency usage, age of acquisition, word length, and syllable length based on procedures described by Monaghan and Ellis (2003). For ratings of *spoken frequency*, Grade 3 educators were asked to rate words in English and Afrikaans on a 5-point scale, where (1 - 2 low, 3 = medium, and 4 – 5 = high spoken frequency of usage). For ratings of *age of acquisition*, Grade 3 educators were asked to calculate approximately the age at which children first learn each English and each Afrikaans word, in either spoken or written form. Ratings for *word length and syllable length* were calculated by using Kroes (1984) for Afrikaans words, and Kucera and Francis (1982) for English words.

3.5.1.1 Pre-testing of the test battery

Pre-testing of the measures was carried out in order to evaluate whether the proposed procedures and measuring instruments were culturally appropriate (Leedy & Ormrod, 2005). Issues around instructions, time allowed appropriateness of item wording and so forth were also examined (Geisinger, 1994).

3.5.1.2 Description of the pretested participants

Three grade three learners aged, eight years and 11 months and nine years and 11 months from each of the target, linguistic and language groups of this study were selected. These learners met the same criteria as set out in Section 3.3.1 for the participants in the main study. Measures described in Section 3.6 were used to elicit responses. Testing was carried out as set out under Section 3.5.2 (procedures for the collection of data). The results were analysed as described under Sections 3.5.3 and 3.5.4 (procedures for the recoding and analysis of data). Based on the result obtained from pretested participants, the researcher made certain changes to the research protocol. These adjustments are set out below.

3.5.1.3 Pre-testing results and changes made to research protocol.

Pre-testing indicated that one change needed to be made to make the item more culturally appropriate. Specifically, the translation of the English word "rough" into Afrikaans was changed from 'ruwe' to 'grof'. Another researcher and one Grade 3 teacher commented on this process. According to Geisinger (1994), using words that are more familiar to the target sample would not negatively affect the reliability or validity of test results. The time taken for the participant to complete the pre-testing battery was 115 minutes. This was well within the planned time limit.

3.5.1.4 Reliability and validity

"Reliability is the consistency with which a measuring instrument yields a certain result when the entity measured hasn't changed" (Leedy & Ormrod, 2005, p. 29). To ensure reliability in this study, tests used in previous research were used. Testing was done in a consistent manner by following steps in the test manuals. Testing for all children was carried out by the researcher and well-trained research assistants in the same distraction-free classroom. Further, reliability for most measures was determined by using Cronbach's co-efficient alphas, the exception being the working memory scores obtained on the AWMA, which, due to its format, required using the Kuder-Richardson 20 to determine its reliability. Reliability results are reported in Table 3.7. From this table it can be seen that reliability scores for all of the measures were acceptable to very good (.70 and above) following Cichetti *et al.*'s (2003, cited in Gravetter and Forzano, 2009) interpretive guidelines, and thus reliable to use for the monolingual and both bilingual groups in this study. These reliability scores have implications for interpreting the results of this study, as well as for future studies that use these measures.

"The validity of a measurement is the extent to which the instrument measures what it is supposed to measure" (Leedy & Ormrod, 2005, p. 28). In order to reach informed conclusions from the collected data, the researcher strove to ensure internal and external validity. Internal validity was ensured by matching all of the participants on intelligence, geographical area and concomitant socio-economic variations, and broad instructional milieu, using well-established measures, using culturally appropriate tests, and using mixed-methods to describe the contexts of monolingual and bilingual children's literacy experiences and reading development. External validity was met by selecting heterogeneous samples of third-grade learners in South Africa, describing the selection of participants in detail, and by conducting the research in a real-life public school setting (Gravetter & Forzano, 2009).

Table 3.7: Cronbach's reliability scores for measures in English and Afrikaans (shaded area).

Total Sample	EL1	EL2(ZL1)	EL2(AL1)
Onset	.77	.81	.80
Rime	.78	.80	.81
Phoneme Deletion	.75	.80	.77
Vocabulary-Similarities	.79	.80	.76
Vocabulary-Definitions	.81	.80	.88
AWMA-Verbal Working Memory	.81	.78	.80
AWMA-Verbal Short-term Memory	.82	.77	.81
AWMA-Visual-Spatial Working Memory	.80	.78	.82
AWMA-Visual-Spatial Short-term Memory	.81	.77	.80
Word Reading	.79	.80	.81
Reading Comprehension	.74	.70	.72
Onset-Afrikaans			.78
Rime-Afrikaans			.77
Phoneme Deletion-Afrikaans			.80
Vocabulary-Similarities-Afrikaans			.82
Vocabulary-Definitions-Afrikaans			.81
Word Reading-Afrikaans			.78
Reading Comprehension-Afrikaans			.80

Note: M = Mean, SD = Standard Deviation, AWMA = Automated Working Memory Assessment, EL1 = monolingual L1 English speakers, EL2 (ZL1) = L1 Zulu spoken proficiency only and L2 English language of instruction, EL2 (AL1) = L1 Afrikaans and L2 English and dual medium instruction in both languages, L1 = first language, and L2 = second language.

3.5.1.5 Description of the research assistants

Three research assistants were used during the testing of the participant's cognitive skills and literacy abilities. Research assistants were closely supervised and continually monitored by the researcher. Table 3.8 provides the relevant information on each of the research assistants involved in test administration to all of the participants of the present research.

Table 3.8: Qualifications of research assistants.

Qualification	Work Setting	Experience	Reason for Selection
BA, MA Communication Pathology: Speech language therapy and Audiology (University of Pretoria)	Private practice	Two years	Knowledge in the field of phonology and fluent in Afrikaans and English
BA (Psychology and Linguistics) MA (Research Psychology- University of the Witwatersrand)	Research company focusing in education evaluation	Three years	Knowledge in the field of cognitive assessment and fluent in Afrikaans and English
BA MA (ED), DTE (University of the Witwatersrand)	Senior lecturer, Department of Languages and Literature	20 years	Field of expertise: Cognitive Psychology, Phonology, Phonetics of Zulu, and fluent in Zulu.

3.5.2 Procedures for data collection for research sample

The general guidelines for conducting least-biased assessment provided by Fabiano and Goldstein (2010) were followed during data collection. At assessment, participants were assigned a number so that their scores were anonymous. A trained research assistant who was a native speaker of the language being tested, individually assessed each child in a quiet classroom at his or her respective school. Difficult tests were placed between the easier, more fun tests in order to keep the participants as motivated and interested as possible. To avoid fatigue, testing was carried out over two days in the monolingual English (L1) and emergent Zulu-English bilinguals, who were tested in L2 English. Each session took approximately 30 – 45 minutes. On the first day, tests of phonological awareness and vocabulary tasks were administered. The AWMA and tests of reading ability were administered on the second day. The AWMA is a more complicated test, but it uses a rule of three consecutive incorrect items to stop a subtest, thus not creating unnecessary anxiety for the participants. Children in the biliterate Afrikaans-English bilingual group were tested in each language over two subsequent days. During the testing of the latter group, the child was only addressed in the language of testing. The order of the language of testing was counterbalanced, half of biliterate Afrikaans-English bilinguals received the English versions of the tests of phonological awareness, vocabulary tasks, and tests of reading ability, then the other half received the Afrikaans versions, and *vice versa*. All of the data was collected within an 8-week period. This approach was employed so that testing interfered minimally with the teaching syllabi of all of the learners who participated in this study.

3.5.3 Procedures for recording of data

Procedures specified in the test manuals for scoring and interpretations were meticulously followed.

3.5.4 Procedures for analysis of data.

The procedures for analysis of the data are described next.

3.5.4.1 Qualitative data analysis

Qualitative or non-mechanical methodology, focuses on interpreting test scores in a holistic manner, leading to holistic interpretation of test results (Foxcroft & Roodt, 2005). To capture descriptions of literacy activities which took place in the home and choice of LoTL in the school environment, responses on the home literacy and language use exposure and school language questionnaire were analysed qualitatively and interpretively using thematic content analysis. Theoretically-derived *a priori* categories (e.g. use of materials from school and activities involving use of print) and empirically-derived (e.g. reasons for choice of LoTL) categories were utilised. These results were discussed in section 3.3.1, and were used to guide the theoretical development of this study. There is an element of subjectivity in qualitative data analysis, which in turn demands the researcher to be mindful of any bias in interpreting test results (Foxcroft & Roodt, 2005). Bearing this in mind, fifty percent of all questionnaires were rescored by a second bilingual researcher. Item-by-item checks indicated 90% agreement between the two judges.

3.5.4.2 Quantitative data analysis.

Quantitative or mechanical methodology emphasises the detection of *patterns* of performance on measures. This allows conclusions to be drawn based on the confirmation of a set of observations using mathematical terms and leads to accurate and potentially generalizable results (Aron & Aron, 1999). To investigate the concepts of phonological awareness, breadth and depth of vocabulary, working memory, and reading, inferential statistical methods were utilised to quantitatively compare and analyse differences in performance on cognitive processing and reading measures in English LoTL in the three linguistic groups of the present study. Additional, within-group testing occurred when performance on cognitive processing and reading measures in the transparent L1 Afrikaans was compared to the opaque English (L2) of the biliterate Afrikaans-English bilinguals.

According to Gravetter and Forzano (2009), the first stage of statistical analyses involves checking the accuracy of input data and computing descriptive statistics (mean, standard deviations). Means and standard deviations reported in the next chapter were found to be within an appropriate range. The second stage of statistical analyses consists of statistical tests aimed at reaching conclusions based on the collected data. To ensure the validity of using planned parametric tests to analyse the data, it is imperative to check that dependent variables use an interval scale of measure, the data follows the normality assumption, and the data shows homogeneity of variance between groups (Wilkinson, 1999). In the present study, all of the tests are interval scale measures. Normality was checked using the Kolmogorov-Smirnov test of normality, with the results revealing sufficiently normally distributed data. Homogeneity of variance was checked using Levene's test, with the results revealing that sufficient homogeneity of variance existed. The next section discusses the value of each parametric test used to analyse the collected data of this study.

To examine between- and within-language effects, a multivariate analysis of variance (MANOVA) was used. MANOVA tests whether mean differences exist between a new dependent variable and an existing set of dependent variables. Wilks' Lambda is used to test the significance of mean differences. When a mean difference is significant then univariate analyses of variance are carried out. This is followed by Bonferroni post-hoc tests to determine exactly which groups are significantly different. In this process, Bonferroni corrections are used in order to correct for inflated Type I errors that occur when carrying out multiple comparisons (Gravetter & Forzano, 2009). Adjusted p values are indicated in the results section of the next chapter. Tests of statistical significance such as MANOVA are influenced by sample size. To provide an enhanced understanding of the size of significant differences among groups, effect size is reported in the present research. Effect sizes use standard deviations rather than standard errors, and thus are not influenced by the size of learner populations sampled (Rosnow & Rosenthal, 1991). Differences in effect size can be considered a standardised measure of group difference.

Pearson's correlation co-efficient (r) is a measure of the strength of the relationship between two variables, ranging from 0 to 1.00. The higher the value the stronger the relationship between two variables (Howell, 2002). Cohen's (1989) guidelines were used to interpret the strength of a correlation, with r = .10 – .29 considered a small relationship between two variables, r = .30 – .49 considered a medium relationship between two variables, and r = .50 or larger considered to be a large relationship between two variables. These guidelines were used to describe the manner in which phonological processing skills correlated with reading performance. An additional factor must be considered when interpreting the strength of a relationship between two variables, namely, the significance of the correlation. In the context of a correlation, the term significance means that a correlation found in the sample data is very unlikely to be just random variation. Instead, a significant correlation most likely represents a corresponding correlation that exists in the population

(Gravetter & Forzano, 2009). By applying Fisher's *z* transformations to Pearson correlation coefficients, the significance of the relationships can be determined. (Gravetter & Forzano, 2009).

Stepwise multiple regression analyses were computed on the data to determine which variables were predictors of reading achievement. The strength of using stepwise multiple regression analyses, is that it permits finding an optimal equation for predicting future randomly selected data sets from the same population, and finding an equation that predicts the maximum variance for the specific data set under consideration by simultaneous examination of the contribution of variables in relation to a specific outcome (Darlington, 1990). George and Mallery (1999) state that stepwise regressions select the variable with the greatest variance from all possible predictor variables added. As each variable is added, variables already selected are considered for elimination if they are deemed to be no longer contributing significantly. In summary, the only variables remaining in the model are those that make a significant contribution to the model (George & Mallery, 1999).

3.6 ETHICAL CONSIDERATIONS

Ethical issues are an invariable and integral part of research, particularly where human beings are the main focus of investigation, including research conducted with children in educational settings (Santrock, 2011). There are specific ethical principles that a researcher must bear in mind before starting and adhere to when planning and executing a research project, in order for research to have value in contributing to knowledge, and ultimately human improvement (Leedy & Ormrod, 2005). The following ethical principles were applied in the planning and execution of this research project.

3.6.1 Ethical clearance

Ethical clearance was obtained from the Human Research Ethics Committee at the University of the Witwatersrand (Protocol number: H0 91010, Appendix A). Permission to carry out the present study in a public school setting was obtained from the South African Gauteng Provincial Government (Appendix B). Permission from the principal of each public school that comprised the research sample was obtained (Appendices C and D).

3.6.2 Respect for the rights of participants

Letters of informed assent, describing the voluntary nature of the study, the purpose and procedures of the study were handed to parents before they were requested to grant written assent for their child to participate in the present study (Appendix E). As the participants were minors, assent to participate was obtained from them after a verbal explanation followed by a letter written at an age-appropriate level (Appendix F). The participants' right to privacy was respected at all times. Numbers were assigned to each participant, ensuring privacy and anonymity regarding scores on tests and information obtained on the home literacy and school language environment questionnaire.

No person other than the researcher had direct access to participants' identifying details, and all information that could identify a participant was removed from the research report. Participants were informed that their identifying data would be destroyed once the research project was completed. Participants were informed that the research results would be reported in a PhD. thesis, and that a summary of the results would be available to schools that constituted the contexts in which this research was carried out. In so doing, the researcher hopes that teachers at these schools will gain insight into cognitive processing skills linked to literacy achievement in their unique contexts, and they will understand the effect that these contexts may have on the development and achievement of these skills. Participants were informed that group results could be reported in a journal article.

3.6.3 Beneficence

The researcher utilised a research design that was appropriate, and strived to conduct the research in a competent and professional manner. Linguistic, social, and cultural characteristics of young monolingual and bilingual children were considered when selecting / developing culturally and linguistically appropriate assessment instruments and approaches—and when interpreting results to make the best decisions about their general language development and future academic development. To date, there is no model of literacy development in South Africa that addresses how differences in the linguistic and social environments of monolingual and bilingual children affect their cognitive functioning and reading attainment. Only a small number of studies have considered language related variables relevant to an explanation of reading development in linguistically diverse children (Greenop, 2004; De Sousa, 2006). The present study is unique in that it includes a number of language related variables to help to fill in the picture of how variability in children's learning environments contributes to variability in children's literacy development. The findings of this study should provide insight into culturally and locally appropriate models of reading development by investigating how language related variables affect the cognitive processes linked to reading attainment and the effects of bilingualism on cognitive development in order to gain an understanding of reading attainment in a multicultural and multilingual South African society. Teachers in South Africa may need to consider the impact of language factors (level of orthographic transparency; language of instruction; degree and nature of bilingualism) on the cognitive and reading development of monolingual and bilingual South African children to know how to improve academic success within the local language and literacy curriculum.

3.6.4 Non-maleficence

The current research did not, at any stage, pose any physical or psychological risks to participants, nor did it expose participants to any risks greater than the normal risks of day-to-day living. The participants were at the most inconvenienced by being subjected to the tests mentioned in Section 3.4. However, all the parents and participants knew beforehand exactly what this research processes required (Appendix H).

3.7 CHAPTER SUMMARY AND CONCLUSIONS

Literacy development in multilingual contexts needs to be viewed and supported within the overall context of political, social, and economic forces that affect the use of language(s).

(Durgunoglu, 2002 p. 453)

The process of formal research requires a researcher to specify in detail, the research method used for the purposes of replication by future studies (Leedy & Ormrod, 2005). In this chapter, the method followed in carrying out this study was described. Research aims were stated and the research design was described. A detailed description of the sample was also provided. Materials and apparatus used for data collection were described. Procedures for collecting, recording and analysing the data were outlined. Ethical considerations in carrying out the study were pointed out. The context of the research was described. This chapter considered environmental learning experiences in relation to the family context and the social and cultural factors. The results presented in this chapter paint a dramatic picture of a complex network of eco-cultural factors playing a role on children's language experience, language development and reading achievement in general. Parental values, beliefs and attitudes towards choosing a specific language as LoTL determine the importance and power given to the language in question in terms of its perceived ability to obtain educational success and development. In addition, teachers' language repertoire and ability to adapt educational methods to a child's L1 are important environmental and social variables to consider in explain reading attainment in bilingual children. The findings broadly support the bio-ecological approach that argues that the context in which reading acquisition occurs can have an important effect on language learning (Amour-Thomas & Go-Paul-McNicol, 1997). The results presented in the next chapter address predictions that are more specific: how culturally determined patterns of language input to children lead to different patterns of linguistic and cognitive development and hence reading attainment in monolingual and bilingual South African children.

CHAPTER 4:
RESULTS, DISCUSSION OF FINDINGS, AND LESSONS LEARNED

4.1 INTRODUCTION: UNDERSTANDING WHY READING LOOKS DIFFERENT IN DIFFERENT LEARNING ENVIRONMENTS IN SOUTH AFRICA THROUGH THE LENS OF LANGUAGE

Subjective belief must be checked against objective reality.

(De Vos *et al.*, 2005, p. 45)

Language is a complex construct because it has two roles. In its public role, it is a system of conventions agreed upon by a group of people so that they can communicate with each another (Share, 2007). However, language also has another, private role, as a system of knowledge that each speaker has internalised in his or her own mind (Bialystok, 2007). Included in this view is the belief that successful reading acquisition in all languages and orthographies involves representing a finite set of recombinant sub-lexical units of speech to produce an infinite number of words with the meaning of words represented only indirectly. In addition, advanced readers have a store of instantly familiar words, each recognised as an integrated autonomous unit, because of years of daily print exposure (Adams, 1990; Share, 2007). Inefficient processing of print-to-sound correspondence is a universal feature of reading difficulties in all languages and orthographies (Share, 2007).

For language to be an effective tool for communication, the private systems of knowledge in the speakers' minds should closely correspond with the public system of linguistic conventions. It is because of this relationship that the public conventions of language can mirror what is happening in the most fascinating and elusive object in the entire universe - the mind (Bialystok, 2007). This line of reasoning has given the impression that language is based in human biology or a cognitive process that provides access to concepts and meanings, allows for problem solving and forms the basis for structuring and organising knowledge. But both language acquisition and reading development impose requirements on the social environment to be optimally achieved (Bronfenbrenner, 1977; Pinker, 1997). This chapter dwells on the nurture side of the controversy, because the role of language environment on cognitive functioning and reading competency in young children in multilingual and multicultural societies is especially and almost universally underappreciated (Bialystok, 2007).

Over the last several decades, research into reading has increasingly allowed researchers insight into questions regarding whether early experiences alter perception and information processing systems in ways that impact on children's learning, storing, processing and production of language (Conboy, 2013). The current research focuses on whether growing up with two languages, instead of only one, has effects on brain function and cognitive-linguistic development, and subsequently, on language learning ability (Bialystok, 2007). The benefit of developmental cognitive neuroscience research is that it can help inform best practices in the education of young language learners. However, a pitfall is that developmental cognitive neuroscience findings are sometimes misinterpreted by members of the educational community, and these misinterpretations may be used to justify questionable educational practices (Heugh, 2010; Krashden, 2000).

The goal of this chapter is to review some key findings from developmental cognitive neuroscience that are relevant to understanding the language and literacy attainment of young monolingual and bilingual children, present the results obtained in the present study, and to provide the reader with a conceptual framework for understanding those findings (Chapter 2, Section 2.8). The research reviewed includes studies that measure brain activity, examining the organization and functioning of language-relevant neural systems. Together with studies of children's learning behaviour, including performance on tests of general cognitive function (including executive control and working memory) and language and literacy, current research that indicates that learning and speaking more than one language results in a cognitive advantage in a variety of tasks. This cognitive advantage is detectable as early as seven months of age (Kovacs & Mehler, 2009), persists throughout childhood to adulthood, and even offers some protection against symptoms of Alzheimer's dementia (Craik, Bialystok, & Freedman, 2010).

Cumulatively, these studies have led to the following conclusions:

1. Language experience affects the organization of the neural systems involved in learning, storing, processing, and producing language (i.e. there is evidence of structural and functional differences between the brains of monolingual learners and biliterate bilinguals. (Kim *et al*., 1997).
2. Dual language learning, far from confusing children, may lead to advantages in many areas of cognition, but may also lead to some challenges, such as in tasks that require rapid word retrieval. Biliterate bilingual children may have smaller vocabularies, when each language is considered independently.
3. Furthermore, effects of dual language learning may depend on the specific languages the child is learning. (Bialystok, 2002).
4. Advantages for biliterate bilinguals seems to be associated with developing proficiency and competency in both languages and thus providing bilingual children with high-quality interaction in both languages is a critical factor in children's cognitive-linguistic development (Bialystok, 2007; Krashden, 2000).

In sum, this chapter will attempt to provide recommendations and implications for how educational practitioners and policymakers can translate evidence from developmental cognitive neuroscience research into best practices in the education of young bilingual children.

4.1.1 Conceptual framework: A bio-ecological approach to language learning

A bio-ecological approach to cognitive-linguistic and reading development (Armour-Thomas & GoPaul-McNicol, 1997), and related approaches such as neuroconstructivism (Karmiloff-Smith 2008; Westermann *et al.,* 2007), provide a theoretical framework for thinking about relationships between children's early language experiences (such as dual language learning), children's cognitive-linguistic skills in each language and reading attainment. In contrast to frameworks that pose questions regarding the relative roles of "nature" and "nurture" in various aspects of cognitive-linguistic and reading development, the bio-ecological approach to cognitive-linguistic and reading development assumes that a dynamic interplay exists between nature and nurture which influences both the structure and the functional organization of the brain throughout development (Diamond, 2008). Moreover, this approach does not assume that there is a unidirectional causal path from maturation of particular brain areas to the use of those brain areas for cognitive behaviour such as language. Instead, it assumes that specialised systems for complex cognitive behaviour such as language, emerge as a product of experience, and that there are bidirectional influences between genes, structural brain changes, and cognitive functions. According to this approach, humans inherit a genetic blueprint that guides certain aspects of development. At the same time, the child's environment can influence which genes are expressed. This process is termed probabilistic epigenesis (Gottlieb, 2007). Elaborating on this, genetic influences on brain maturation influence how much a child can process information, and thus learn, from his / her environment at various points in development with previous learning influencing further learning by changing the brain's structure and function (Gottlieb, 2007).

In summary, neuroconstructivism views brain development as being dynamic through the lifespan, instead of ending after a specific point of maturation is reached. Moreover, cognition is viewed as being constructed in a progressive manner; new cognitive abilities coming into being based on previous, simpler ones. In this way, development itself changes the manner in which further development occurs (Westermann *et al.,* 2007). Moreover, such an approach provides a means by which educational practitioners might be able to take into account the cultural influences and the social contexts in which cognitive-linguistic processes linked to reading attainment are demonstrated, including the roles that language and culture play in the cognitive-linguistic development and reading attainment of children with different linguistic profiles and literacy-learning environments (Armour-Thomas & GoPaul-McNicol, 1997; Bonfrenbrenner, 1979; Bialystok, 2007;Vygotsky, 1978). This chapter presents how a bio-ecological approach and related neuroconstructivist perspective may be applied to understanding and explaining the following dynamic aspects of language learning and use that has been noted in the empirical literature:

- Differences in the cognitive development and functioning between bilingual individuals (who control two different vocabularies, sets of speech sounds, and systems of grammatical rules) and monolingual individuals (who control only one language);
- Different patterns of cognitive development and functioning for processing each of the same individuals' languages, with which they have different experiences and levels of expertise, even when the two languages are acquired in early childhood;
- Differences in the cognitive development and functioning within individuals as they learn another language, or as they become more or less proficient in one of the languages that they already know due to increases or decreases in use over time;
- The apparent positive consequences on cognition in the case of children who develop proficiency and competency in two languages via high quality home and school interactions.

Westerman *et al.* (2007) point out that the objective of neuroconstructivism is not to reduce complex cognitive behaviour such as language to descriptions at the neural level or to map language to specific regions of the brain. Instead, its objective is to provide a model of how language is represented in the brain through the progressive elaboration of cortical structures. At the same time, aspects of early brain development associated with language knowledge and use are influenced by the contexts in which monolingual and bilingual children develop. Thus, in order to consider how the bio-ecological approach might be applied to understanding and explaining reading attainment in monolingual and bilingual children, the reader needs to consider how key cognitive-linguistic processes are linked in reading development and how they might be influenced by the b contexts in which monolingual and bilingual children develop. These are summarised in the next section.

In this study, an adapted version of Frith's (1995) reading framework was used. It views reading as comprising four levels. The *biological and cognitive levels* influence the *behavioural level* in a reciprocal manner. The *behavioural level* includes the output of reading, such as word reading and comprehensions. The environment level influences all of the previously mentioned levels. It includes the cultural influences, as well as the social contexts in which the cognitive skills linked to reading are demonstrated (Figure 4.1). The environmental level includes level of orthographic transparency, level of bilingualism, degree / type of bilingualism and language of instruction at school on the development of reading and the cognitive processing skills linked to reading achievement in a first language and / or L2 (Table 4.1).

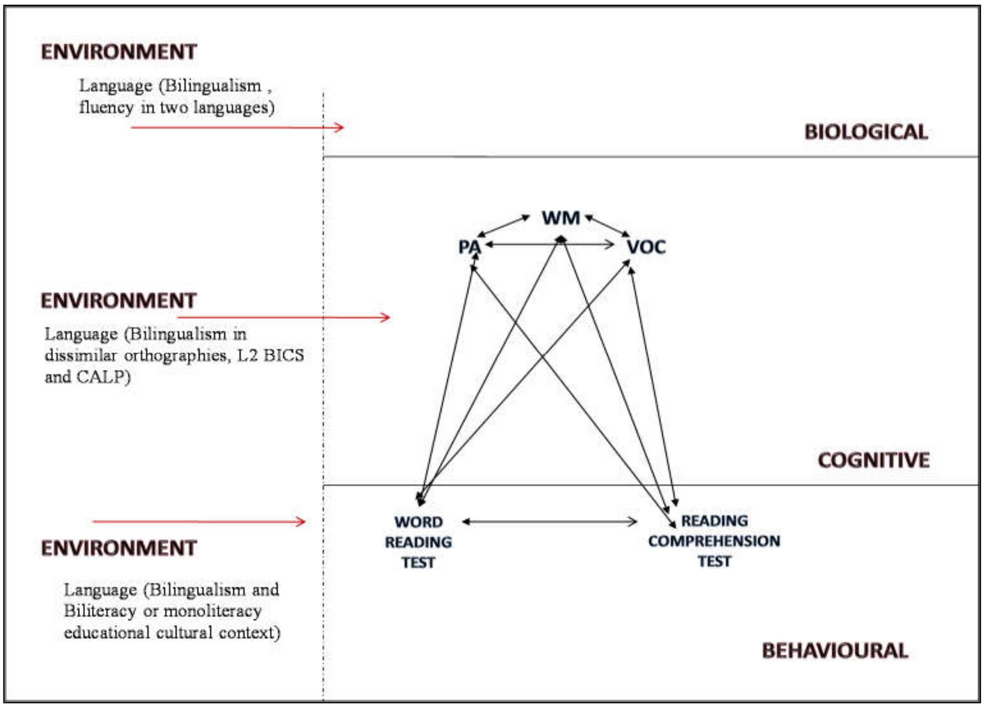


***Figure 4.1*: Revised summary of Frith's reading framework (1995) incorporating relationships assessed, utilised in the present research.**

Table 4.1: Factors involved in a framework for reading in South Africa.

Factor	Variable
Biological	Biological factors include general intelligence and specific areas active when the brain performs a specific task, and the impact that genetics and environmental stimulation may have had on brain development. This level was not measured in this study, because as Deutscher (2010, p. 3772) points out, "*the most sophisticated MRI only reveals where there is increased blood flow at any given moment, and we infer from this that more neural activity is taking place there. But we are nowhere near being able to understand what is "said" in the brain. We have no idea how any specific concept, label, grammatical rule, colour impression, orientation strategy, or gender association is actually coded*."
Cognitive	Cognitive factors impact directly on the *behavioural level*; we infer from this that skills that underlie reading ability such as phonological awareness, vocabulary knowledge and working memory can be used to measure and to determine reading ability at the *cognitive level* due to past research that has shown that these skills predict current and future reading ability in both monolingual and bilingual children (Wagner & Torgeson, 1987; Geva & Siegel, 2000; Everatt *et al*., 2000).
Behavioural	Behavioural factors are those that are directly observed; in effect, the activity of reading and moving through text to decipher what the writer has written. In this study, those behavioural factors were measured by reading words and answering comprehension questions on a text.
Environmental	The *environmental level* is varied and diverse, including level of orthographic transparency, level of bilingualism-absolute and relative levels of first language / L2 proficiency, and language mode and medium of literacy instruction at school. All of these have been shown to mediate the development of reading and its composite cognitive processing skills in bilingual children (Share, 2007; Cummins 1999; Krashen, 2000). Few studies have incorporated measures of the many language-related variables at the environmental level that influence the reading process in bilingual children. In this study environmental factors were measured by noting structure of language(s) of instruction, socio-linguistic factors in relation to L1 or L2 reading acquisition and use of home language as LoTL as factors operating at the home-school-level (Heugh, 2002; 2010).

4.1.2 Language environments and language and literacy development and cognitive functioning

By the time, a child is born, his / her brain contains most of the neurons it will need. During this time, major sensory pathways are already able to process input and are therefore ready to learn from the external environment (Lebel & Beauliey, 2011). At the same time, there is research evidence that connections between neurons (synapses) are created in response to challenging learning situations in adulthood, in particular the hippocampus in the medial temporal cortex which is known to be important for memory formation (Deng, Aimone, and Gage, 2010). This pattern has also been reported in adult animals in response to learning situations such as rodents reared in relatively “enriched” (as opposed to deprived) cages (Van Praag, Kempermann, & Gage, 2000). Thus, there appears to be a causal link between connections of neurons (synapses) and experience or learning, suggesting that variations in cognitive performance are due to genetic or environmental influences, or inseparability of environment or context and cognition as found in the bio-ecological approach to cognitive assessment (Armour-Thomas & GoPaul-McNicol, 1997).

For example, the auditory cortex, in the temporal lobe of the brain, at and even prior to birth, can process and remember speech and other complex sounds, suggesting that the human brain is equipped to process language from birth - termed absolute functionality (Kisilevsky *et al.,* 2009). However, the physical environment can limit the way in which brain regions communicate with other brain areas - termed task specificity functionality (Clancy & Finlay, 2001). Studies of foetuses and pre-term infants provide the opportunity to examine the degree to which the foetal environment influences learning compared with brain maturation. According to Kisilevsky *et al.* (2009), by the third trimester of gestation, the auditory, sensory and perceptual areas of the foetal brain are sufficiently developed to detect fine-grained distinctions between speech sounds (e.g. the difference between the vowel sounds “ah” and “ee”). However, foetuses cannot hear all of the differences in speech sounds because the amniotic fluid in the uterus filters out sounds with frequencies above 500 Hz (hertz, or cycles per second). Thus, at and even prior to birth, children can perceive fine-grained distinctions between speech sounds, but the physical environment can have an important effect on how development proceeds.

Similarly, behavioural studies in which children are trained to provide an overt response such as turning the head when a sound changes, have indicated that infants can distinguish different speech sounds of both their native language and non-native languages at six to eight months, but only those from their native language at 10 to 12 months (Werker & Tees, 1984). This pattern of developmental change linked to language experience has been replicated in other behavioural studies and in brain-imaging studies (Fava, Hull, & Bortfield, 2011). The decline in the ability to distinguish sounds from a language that the infant is not hearing in his or her daily input has been interpreted as showing the use of general cognitive abilities that allows him / her to ignore irrelevant sounds while attending to relevant ones (Conboy, Sommerville, & Kuhl, 2007). Data from brain-imaging studies has shown a functional link between brain areas underlying speech perception (the superior-temporal Wernicke's area) and speech production (the inferior-frontal Broca's area) between the ages of six and 12 months (Imada *et al.,* 2006). Therefore, when infants begin to practice producing speech sounds in their first year, this may change how they perceive speech sounds and lead to the establishment of new neural pathways. This in turn means that differences across children in brain structure and / or function can be expected, and such differences can be expected to lead to variability in future learning, including language and literacy development (Frith, 1995).

A genetic factor that alters some aspect of early brain development (for example, one that causes a language learning disability, such as dyslexia), could diminish a child's readiness to learn from the environment, affecting subsequent experience-dependent aspects of brain development. This in turn, further diminishes learning, widening the academic achievement gap between the affected child, and as his / her peers (Frith, 1995). At the same time, a normal developing brain could be altered given small variations in experience, such as amounts or types of language input (Bialystok, 2007). In this context, the bio-ecological approach to cognitive assessment predicts that in any group of learners (monolingual, biliterate bilingual, or emergent bilingual), differences in language experience will affect language functioning and subsequent learning. For example, Rogoff and colleagues (2003) report differences in attentional abilities and nonverbal communication between children from Spanish communities and children from Western communities, and they show that parent educational level modulated these differences. In some ways, research from cognitive neuroscience is consistent with the bio-ecological approach. Children with high socio-economic status (SES) were more likely to show specialisation of function limited to the left Inferior Frontal Gyrus (IFG) than were children with low SES who showed engagement of both the left and right hemisphere IFG. Functional specialisation means use of specific brain regions for language processing, and this is considered a sign of brain efficiency (Raizada &

Kishiyama, 2010). Therefore, functional specialisation is an indicator of relatively stronger language skills and greater efficiency in how the brain processes language associated with high SES children.

Other research has found that experiential factors may play a greater role than maturation factors. For example, Conboy and Mills (2006) record event related potentials (ERP) to known and unknown English and Spanish words in 19- to 22-month old bilingual toddlers. All of these children are learning English and Spanish simultaneously, but have an uneven development across languages. Each child's dominant language is determined by having parents complete a questionnaire on language exposure and use in English and Spanish. For both languages, ERP amplitudes are significantly larger for the known versus unknown words, consistent with findings for monolingual infants and toddlers (Pearson, 2002). However, the word recall patterns varied in Spanish-English bilingual children, for their dominant and non-dominant languages. These children processed words more rapidly in their dominant than in their non-dominant language, reflecting greater word familiarity and ease of lexical access in the dominant language (Levelt, 1989). This pattern of finds was explained as reflecting experiential factors, not brain maturation, because maturation was held constant. In addition, it was found that unlike monolinguals of the same age, bilingual toddlers show ERP effects broadly distributed across the brain rather than limited to left electrode sites. Moreover, bilingual toddlers knew approximately the same numbers of words in *each* of their languages as the younger monolingual toddlers. In other words, developmental language milestones are achieved in bilinguals but in slightly different ways to monolinguals (Berhardt, 2003). Other studies that have found that bilingual word learning leads to initially smaller vocabularies in *each separate language* than for monolingual learners of those same languages. This is because the total vocabulary size, the sum of what bilingual toddlers know in both their languages, is similar to that of same aged monolingual toddlers (Pearson, Fernandez, Lewedeg, & Oller, 1997). Thus, the organization of the brain for language processing is influenced by experience with language and thus second language experience can change structural and functional properties of the mind.

Bilingual speakers process information in ways that are different from those of monolinguals. In addition to sorting out conflicting cues to speech sounds, word structure, and sentence structure, bilingual speakers frequently process language under mixed-language conditions (i.e. hearing words from both languages mixed into the same sentence or conversation). Enhanced functioning on non-linguistic tasks that require executive functions, such as working memory, inhibitory control, and the ability to control attention to relevant versus irrelevant cues, is seen in pre-school and school-aged bilingual children (Carlson & Meltzoff, 2008) and adults (Bialystok *et al.,* 2004; Ransdell, Arecco, & Levy, 2001). For example, Ransdell *et al.* (2001) report that skill in a second language confers long-term working memory benefits in performing dual language tasks. These researchers found that bilingual adults were better able to maintain native language writing quality and fluency in the presence of unattended irrelevant speech while maintaining a concurrent 6-digit memory load compared with monolinguals. These authors interpreted this finding to mean that inhibiting the non-active language of input during dual-task performance was possible due to high levels of language experience, which, in, turn, allowed bilinguals to cope effectively with the storage and processing demands of working memory tasks.

Shafer, Yu, and Datta (2011) use ERPs to directly compare the speech sound discrimination skills of bilingual and monolingual infants and young children learning English and Spanish in New York City. Children are tested on 22 sounds (vowels) that are found in English but not in Spanish. The ERPs show discrimination, but the effects vary by age and language experience (monolingual versus bilingual). In particular, bilingual infants have higher levels of attention while processing the speech sounds. This result is confirmed in a subsequent study (Shafer, Yu, & Garrido-Nag, 2012). In other words, enhanced attention during speech processing can be conceptualised as an adaptive strategy that comes about due to bilingualism, which gives bilingual children the ability to keep pace with their monolingual peers in achieving developmental milestones in language.

There are other reasons why bilingual children's cognitive processing linked to reading attainment would be different from that of monolingual peers. One possibility is the need to learn and manage conflicting sets of cues for each language, such as selectively attending to each language's sound patterns and grammatical rules, inhibiting the retrieval of words in one language when using the other language, and being able to translate and process mixed language input (Bialystok, 2002). For example, English has many two-syllable words with a stress pattern in which the initial syllable is of longer duration and higher intensity (loudness) than the second syllable (e.g. "mommy"). Initial consonants in English words are thus perceptually salient because they tend to be louder and longer than other sounds in the word. This saliency helps listeners to recognise individual words, but emphasis on the initial parts of word is not common to all languages, termed the orthographic depth hypothesis (Snowling, 2000).

For example, Vihman *et al.* (2007) use both behavioural and ERP methods to test infants' recognition of English and Welsh words. Their study shows that the stress patterns of each language account for distinct results across learners. Monolingual Welsh-learning infants did not show recognition of consonant-initial words at any point between nine and 12 months of age, whereas monolingual English-learning infants did so by 10 months, reflecting the stronger cues to word onset provided by initial consonants in English compared with Welsh. Bilingual English-Welsh infants recognised both English and Welsh words by 11 months, a pattern intermediate to those of the monolingual infants. However, this finding does not reflect a delay induced by bilingualism, because the bilingual infants in this study recognized words at an earlier age than did the monolingual Welsh infants. If there is a difference in the stress patterns, or orthographic depth, of the words in children's two languages, this may influence differences in letter-to-sound correspondence rules that could lead to the development of reading processes and skills between languages. The less transparent the orthography, the more complex the process of phonological encoding and decoding and, ultimately, teaching phonological awareness skills that are causally linked to reading achievement should take into consideration differences in the phonological structure of the home language relative to the school language to facilitate and promote reading attainment in bilingual children (Bernhardt, 2003).

The ability to recognise words depends on being able to perceive and processes speech sounds (phonemes). The perceptual abilities of bilingual learners may be explained to some extent by relative amounts of experience with each language. For example, Garcia-Sierra and colleagues (2011) present bilingual children with English and Spanish speech sound contrasts. Children who hear more English in the home show a larger discriminatory response for the English than for the Spanish contrast, whereas children who hear more Spanish at home show the opposite pattern, and children with more balanced input across languages show similar discrimination for each language. When these results are compared with the results from a previous study of monolingual infants, it is noted that the younger members of the bilingual group (six-month olds to nine-month olds) do not show exactly the same patterns as monolingual infants of that age. These results suggest differences in brain functioning across monolingual and bilingual children at different points in their bilingual development, underscore why monolingual standards are inappropriate for assessing bilingual learners, and that the relative amount of experience with each language, influences how the brain processes language. In other words, areas in the brain become established for each language based on experience with that language, and this process requires time, as well as rich input in each language.

Based on the aforementioned review of the literature, the cognitive processing skills used to read may be different to the extent to which the socialization experiences within one context are politically and psychological different from other contexts. In other words, cognitive and reading ability may reflect the sociocultural milieu in which they emerged and developed through social context (Armour-Thomas & GoPaul-McNicol, 1997; Bialystok, 2007; Vygotsky, 1978). This line of reasoning has led the researcher to conceptualise cognitive and reading behaviour as a bio-cultural phenomena and argue for a bio-ecological model approach to assess the cognitive functioning and reading competency of culturally diverse individuals in a more comprehensive and heterogeneous manner.

Bilingualism is positive adaptation to the environment; a valued precursor to greater linguistic flexibility and analytic ability. This in turn means that the cognitive demands of managing two languages may sharpen abilities in other domains, outside of language such as long-term working memory, and these enhanced cognitive abilities may be used to further process and learn language (Ransdell *et al.*, 2001).

Conboy (2013, p 15) has argued that *"there are differences across bilingual and monolingual children in functional specialisations for language, which should not be interpreted as evidence of a delay induced by bilingualism but rather as a distinct developmental pattern linked to experience with each language"*.

Such statements point to the importance of studying language and literacy differences in monolingual and bilingual children (Bernhardt, 2003). Moreover, as the number of bilingual children increase worldwide, it is vital that research on the cognitive advantages of bilingualism takes a more prominent role in the field of language and literacy development (Bialystok, 2010).

Research from the 1950s has appeared to demonstrate that children learning two languages acquired language more slowly than monolingual children and achieved smaller vocabularies. However, most recent studies that control for SES and language status on measures of language and literacy achievement, have found no differences in reading achievement between bilinguals and monolinguals (Bialystok, 2010). This finding suggests that SES and socio-linguistic factors rather than learning to speak and read in more than one language, contribute to children's smaller vocabulary size. (Bialystok, 2010). Similarly, the well-documented achievement gap between dual language learners and monolingual English children is viewed as providing evidence that dual language learning negatively affects children's language development and cognitive functioning. However, when SES and related variables are controlled for, the achievement gap is greatly diminished (Crosnoe & Turley, 2011). Indeed, dual medium education has the goal of developing full conversational and academic proficiency in both languages through the use of these languages for instruction (Thomas & Collier, 2002).

Research evidence exists that shows that dual language instruction programmes assist bilingual children to attain high levels of academic achievement in the L1 or L2 and even higher by the end of schooling. Despite widespread agreement about the successes of dual language instruction programmes implemented in the United States and Canada for speakers of Spanish, Cantonese, French, Portuguese, Arabic, or Japanese (Cummins, 2000; Thomas & Collier, 2002), there is not the same agreement about the success of these programmes in South Africa. Henning and Dampier (2012, p. 105) surmise:

> *The research in South Africa does not as yet have data to echo what bilingual research in the USA, such as Thomas and Collier (2002), has found after decades of large-scale research. We are not convinced, either that these findings can be applied to the South African context, as most of the research in that vast literature concerns Spanish and English, or French and English. In the case of Canadian research, languages from the Indo-European group share may similarities in syntax and morphology with English. This is not the case with indigenous South African languages.*

However, a potential problem with Henning and Dampier's (2012) argument is that it appears to misinterpret the benefits of learning multiple languages early in life, and ways that dual language education positively influences children's reading attainment and cognitive functioning. It assumes that the benefits of dual language instruction are only possible in languages that share cognates and the large number of languages in South Africa are conceived as an impediment for the success of dual language programmes. This argument could be used to justify questionable educational practices, i.e. condemnation of dual language programmes and used to promote an English-centric perspective if used in conjunction with data from poorly conceived or implemented dual language programmes. In fact, research evidence for the benefits of dual language instruction for reading attainment in languages that do not share cognates, has been found (e.g. Cantonese / English) (Uchikoshi, 2012).

What is additionally troubling, is that consistent conclusions that the benefits of early mother tongue literacy and home language maintenance for academic achievement in bilinguals, spans a number of language pairs, is seen as dubious. Moreover, according to Heugh (2010, p. 179), Henning and Dampier’s (2012) statement echoes:

> *old suspicious, conspiracy laden discourse of apartheid where active measures were taken to 'protect' South Africans from gaining access to 'dangerous ideas' from beyond the country's borders. It would be foolish if one were to seek succour in the vacuum of academic isolationism, which existed during the years of apartheid. It is important to keep abreast of international findings and developments since the country's survival during the phase of globalisation depends upon this.*

Heugh (2010, p. 179) further points out:

> *Why is it that sources who have not kept abreast of research in the area, are cited as the authoritative voices in literature which continues to support the status quo position, namely, a replacement of first language in education by English mainly?*

This point is discussed in more detail in a later section of this chapter, when the results of the present study are compared with poorly conceived or implemented dual language programmes that implicitly or explicitly impede the implementation of bilingual education for all children in South Africa.

While the effects of language related variables on children's cognitive functioning and reading competency may appear less impressive than those of complex, causal modelling of reading growth and identifying predictors of reading growth flaunted in the past (Wagner, *et al*., 1993), we shall see that some of them are no less striking after all. The next section presents the results and discussion of the results of this research into language related factors on reading attainment in monolingual and bilingual children, together with conclusions reached and possible future directions research of this nature may take, and outlines the two research hypotheses of the present study (Figure 4.2).

Research hypothesis one deals with different aspects of learning to read in two orthographically dissimilar languages (i.e. Afrikaans and English) concurrently. It explores whether differences found reflect that delays or deficits exist and represent an adaptation to the unique circumstances of learning to read in two languages, which, in turn, can result in cognitive advantages when both languages are supported pedagogically and philosophically via enriched learning opportunities at home and at school (Bialystok, 2007). Research hypothesis two focuses on whether providing continuing support for children's mother tongue / home language as they learn English is important for optimal English language learning across all cognitive processing skills associated with reading development. At the same time, how learning to read in more than one language affects executive control and working memory through teaching practices and collaboration with families that specifically enhance the reading attainment and cognitive functioning of biliterate Afrikaans-English bilingual children, is explored. As a set, these two research hypotheses reflect the most current research related to reading attainment and cognitive functioning of young bilingual children. They provide insight into how bilingual children learn to read in two languages, and how they develop cognitive processing skills in verbal and visual-spatial domains. It is hoped results from these research hypotheses will be an invaluable resource for how to support the reading attainment and cognitive development of young bilingual children in South Africa.

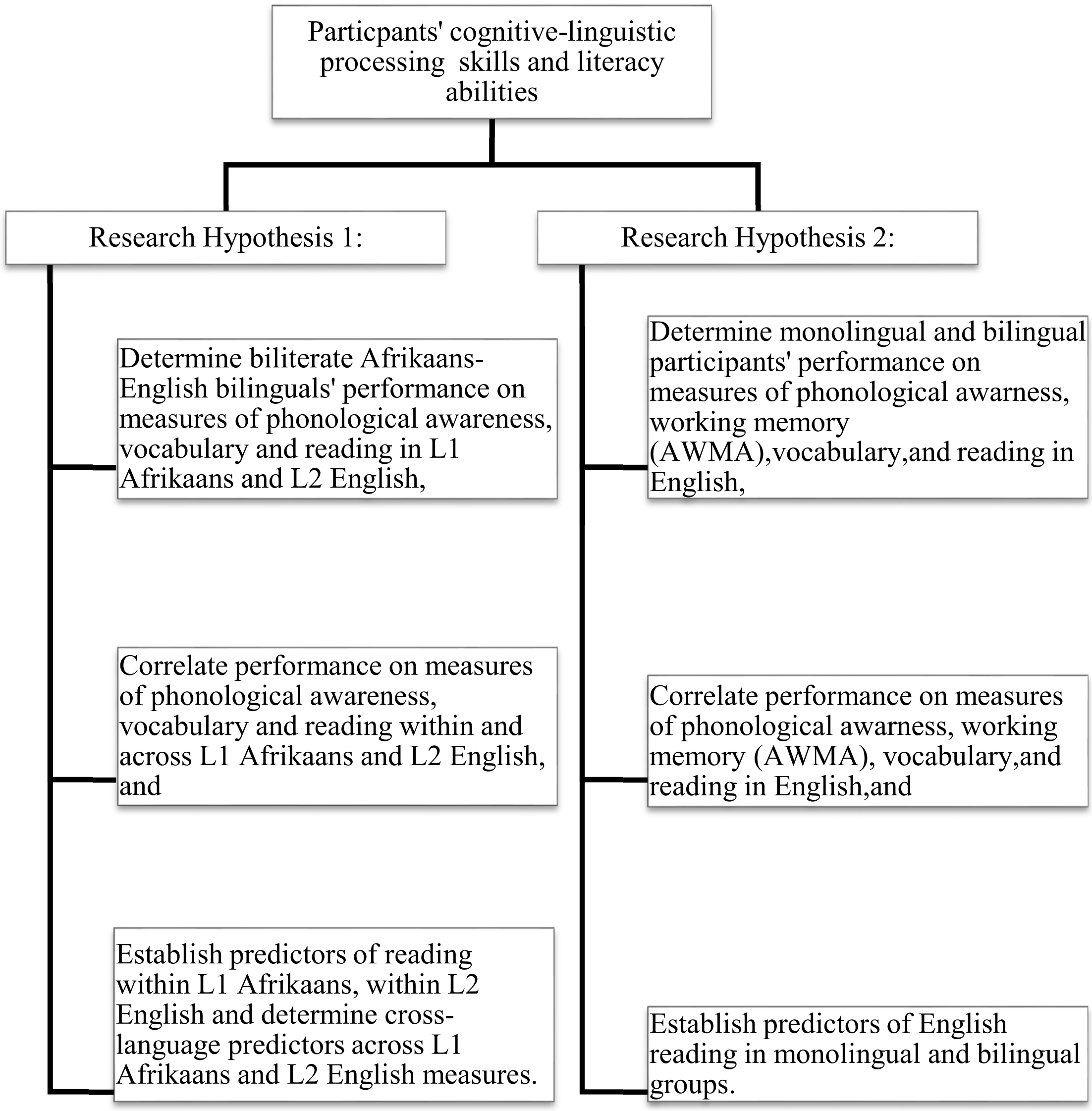


***Figure 4.2*: Outline of presentation of results.**

4.2 RESEARCH HYPOTHESIS 1

1. Phonological awareness and vocabulary skills in L1 (Afrikaans) will be related to word reading in L1;
2. Phonological awareness and vocabulary skills in L1 (Afrikaans) will be related to word reading in L2 (English);
3. Phonological awareness and vocabulary in L2 will be related to word reading in L1;
4. Phonological awareness and vocabulary in L2 (Afrikaans) will be related to word reading in L2;
5. Biliterate Afrikaans-English bilinguals will perform differently on measures of phoneme and word reading in L1 Afrikaans relative to L2 English, and
6. Biliterate Afrikaans-English bilinguals' phonological and vocabulary skills in L1 Afrikaans will make a positive contribution to L2 English reading performance.

The aforementioned research sub-hypotheses address an integrative hypothesis using the adapted version of Frith's (1995) framework. This integrative hypothesis concerns language related factors (level of orthographic depth, level of bilingualism, learning to read in two languages simultaneously with equal status attributed to both languages in the schooling and home settings) at the *environmental level* influencing performance both tests of phonological awareness, vocabulary knowledge, and reading ability at the *biological and cognitive and behavioural levels* respectively. Through such research, support for the roles of language on the relationship between *biological* / *cognitive and behavioural levels* can be ascertained.

4.2.1 A cognitive and reading profile in Afrikaans and English

4.2.1.1 Comparison of performance on cognitive processing tasks and literacy measures for L1 Afrikaans and L2 English in biliterate Afrikaans-English bilinguals

The mean scores and standard deviation scores for the cognitive processing tasks and reading measures in Afrikaans (L1) and L2 English of the biliterate bilingual Afrikaans-English children are presented in Table 4.2 and illustrated in Figure 4.3. This data indicated quite variable performance in both L1 Afrikaans and L2 English in biliterate Afrikaans-English bilinguals ($N = 100$). Examination of the distributional properties of the tasks indicated that the data was sufficiently normal to conduct parametric data analyses. Other parametric assumptions of observations independence and interval scale of measurement were also met (Whitley, 2002).

A multivariate analysis of variance (MANOVA) was performed between L1 and L2 phonological awareness, vocabulary, and reading measures to determine if significant differences emerged between the two orthographically dissimilar languages. This analysis demonstrated that performance was significantly different for the two languages, Wilks' Lambda, $F(1, 98) = 26.55$, $p < .001$. Given this result (see e.g. Coolican, 2004), seven F-tests were carried out between L1 Afrikaans and L2 English phonological awareness, vocabulary, and word-reading measures as the dependent variables. Type I error rates among the seven F -tests were controlled through Bonferroni adjustments (only accept variables that have a significance of less than 0.004). These results are summarised in Table 4.2.

Table 4.2: Descriptive statistics and MANOVA results for phonological awareness, vocabulary and word reading measures in L1 Afrikaans and L2 English of biliterate Afrikaans-English bilinguals.

	AL1		EL2		*F*-score (1,98)	Effect size Cohen's d
Measure	**Mean**	**SD**	**Mean**	**SD**		
Word reading	70.59	9.07	63.92	10.47	16.23***	.68
Comprehension	11.84	2.70	11.80	2.13	2.10	-
Onset level of PA	8.14	1.65	7.61	1.81	5.29	-
Rime level of PA	7.27	1.85	6.90	1.92	1.39	-
Phoneme level of PA	14.17	1.86	13.07	1.48	11.74***	.60
Definitions breath of VOC	16.14	2.64	16.54	2.92	.71	
Similarities depth of VOC	25.82	2.07	25.42	2.66	1.02	-

Note: AL1 = Afrikaans (L1), EL2 = English (L2), M = mean, PA = phonological awareness, SD = standard deviation, and VOC = vocabulary. Significant *at $p < .001$. d = Cohen's d, with d = .10 - .20 = small effect size, d =.30 - .59 moderate effect size, and d = .60 and above large effect size.

4.2.2 Results and interpretation

From Table 4.2 it can be seen that the mean number of words read in L1 Afrikaans was higher (M = 70.59, SD = 9.07) than the mean score for words read in L2 English (M = 63.92, SD = 10.47). The difference between the means was significant, F (1, 98) = 16.23, p <.001, two tailed. Similarly, the mean number of words read in L1 Afrikaans was higher (M = 14.17, SD = 1.86) than the mean score for words read in L2 English (M = 13.07, SD = 1.48). The difference between the means was significant, F (1, 98) = 11.76, p <.001, two tailed. Both statistically significant results also demonstrated a moderate-to-large effect size following (Cohen's 1961 effect size interpretative guidelines cited in Graveter and Forzano, 2009). These results provide evidence that suggests that word reading and phoneme deletion ability were less easily attained in the opaquer orthography (English) than in the transparent orthography (Afrikaans) supporting sub-hypothesis 1e, consistent with predictions of *the scripts-dependent hypothesis,* which proposes that reading attainment varies across languages, such as the two dissimilar orthographies in biliterate Afrikaans-English bilinguals.

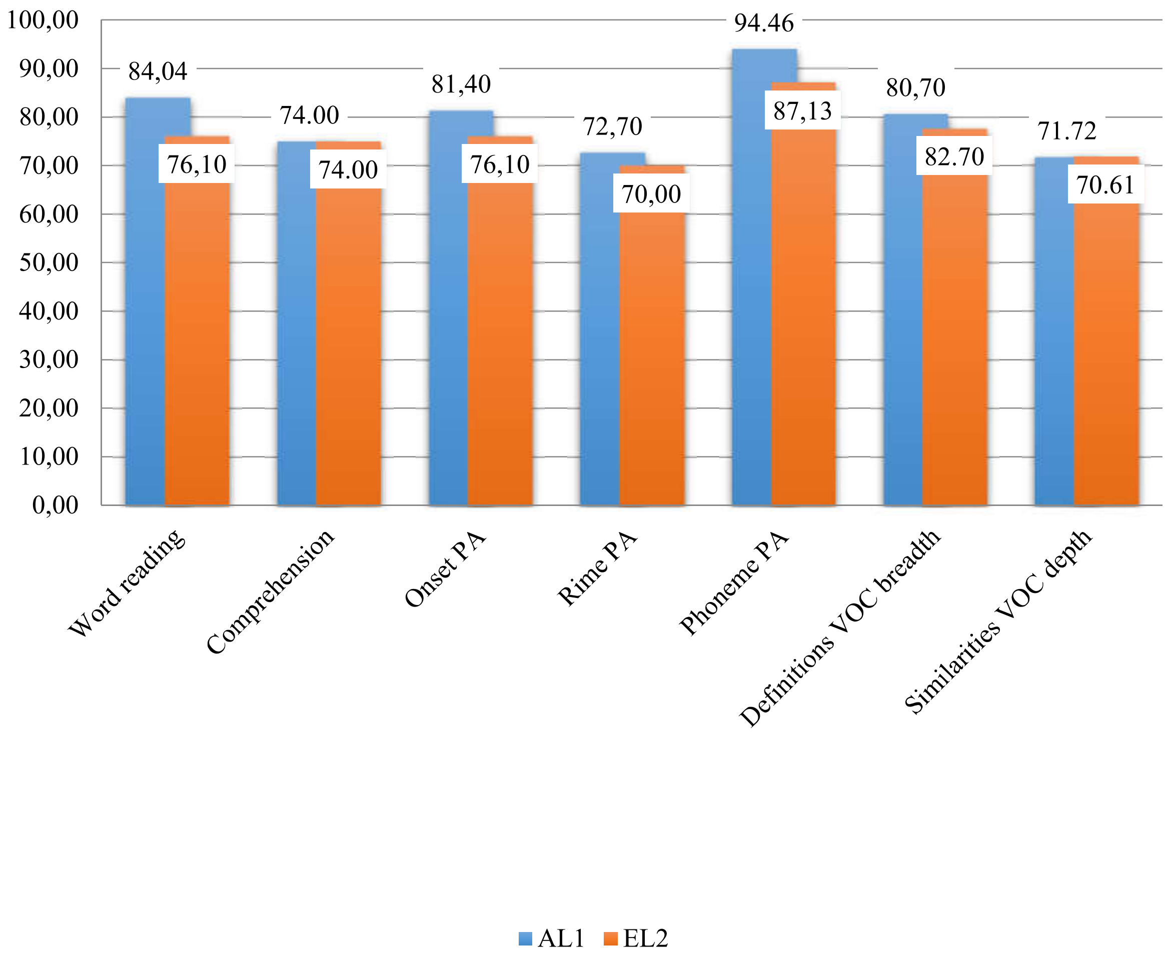


***Figure 4.3*:** **Proportion of phonological awareness and vocabulary tasks and reading measures answered correctly in the L1 Afrikaans and English (L2) of the biliterate Afrikaans-English bilinguals.**

Note: AL1 = Afrikaans (L1) and EL2 – L2 English, PA = phonological awareness, VOC = vocabulary.

4.2.2.1 The relationship between L1 Afrikaans and L2 English cognitive processing and reading measures

Pearson correlational analyses were performed to investigate inter-relationships between L1 Afrikaans and L2 English phonological awareness, vocabulary and reading measures. Table 4.3 presents these inter-language cognitive processing and reading correlations.

Table 4.3: Pearson correlations between L1 Afrikaans (shaded area) and L2 English (L2) (non-shaded area) measures. Inter-language relationships are shown in *italics* along the diagonal.

		L2 English						
	Measure	**Onset**	**Rime**	**Phoneme**	**Word read**	**Comp**	**SIM**	**VOC**
	Onset	.75***	.52***	.22*	.39***	.39***	.24***	.19***
L1 Afrikaans	Rime	.31***	.70***	.28**	.44***	.46***	.41***	.23***
	Phoneme	.56***	.24***	.73***	.21***	.21*	.29**	.28***
	Word read	.29***	.21***	.35***	.82***	.73***	.53***	.21***
	Comp	.28**	.34***	.29**	.66***	.82***	.59***	.22*
	SIM	.27**	.27**	.27**	.35***	.45***	.70***	.50***
	VOC	.30**	.33***	.23**	.29***	.21*	.28**	.70***

Note: Onset Afrikaans/English = onset level of phonological awareness, Rime Afrikaans/English = rime awareness level of phonological awareness categorisation test, Phoneme Afrikaans/English = phoneme level of phonological awareness, Word read Afrikaans/English = single word reading test, Comp Afrikaans/English = reading comprehension test, SIM Afrikaans/English = similarities-breadth of vocabulary, VOC Afrikaans/English = expressive-depth of vocabulary. Significant at p < .05; ** correlation significant at p < .01; and *** correlation significant at p< .001.

The data in Table 4.3 suggests that performance in one language was highly related to performance in the second; significant, strong positive correlations were evident in phonological awareness, vocabulary and reading measures across the two languages with r_s (99) = .70 - .82, all p_s < .001, two tailed. These statistics provide evidence of the use of similar cognitive-linguistic processing skills, phonological awareness and vocabulary across the two languages despite differences in orthographic depth between the two languages supporting sub-hypotheses 1a-d. These results are consistent with predictions of the *central processing hypothesis*, which states that common underlying cognitive-linguistic processes influence the development of reading across all languages and children with poor performance in such skills are more at risk for developing reading difficulties than those with good skills in these areas (Geva & Siegel, 2000).

However, the correlations between L2 English cognitive processes skills and word reading tasks were significantly higher, with r_s (99) = .19 - .53, p <. 001, than the smaller positive correlations between Afrikaans (L1) cognitive processing skills word reading tasks, with r_s (99) = .23 - .35, p <. 001 (Table 4.3 Almost identical findings are reported by Geva *et al.* (1993) who have found a correlation between pseudo-word reading and phonemic awareness of 62 for English but only .23 for Hebrew in first-grade Canadian English-Hebrew bilinguals. Wimmer and Goswami (1994) suggest that children with reading difficulties are to some degree successful at phoneme manipulation in a transparent orthography when word reading accuracy is considered. In the Afrikaans / English data, decoding and reading in the transparent orthography, Afrikaans, was developing at a faster rate than in the less transparent orthography, English. The latter orthography requires lexical-semantic information to cope with the ambiguity of English spelling. To the extent that phonological decoding and reading differences found in the present study reflect phonemic analysis, the data provides support for the idea that phonemic awareness is acquired more rapidly and easily in a transparent Afrikaans than in an opaque orthography such as English. This is consistent with predictions of *the scripts-dependent hypothesis.* The latter posits that the less transparent the orthography, the more complicated the process of phonetic decoding and the acquisition process (Geva & Siegel, 2000).

Unlike previous studies that neglected to compare well-matched participants from the same culture or compared different languages in the same sample of bilingual children, or did not control for psycholinguistic dimensions such as word length, word frequency, syllabic length and structure, this study did consider these factors. Therefore, the findings indicate that orthographic depth alters the rate and course of reading development for different languages in bilingual children. Predictable grapheme-phoneme correspondence rules in Afrikaans resulted in higher phonological decoding and word reading accuracy. This will likely occur even when introduced alongside an opaque orthography such as English and, even when both languages are acquired from birth and attributed equal status in the schooling environment.

The next stage of the analysis involved carrying out Fisher Z tests to investigate the statistical significance of the relationships between phonological processing skills and word reading, between Afrikaans (L1) and L2 English in the biliterate Afrikaans-English bilinguals. Of the correlations shown in Table 4.3 only the relationship between *onset-phoneme* was significantly different between the two languages with $Z = 2.850$, $p < .01$, with $r\ (99) = .56$, $p < .001$ in L1 Afrikaans and $r\ (99) = .22$, $p < .05$ in L2 English. This pattern of findings demonstrates that different orthographies require different phonological levels of input for reading success, and, different orthographies influence the linguistic level that bilingual children find salient for reading (Ziegeler & Goswami, 2005). Afrikaans is transparent and easier to decode using simple letter-to-sound correspondence rules (phonics approach) while English has complex letter-to-sound mappings that are often not predictable at the phoneme level and thus a whole-word approach is utilised (Botha *et al.*, 1989). Therefore, component processes utilised during the development of reading and phonological decoding in different languages cannot be assumed to be the same, and theories that make this assumption are inappropriate for explaining how bilingual children learn to read in orthographically dissimilar languages (Ziegeler & Goswami, 2005; Share, 2007).

A corresponding analysis focusing on whether there was a real difference in the relationships between cognitive processing and reading skills between L1 Afrikaans and same-aged L1 English monolingual peers was carried out. Table 4.4 presents these results. These results showed that there were significantly different correlations between the two linguistic groups. Correlations for cognitive-linguistic processing and word reading ability were significantly higher in L1 English monolinguals than the small-to-moderate correlations for the L1 Afrikaans of the biliterate Afrikaans-English bilinguals. The latter often just reaching significance, while the former were strongly significant at the $p < .001$ level. Again, this shows support for *the scripts-dependent hypothesis* as the development of reading processes and skills varies with orthographic transparency. Cognitive processing and reading skills in Afrikaans were developing at a faster rate than in English. This finding can be attributed to Afrikaans having more predictable grapheme-phoneme correspondence rules than English does, and, therefore, being easier to decode, than in English.

Inspection of Table 4.4 reveals a weaker reading-phonemic awareness in L1 Afrikaans - a phonemically more transparent orthography compared with English. This result is consistent with the other research in transparent languages that report a decline of the phonemic-reading relationship and inflated correlations between phoneme awareness and reading. (German: Wimmer & Hummer, 1990; Spanish: Goswami *et al*., 1998; vowelled Hebrew: Geva & Siegel, 2000; Italian: Cossu, 1999). In Latvian - a highly transparent orthography - Sprugevica, Paunina, and Hoien (2006, cited in Share, 2007) reported that a composite measure of phoneme segmentation and phoneme deletion accounted for 27% of the variance in word reading accuracy at the start of Grade one, 9% by the end of Grade one and, nothing by the end of Grade one. In other words, although phonemic awareness is a core component of learning to read in opaque *and* transparent orthographies, differences in decoding and reading ability in the Afrikaans / English data suggests caution is needed when extrapolating results from English-language reading research to reading acquisition in other languages.

At the same time, a universal model of reading needs to account for reading behaviour and development in transparent and opaque orthographies; thus we cannot ignore reading acquisition in English. Instead, we need to examine it in relation to reading acquisition in other language orthographies (Share, 2007). This study provides a step towards this goal. Moreover, the revised Frith (1995) reading framework of this study takes into consideration the role of orthographic transparency on the development of reading in each language of bilingual children (Ziegeler & Goswami, 2005).

Table 4.4: Results of Fisher *Z*-tests in Afrikaans (L1) and L1 English groups.

Relationship	English (L1)	Afrikaans (L1)	Z-score
Onset-rime	.60	.31	2.850**
Phoneme-reading comprehension	.67	.29	3.567***
Similarities-definitions	.55	.28	2.303**
Word recall-VSTM	.80	.58	3.039***
VWM-comp	.57	.11	3.740***
VWM-block	.47	.05	3.204***
Listen recall-onset	.49	.10	3.034***
Listen recall-reading comprehension	.48	.02	3.503***
Counting recall- reading comprehension	.51	.07	3.431***
Counting recall-VSSTM	.60	.23	3.196***
Counting recall-block recall	.53	.02	3.971***
Backward digit recall-Listening recall	.58	.32	2.304**
VSWM-onset	.54	.19	2.868**
VSWM-VWM	.60	.30	2.672**
VSWM-counting recall	.59	.12	3.880***
Odd-one-out-counting recall	.50	.05	3.477***
Odd-one-out-VSWM	.80	.57	3.141***
Mr X-word reading	.31	.01	2.163***
Spatial recall-onset	.30	.02	2.016*
Spatial recall-VWM	.41	.14	2.052*
Spatial recall-counting recall	.41	.06	2.610**
Spatial recall-backward digit recall	.49	.20	2.310**
Tot WM storage-plus-processing-reading comprehension	.50	.07	3.337***
Tot WM storage-plus-processing-VSSTM	.69	.37	3.200***
Tot WM storage-plus-processing-counting recall	.81	.61	2.192**
Tot WM storage-plus-processing-VSWM	.94	.47	3.552***
Tot WM storage-plus-processing-Mr. X	.75	.54	2.568 **

Note: V-STM = Verbal Short-term scale, VS-STM = Visuospatial Working Memory, VWM = Verbal Working Memory, VSWM = Visuospatial Working Memory, and Tot = Total.

4.2.2.2 Predicting Afrikaans and English word reading ability

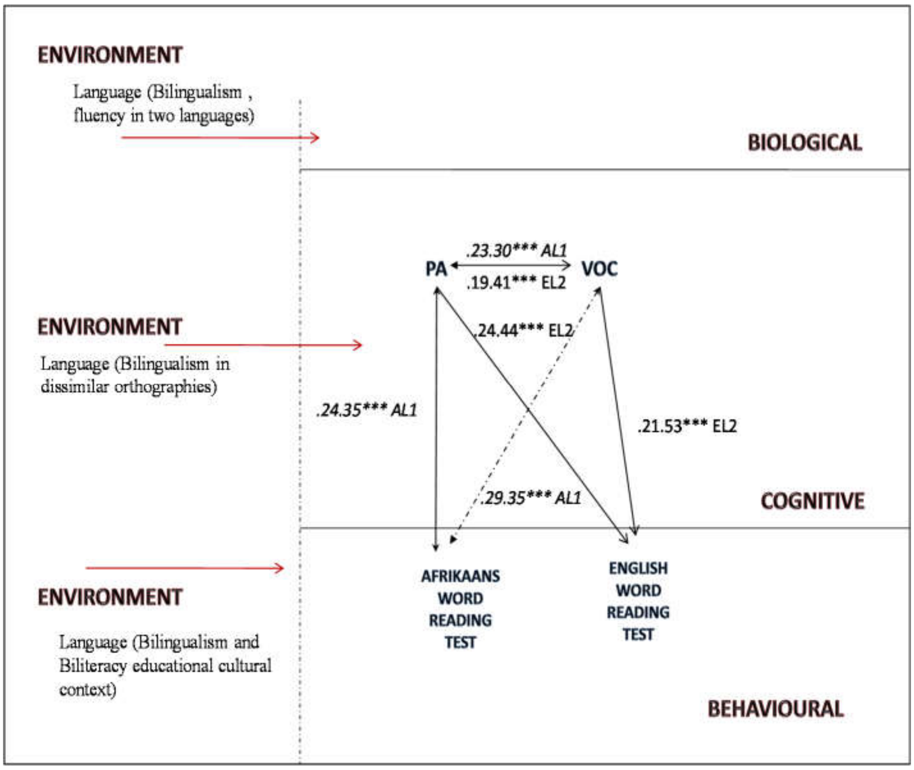
The final stage in the analysis utilised stepwise multiple regression to investigate the extent to which cognitive-linguistic measures explained variability in Afrikaans and English word reading. *For Afrikaans word reading*, Afrikaans phoneme deletion accounted for 16% of the variance, F (1, 98) = 58.64, p < .001. The corresponding analysis for *English word reading* indicated that English phoneme level of phonological awareness accounted for 25% of the variance F (1, 98) = 37.54, p < .001, with similarities - depth of vocabulary task - adding a further 10 % to the prediction F (1, 98) = 11.07, p < .01. These analyses indicated that phonemic skills were reliable predictors of reading ability in both languages. The phoneme deletion task reflects mastery of letter-sound correspondence rules and automaticity of the assembly strategy. In this task, the child is required to encode and hold phonological information in auditory working memory, access phonemic units and map these onto their corresponding grapheme units and articulate a new word. A child uses a similar process in order to read a word (Adams, 1990). Common predictors are consistent with the predictions of the *central processing hypothesis* (Geva & Siegel, 2000).

At the same time, the phoneme tasks predicted different levels of variability in both languages. In addition, the similarities-depth of vocabulary task predicted reading ability in English, but not in Afrikaans. The vocabulary task requires the child to encode verbal information in auditory working memory by focusing on morphemic units (roots, derivations and inflections) or lexical labels and retrieval of the correct item from verbal long-term working memory, and then articulate the word. Different scripts being related to different oral and underlying processing skills is consistent with the *script-dependent hypothesis* (Geva & Siegel, 2000). Several English-language studies have confirmed a significant role for vocabulary in reading English words (Nation & Snowling, 1998). This effect was weaker or non-existent in phonologically transparent orthographies (Share, 2007; Seymour & Elder, 1986; Spencer & Hanley, 2003). Therefore, the findings suggest that the contribution of lexical-sematic information depends on orthographic transparency. Phonological opaque English utilised phonological awareness but may rely more heavily on lexical factors to overcome decoding uncertainties inherent in the spelling of words in English. Therefore, the role of lexical-semantic information does not appear to generalise to reading in transparent orthographies and, therefore, raises doubt about the applicability of logographic and partial alphabetic stages of English reading development to other languages and orthographies.

4.2.2.3 Predicting word reading skill in English from phonological and vocabulary measures in Afrikaans

A final series of stepwise multiple regression analyses investigated cross-language predictors. English phoneme deletion and vocabulary tasks predicted 28% of variability in *Afrikaans word reading* and 25% of variability in *English word reading*, whereas Afrikaans phoneme deletion and vocabulary tasks predicted 16% of variability in *Afrikaans word reading* and 21 % in *English word reading*. Combining Afrikaans and English phoneme deletion and vocabulary tasks resulted in 28% of variability in *Afrikaans word reading* being predicted (no more than the English phoneme deletion and vocabulary tasks alone) and 26% of *English word reading* (1 % more than the English phoneme deletion and vocabulary tasks alone). Evidence was thus found for L2 word reading ability being predicted by L1 cognitive-linguistic processing skills, thereby supporting sub-hypothesis 1f.

By way of concluding the discussion of the results for research hypothesis one, Figure 4.4 addresses the concept of cross-language transfer of phonological awareness and vocabulary knowledge and the unique relationship between reading in each language and phonological awareness. These results indicate a strong link between first language and L2 phonological awareness and reading (Comeau *et al.*, 1999; Geva & Siegel, 2000), suggesting that this skill may be universal across languages and may only need to be acquired once, and once acquired, will influence reading development across the alphabetic languages of Afrikaans and English. This finding supports the central processing hypothesis that suggests that specific cognitive-linguistic processes, such as phonological awareness transfer across languages and are basic to reading in any alphabetic language (Comeau *et al.*, 1999; Geva & Siegel, 2000).



Note: Dotted line between VOC and Afrikaans word reading indicates VOC was not a significant predictor. AL1 = L1 Afrikaans, EL2 = L2 English, PA = phonological awareness, and VOC = vocabulary knowledge.

***Figure 4.4*: Summary of Frith's adapted reading framework (1995) incorporating relationships assessed, and illustrating the main findings of research hypothesis 1 in the present research.**

However, additional language-factors related to reading may be a function of depth of the orthography such as different predictors of reading in each language, different reading strategies related to different underlying processing skills for L1 and L2 reading and an additive bilingual learning context, linked to results shown in Tables 4.2 – 4.4 and Figure 4.4. These results suggest that social and educational factors play a role in reading development, independent of aspects of cognitive processing skills which are universal across language orthographies. These findings highlight interactions among environmental and cognitive factors, and they underscore the importance of considering sociocultural or experiential factors in which cognitive processing skills linked to reading, are demonstrated. The revised Frith (1995) model is recommended as it provides a means by which practitioners can take into account the roles that language plays in the cognitive functioning and reading competency of monolingual and bilingual children.

4.2.3 Discussion: bilingualism, biliteracy and learning to read in different language orthographies simultaneously in social context

The critical questions addressed in this study focused on the accessibility of intra-syllabic phonological units for biliterate Afrikaans-English bilingual children, and intra- and inter-linguistic relationship of phonological and reading skills in Afrikaans and English. The findings of this study contribute to the growing body of literature on the nature of phonological awareness in the first language and L2 for bilingual children. This study revealed four main findings to consider from the above-mentioned results. First, Afrikaans-English bilingual children tended to perform more accurately on onset-phoneme tasks than on onset-rime awareness tasks. Second, there was a strongly positive relationship between phonological awareness in the two languages, Afrikaans and English. Third, biliterate Afrikaans-English children's Afrikaans phoneme awareness, not rime awareness, was significant, and strongly positively related to phonological and reading skills in English. Fourth, biliterate Afrikaans-English bilingual children's Afrikaans made a positive contribution to English reading skills even after controlling for word reading skills in English.

The results of this study also suggest that the two languages that biliterate Afrikaans – English bilingual children are exposed t, may play an important role in the development of phonological awareness in bilingual children. In particular, biliterate Afrikaans –English bilingual children finding onset-phoneme units more accessible than onset-rime units is consistent with phonological awareness development in Afrikaans monolingual children (Greenop, 1997). This is because Afrikaans is a transparent orthography in which grapheme-phoneme correspondence rules represent only one phoneme and hence it is easier and faster for children to learn to read in a transparent language (Botha *et al.*, 1989). Consistent with this, Goswami, Gombert, and Barrera (1997) have shown that English readers are better at reading nonsense words in which the rime segment occurs frequently in written English. For example, *bomic* was read more easily than *bommick*. The authors interpreted this to mean that monolingual English children use familiar rime segments to read unfamiliar words. This effect was weaker in children learning to read in Spanish, suggesting that rimes may not be salient for children learning to read in a transparent language. Wimmer, Landerl, and Schneider (1994) demonstrate that the relationship between performance on rime tasks and reading at the end of the first year of schooling is much weaker in children learning to read German than in English children, but this ability improves by the end of Grade 4. Cardoso-

Martins (2001) finds that global phonological sensitivity does not make a distinctive contribution to reading acquisition in Portuguese, which also has a more predictable alphabetical orthography than English. The effect of rime awareness being achieved equally well across Afrikaans and English is an important finding. It suggests that these children's phonological structures are initially based on their L1 due to mother tongue / L1 instruction, but with exposure to L2 at a certain point in bilingual proficiency, their phonological representations in L1 may evolve to incorporate L2 phonological characteristics, resulting in bidirectional influence. Therefore, as Afrikaans–English bilingual children develop their proficiency in English, they may develop sensitivity to rime as a unit of analysis not only in English but also even in Afrikaans. A monolingual Afrikaans group would therefore be important for future research to add weight to this finding. Nonetheless, the research reported here supports the results of previous studies such as that of Kim *et al.* (2009). These authors reported that Korean-English bilingual children were aware of rime not only in English but also in Korean, a language in which koda units are related to reading development.

This finding of elevated phoneme awareness scores in Afrikaans and in English is an important finding. English is a language that does not allow 'easy access' to phonemes due to its opaqueness. Spencer and Hanley (2003) find that phoneme test scores in an opaque orthography is much more strongly mediated by knowledge of spellings of words than is the case in transparent orthographies. Thus, scoring high on phonemic tasks that require the arbitrary sounds in words to be identified in both languages, demonstrates that bilingualism positively influences meta-linguistic awareness. This effect has been shown in Italian-English and English-Afrikaans pre-readers (Campbell & Sais, 1995; Ianco-Worrall, 1972), and thus represents a general effect of bilingualism rather than being due to reading attainment as result of literacy instruction. If two languages share target sounds, children can transfer skills from one language to the other as long as they have sufficient opportunities to learn in each language. Consistent with this, Comeau *et al.* (1999) report cross-language transfer of phonological awareness in French and English and the unique predictive power of both L1 and L2 phonological awareness in French and English to L1 and L2 reading. The results of this study also suggest universal cross-language phonological transfer as strongly positive. Correlations were evident for phonological awareness, vocabulary and reading skills within and across Afrikaans and English and L1 Afrikaans phonological awareness predicted L2 English word reading, despite both languages differing in orthographic transparency as is the case in other transparent-opaque reading (Durgunoglu, 2002). Both Afrikaans and English use alphabetic writing systems, although orthographically different, that require different emphasis on levels of phonological awareness. The alphabetic principle - learning to map graphemes to phonemes - is critical in acquiring literacy skills in both languages (Botha *et al.*, 1989). Thus, Afrikaans-English bilinguals' skills in manipulating sounds in their L1 establishes a foundation for their understanding of sound structures in their L2, which is essential for literacy acquisition in L2 (Geva and Siegel, 2000).

However, the particular pair of languages a child is learning may influence how learning in the two languages interacts. Evidence to support this point comes from different predictors for reading in English and Afrikaans. Correlations were higher between phonological awareness, vocabulary and reading measures in English than was the case in Afrikaans. Significantly, different relationships found between English and Afrikaans were also found. This effect occurred despite the two languages being introduced side-by-side, both languages having equally high socio-linguistic status in some communities and tests used in this investigation matched on several psycholinguistic dimensions that could have potentially influenced learning and reading performance. Thus, the findings illustrate that the particular pair of languages a child is learning may influence how learning in the two languages interacts, including a different developmental level for each language, which is, in turn supported by the large effect size for significant differences found for phoneme and reading in the two languages. Effect size is unaffected by sample size and thus a true reflection of group difference (Cohen, 1988). Therefore, the effect of bilingualism on learning to read depends on the type of orthography each language uses. This in turn means that even though Afrikaans and English are alphabetic languages, when teaching phonological awareness skills, teachers should always consider how the phonological structure of children's L1 is different from the L2, so that teaching strategies for reading are tailored specifically to the writing system of each language.

According to the psycholinguistic grain size theory developed by Ziegler and Goswami, (2003), in Afrikaans word reading, children would use recoding strategies at a small grain size (i.e., phoneme) because the grapheme-phoneme mapping is fairly consistent, while in English word reading, children would use recoding strategies at both large and small grain sizes (i.e., rime and phoneme). The results of this study showed this, albeit cross-linguistically within the same children. Interestingly, the results in Afrikaans differ from previous studies with Afrikaans monolingual children in two aspects: (1) a relationship exists between onset-rime and word reading in Afrikaans and (2) the relationship between vocabulary knowledge in Afrikaans and Afrikaans word reading is similar in size to that of the relationship between vocabulary knowledge in English and English word reading.

In relation to the first, Botha *et al.* (1989) state that onset-rime units can have a special status for a few English words that have the same spelling but different pronunciation, e.g. 'arm' in Afrikaans, means a part of the body or poor, in English. With regard to the second, children's vocabulary sizes in L1 and L2 are related to their phonological representations because vocabulary has been hypothesized to be the main factor for children's phonological development (Walley, Metsala, & Garlock, 2003), which, in turn, influences reading development in both languages. Both language proficiency and language of schooling may contribute to bilingual children's reading performance (Cummins, 2000). Thus, when examining reading performance of bilingual children, we need to consider a number of factors: the similarities between the two languages, the language of the child's school experience and the quality and quantity of the child's exposure to each language. In other words, the extent to which a child develops both conversational and academic language, determines the level of reading achievement in both languages. This explains the high levels of performance in cognitive processing and reading tasks across L1 and L2 of the biliterate Afrikaans-English bilinguals. To examine this finding in more detail, writing samples could be used to show evidence of children's knowledge in two languages. School projects could be examined to determine how well children present information in two languages. In general, the results suggest that dual medium instruction shows promise for promoting high levels of bilingualism and reading achievement in the L1 and L2 of bilingual children.

The results of this study also show that the similarities in dimension of vocabulary knowledge explained approximately 25% of unique variance in L2 English word reading, and explained a larger amount of variation relative to the effect of phonological awareness within and across languages in the Afrikaans-English bilinguals. One possible explanation for this finding is that the similarities that vocabulary measures are more demanding for L2 children. This is because it captures additional variance related to language proficiency as it draws on additional linguistic skills such as morphological knowledge. According to Cummins (2000), L2 CALP is morphological involving knowledge of the second language itself. However, vocabulary and comprehensions were not significantly different, with both of these skills achieved at high levels within and across languages. Given the established relationship between vocabulary knowledge and reading and reading comprehension (August *et al.*, 2005), these findings indicate that explicit vocabulary instruction in dual medium education programmes results in high levels of vocabulary and reading comprehension, such that Afrikaans-English bilinguals in dual medium instruction can perform well on a test of content in either language. Teachers of Afrikaans-English bilingual children noted that they used teaching strategies that support the linguistic and conceptual development in the primary and second language of the L2 learner:

- Teaching basic vocabulary, explaining and contrasting language structures and grammatical rules between the L1 and L2,
- Introduce a story by drawing out key concepts / themes in child's native-language; next apply same strategy in English until learners have grasped reading comprehension strategy, and conclude by writing practice in both languages.
- Use illustration and context cues to deduce meanings before directly teaching vocabulary. In this way reducing cognitive demands in L2 English reading and scaffolding reading of a new text.

It is important to note the above teaching strategies involve interactive or dialogic reading. This instructional strategy involves teachers accessing children's prior knowledge about the concepts and vocabulary in the texts within and across languages to encourage understanding of content (Lightbrown & Spada, 2006). Although children can learn a great deal simply from exposure to comprehensible language, research has found that rich explanations of target vocabulary, coupled with frequent home reading and initial L2 vocabulary in English, made significant contributions to vocabulary knowledge more than teaching support that is given in English-only (Whitehurst, 1992). Finally, English does not have cognates in non-European languages. In this regard, Uchikoshi (2012) shows that interactive reading demonstrates significant gains in children's language and cognition scores in third grade Cantonese-English bilinguals and reduces some of the initial gap associated with learning more than one language when compared to English monolingual children.

Thus, the benefits of dual medium education are independent of cognate instruction and, students who are learning content in a language they are simultaneously learning to speak and understand can benefit from using the home language to support concept and language development to optimize reading success in bilingual children. Therefore, children's developmental cognitive capacities for reading achievement in their L1 and L2 are influenced by the social and educational circumstances in which they learn to read. Sociocultural and educational factors determine the extent to which high levels of bilingualism and biliteracy are possible (Bialystok, 2007). In general, the results of this study highlight interactions among language variables at the environment level and the cognitive and behavioural levels and the importance of considering sociocultural and educational factors in the cognitive development and reading competency of bilingual children (revised Frith model, 1995). These factors play a role in reading acquisition and achievement, independent from that of intrinsic biological / cognitive factors in the form of adequate stimulation and absence of pathology (revised Frith model, 1995). The findings have implications for the assessment of children and adults from diverse linguistic and cultural groups, for the development of early literacy intervention or environmental enrichment language instruction programmes, and for education policy.

4.2.4 Recommendations for education practice

The research suggests that children have the capacity to learn two languages. This early dual language exposure may affect performance on tests, but it does not necessarily indicate a delay or deficit as long as they have sufficient opportunities to learn in each language. Because bilingual children are developing proficiency in two languages, as well as reading in each, both languages need to be assessed. In addition, children's language proficiency and language learning opportunities determine their linguistic and cognitive abilities, thus it is important to obtain an accurate measure of degree of language proficiency when examining reading development in two languages. Children should be provided with language experiences and support to master both spoken and written forms of their languages. One of the best ways to provide children with high-quality language experiences is through dual-medium education. This model of education allows children to practise, interact, and speak with other proficient users of the languages, developing full conversational and academic language proficiency in the first language and L2 (Cummins, 2000).

The research also suggests that, because experience shapes children's learning mechanisms, models of learning need to reflect that bilingual children may learn differently from monolingual English children. In bilingual children, phonological awareness is related to reading across languages, but what matters are the relationships between children's level of proficiency in each language, their progress in literacy development, and the relationship between the two writing systems. Thus, when examining the reading performance, we need to consider a number of factors: the similarities between the two languages, the language of the child's school experience and the quality and quantity of the child's exposure to each language. Finally, slight differences between Afrikaans-English bilinguals and Afrikaans monolinguals or English monolinguals underscore why monolingual standards are not appropriate for assessing reading performance and its composite cognitive processing skills in bilingual children. Instead, bilingual children's cognitive and reading performance needs to be compared with other bilinguals at the same level of bilingual proficiency and / or additive or subtractive educational context.

4.2.5 Conclusion

In conclusion, the results for research hypothesis 1 indicate that dual medium instruction results in full conversational and academic proficiency in both languages, using these languages for instruction. Instruction in the home language and instruction in English are in no way mutually exclusive; both should be used to support children's cognitive growth and reading development. Children's home language plays a prominent role in dual medium instruction as an additional resource to promote language and cognitive growth more fully across both languages. For example, teaching to read using books in the home language, previewing key vocabulary terms in the home language and in L2 English, building on familiar content within languages, and making explicit connections across languages to make learning more meaningful and comprehensible in either language, are strategies that can be used. This is consistent with Cummins' (2000) view that children can learn effectively in either their mother tongue or L2, given appropriate instructional strategies in one language and then transferring knowledge and skills gained to the other language. At the same time, phonological decoding and reading accuracy scored in Afrikaans and English, differed significantly, reaffirming Geva and Siegel's (2000) conclusion that specific scripts are related to different cognitive processing skills. In other words, the orthographic similarity between the two languages determines how bilingualism affects literacy development. Thus, the results provide insight into literacy development where both languages are given space in the instructional setting. This context is different to situations where one language is given spoken-only status and the other educational status. Taken together, the present research has revealed that an assessment of bilingual children's reading development should consider the following language related factors: the similarities between the two languages, the language of the child's school experience, and the quality and quantity of the child's exposure to each language. Furthermore, dual language learning seems to bestow certain cognitive and academic benefits or at least offer considerable promise for bilingual children who are academically underachieving in English-only programmes. The latter programmes do not explicitly teach linguistic, vocabulary and conceptual development to help bilingual children perform well on academic content in either language.

To support the development of full bilingualism and biliteracy, teachers need to represent the cultures and languages of the children and have adequate language skills so that they can engage meaningfully and extensively with children in both languages. In this research, experienced teachers were fluent speakers of the language(s) of instruction and this may have played a role in the successful cognitive and reading development of the biliterate Afrikaans-English bilingual children. Previous research has shown that bilingual children in dual medium settings taught by monolingual teachers demonstrate a discrepancy between reading attainment in the L1 and L2. This is because monolingual teachers who are not fluent in the child's L1 are likely to rate the reading behaviour of this child as challenging and less likely to converse with him / her. Bilingual teachers who speak the child's L1 and L2, are more likely to view the child in a more positive light (Conboy, 2013). The interviews with teachers in the present study substantiate this view. Young bilingual children taught to read by monolingual English teachers may contribute to the well-known L1 and L2 reading achievement gap, whereas bilingual teachers bridge this gap by means of vocabulary instruction that supports the second language and promotes biliteracy within a supportive learning environment. It is important for bilingual children to feel safe to try out their two languages - in addition to typical learning strategies such as repetitive songs and rhymes and teaching phonological awareness for successful reading attainment in these children (Conboy, 2013).

4.3 RESEARCH HYPOTHESIS 2

The research sub-hypotheses addressed in this section are as follows:

1. Afrikaans (L1) and L2 English literacy developed in a dual medium instruction context, will promote high levels of academic proficiency in reading and working memory.
2. The relationships between cognitive processing skills and reading will differ between English (L1) and L2 English children.

The aforementioned research hypothesis addresses an integrative hypothesis using the revised version of Frith's (1995) framework for reading. In particular, it examines the extent to which levels of bilingualism or absolute L1 / L2 proficiency at the *environmental level* provide a source of variance in solving cognitive processing and reading tasks at the *cognitive / behavioural levels*. In addition, the extent to which the type of bilingualism (i.e. additive *vs*. subtractive) at the biological / cognitive levels influences cognitive development or functioning at the *behavioural level,* is also considered. As a set, these research hypotheses reflect the most current research related to the learning and literacy development of young dual language learners. The bio-ecological approach to cognitive and reading assessment predicts that the extent to which language learning experiences within one context differ from another, determines differences in reading ability. It locates the acquisition of literacy in a framework that includes details about social and cognitive / linguistic contextual factors that support (or fail to support) children's literacy acquisition in a second language (Armour-Thomas and GoPaul-McNicol, 1997).

4.3.1 Cognitive and reading profile in English in monolingual and bilingual language learners

4.3.1.1 Comparison of performance in cognitive and literacy tasks in English for EL1, EL2 with spoken (ZL1) only, and EL2 with spoken and written (AL1) groups

The mean scores and standard deviation scores for the cognitive processing tasks and reading measures in L1 English and in the L2 of emergent Zulu-English and biliterate Afrikaans-English bilinguals are presented in Table 4.5 and illustrated in Figure 4.5 and Figure 4.6

Examination of the distributional properties of the tasks indicates that the data was sufficiently normal to conduct parametric data analyses. Other parametric assumptions such as observations being independent and an interval scale of measurement, were also met (Whitley, 2002).

A multivariate analysis of variance (MANOVA) was performed between L1 and L2 English phonological awareness, vocabulary, working and reading measures to determine if significant differences emerged between L1 and L2 English groups. This analysis demonstrated that performance was significantly different for the three linguistic groups: Wilks' Lambda, $F\,(2, 197) = 127.91$, $p < .001$, $\eta^2 = .67$, indicating a medium-to-large effect size difference (Gravetter and Forano, 2009). Given this result, (Coolican, 2004), 11 F-tests were carried out between L1 and L2 English groups with the cognitive processing and reading measures as the dependent variables. Type I error rates among the seven F-tests were controlled through Bonferroni adjustments (only accept DVs that have a significance of less than 0.002). These results are summarised in Table 4.5: Descriptive statistics and MANOVA results for phonological awareness, vocabulary and reading measures in EL1, EL2 (ZL1), and EL2 (AL1) groups.

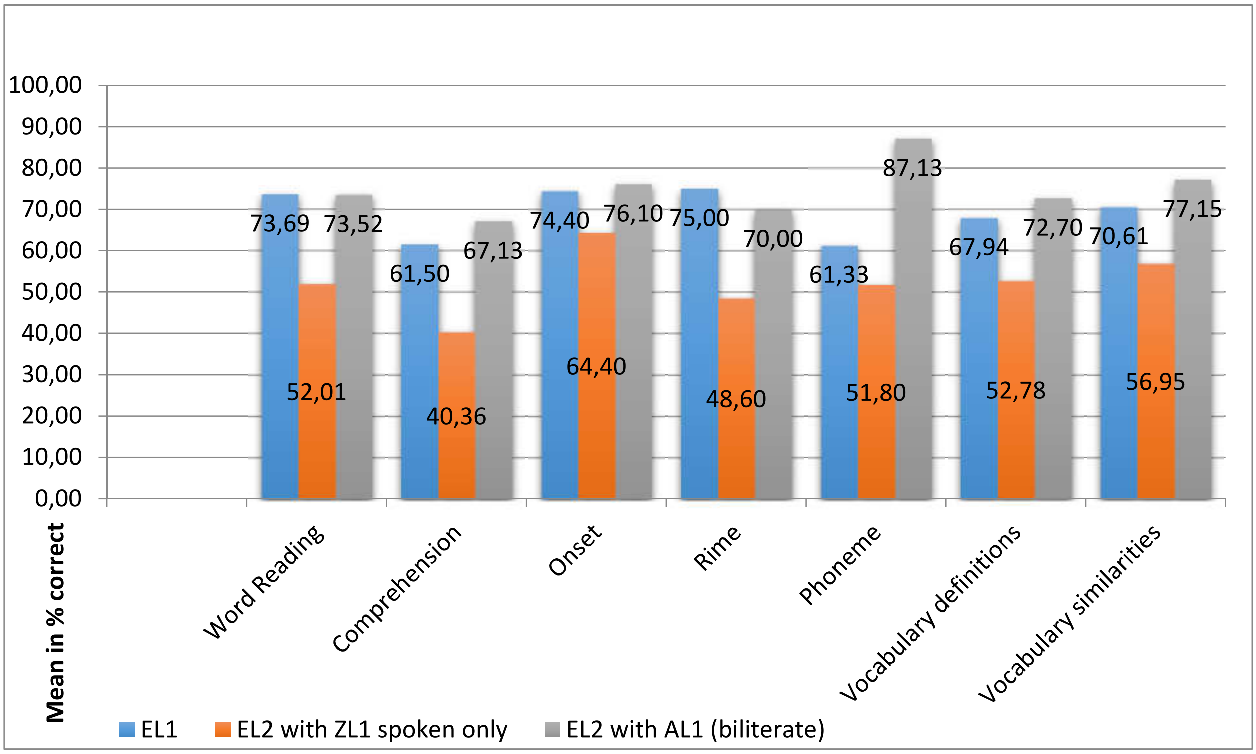


Figure 4.5: **Proportion of PA and VOC tasks and reading measures answered correctly in ELoTL for the three linguistic groups (EL1, EL2 (ZL1), and EL2 (AL1).**

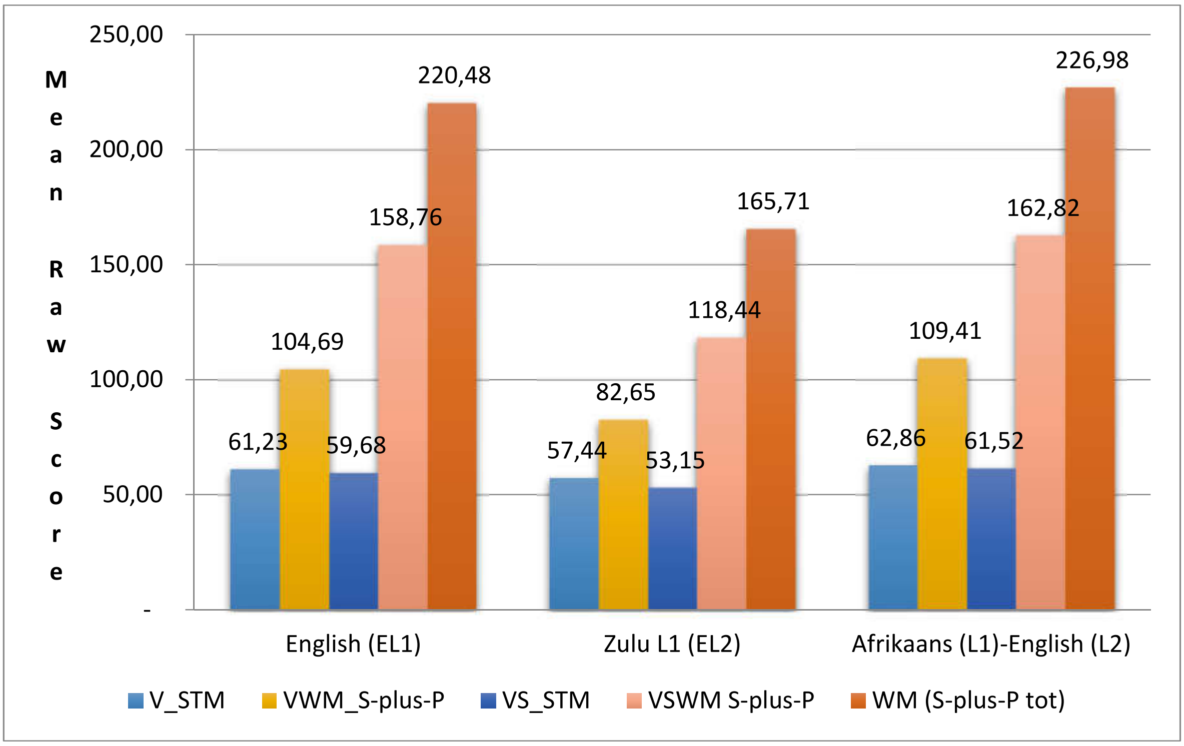


***Figure 4.6*: Proportion of working memory measures answered correctly in ELoTL for the three linguistic groups (EL1, EL2 (ZL1), and EL2 (AL1).**

Table 4.5: Descriptive statistics and MANOVA results for phonological awareness, vocabulary and reading measures in EL1, EL2 (ZL1), and EL2 (AL1) groups.

Variables	EL1 (N = 100)		EL2 (ZL1) (N = 100)		EL2 (AL1) (N = 100)		Test F	Effect Size
	M	SD	M	SD	M	SD	(2, 197)	
Word	62.01^{a}	9.59	43.69^{b}	12.18	61.91^{a}	10.47	93.39***	.38
Comprehension	9.84^{b}	3.74	5.83^{c}	3.00	10.10^{a}	3.13	26.66***	.26
Onset	7.44^{b}	1.72	6.44^{c}	2.24	7.61^{a}	1.81	10.65***	.10
Rime	7.50^{a}	2.11	4.86^{b}	2.17	7.00^{a}	1.92	45.92***	.23
Phoneme	9.20^{b}	2.20	5.18^{c}	2.45	13.07^{a}	1.84	228.17***	.48
SIM	24.46^{b}	2.39	19.00^{c}	3.57	26.16^{a}	4.07	119.88***	.44
VOC	14.12^{b}	2.73	11.39^{c}	3.63	15.43^{a}	3.64	37.66***	.20
VSTM	61.23^{b}	7.68	57.44^{c}	7.92	62.86^{a}	7.12	13.47***	.10
VWM	104.69^{b}	35.44	82.65^{c}	20.58	109.41^{a}	23.55	27.18***	.15
VSSTM	59.68^{b}	9.43	53.15^{c}	10.21	61.52^{a}	12.26	16.90***	.10
VSWM	158.76^{b}	53.69	118.44^{c}	44.29	162.82^{a}	46.18	25.88***	.15
WM (S-plus-P tot)	220.48^{b}	29.71	165.71^{c}	21.62	226.98^{a}	23.24	179.77***	.54

Note: EL1 =English (L1), EL2 = English (L2), AL1 = Afrikaans (L1), M = mean, SD = standard deviation, Onset, Rime, Phoneme = Levels of Phonological Awareness, Word read = word reading, Comp = Reading Comprehension, SIM and VOC = similarities and expressive vocabulary of WISC-IV, VSTM = Verbal Short-term Memory, VSSTM = Visual-spatial Short-term Memory, VWM = Verbal Working Memory, VSWM = Visual-spatial Working Memory. WM (S-plus-P-tot) = combined VWM, VSTM, VSWM, and VSSTM score. Different Latin superscripts (a, b, and c) indicate a statistically significant difference; groups sharing a common superscript do not differ significantly. Significant *at $p < .001$. $\eta^{2} = .01$ small effect (around 1% of variance accounted for), $\eta^{2} = .09$ medium effect (around 9% of variance accounted for), $\eta^{2} = .25$ and above large effect (> 25% of variance accounted for).

4.3.2 Results and interpretation

The data in Table 4.5 indicates quite variable performance between the L1 English and English (L2) groups, thus providing an argument for within-group variability in English (L2) children. This variability is consistent with the conceptualisation of bilingualism as a continuum of proficiency in both languages. Typically, children who are presumably bilingual, are tested in English (the language of schooling) yet this may not be the child's strongest language. Francis, Rivers, Lesaux, Kieffer, and Rivera (2006) point out that there is no single operational definition of *English language learner*, thus both bilingual groups in the present can be considered English language learners because they speak a language other than English at home and they are developing oral language proficiency in their home language as they learn English at school.

Emergent Zulu-English bilinguals appeared more novice readers of English compared with biliterate Afrikaans-English children. The latter children consistently outperformed the former children by a large margin on all measures, including reading, cognitive processing and working memory. This finding reinforces the idea that the nature of bilingualism is decisive in determining the effect it will have on L2 reading. Like in monolinguals, cognitive processing skills were related to reading in both bilingual groups, but at a different developmental level. Thus, these measures can be examined for potential effects that bilingualism has on their development, which, in turn, permits an assessment of possible differences between monolingual and bilingual children, as well as a within-group factor for bilingual children in their efforts to acquire literacy (Bialystok, 2002; 2007; revised Frith framework, 2004).

On phonological awareness, vocabulary and reading tasks, both measures at the *biological / cognitive levels,* the biliterate Afrikaans-English bilinguals performed the best, followed by the L1 English monolinguals, and, then L2 emergent Zulu-English bilinguals. Consistent with this, Schwartz *et al.,* (2008) have shown that biliterate Russian-Hebrew bilinguals facilitated L2 phonological awareness and boosted L2 reading acquisition even when the two languages (i.e. Russian and Hebrew) belong to different linguistic families with distinct orthographies. In this study, high scores on phonemic awareness are important because English is a complex language orthography that does not allow 'easy access' to phonemes due to its opaqueness. Reading words in English is more strongly mediated by knowledge of the spelling of words than is the case in transparent orthographies. The findings thus suggest that high levels of bilingualism and dual medium schooling impact positively on meta-linguistic awareness development. Ianco-Worral (1972) finds that four- to nine- year old English-Afrikaans bilingual children are better able to analyse language as abstract than are monolinguals. Ianco-Worrall (1972) also finds that that four- to nine-year old English-Afrikaans bilingual children are better able to separate meaning and sound.

Uchikoshi (2012) finds that both Cantonese-English and Spanish-English biliterate bilinguals exposed to English from a younger age in the home and school environments have higher English receptive and expressive vocabulary scores than bilingual children who are exposed to English at a later age or in the school setting only. In this study, biliterate Afrikaans-English bilinguals obtained significantly higher scores on phonological, vocabulary and reading measures in English than emergent Zulu-English bilinguals. The results of the present study support previous studies that indicate that high levels of bilingualism and biliteracy achieved in dual medium schooling result in high levels of cognitive and reading ability in bilingual children. Bialystok (1988) and Cummins (2000) have noted that children show increased cognitive and reading abilities only when they have attained a certain threshold of second language ability; this process occurs irrespective of the language pairs involved. The research reported in this study, therefore, supports the results of previous studies that have considered oral language proficiency an important explanatory variable for successful L2 reading attainment (Ianco-Worall, 1972; Schwartz *et al.*, 2008; Uchikoshi, 2013). The results of this study thus urge future studies of reading development in South Africa to assess level and degree of bilingualism ideally within the adapted Frith (1995) framework from a bio-ecological point of view, to interpret and explain reading development in monolingual, emergent and biliterate bilingual children in South Africa.

Pearson *et al.* (1997) state that when vocabulary is considered separately for each individual language, the majority of studies show that bilingual children have smaller vocabularies and slower rates of growth over time in each language when compared with English-speaking monolinguals. This developmental pattern has been attributed to vocabulary in each language being heavily dependent on the amount of input per language for bilinguals. This effect is often confounded with socio-economic status (SES). Bilingual children from homes of low SES scored two or more standard deviations below the English and Spanish norms on standardised vocabulary tests (Hammer, Lawrence, & Miccio, 2008; Tabors, Paez, & Lopez, 2003). In a recent study, Barac and Bialystok (2012) find that bilingual children do not have lower English vocabulary scores than English monolinguals, when bilinguals are schooled in English and their SES is matched with monolinguals.

In this study, biliterate Afrikaans-English bilinguals obtained scores on vocabulary and reading measures superior to English monolinguals, which supports and develops the results of Barac and Bialystok (2012). This is because biliterate Afrikaans-English bilinguals and English monolinguals were from homes with comparable SES, were of a similar age, started school at the same age, and had been learning to read in English for an equivalent length of time. Furthermore, measures used were equivalent across groups. Dufour and Kroll (1997) note that as the size of the L2 lexicon or word-learning history increases, bilinguals becomes more proficient in the L2 and the size of the conceptual set activated by the L2 over time, becomes comparable to that accessed by the L1. At this point, the bilingual is able to use the L2 to directly access meaning and to mediate access from L1 to L2 through shared conceptual representations (Dufour & Kroll, 1995). Evidence to support this view comes from no significant differences being found between L1 Afrikaans and L2 English vocabulary and comprehensions measures. These findings indicate strong conceptual and lexical links between L1 and L2, as well as L2 and L1.

It is important to note that biliterate Afrikaans-English bilinguals showed significantly higher performance on L2 English vocabulary and comprehensions measures relative to English monolinguals. This data indicates a need for some caution when researchers make predictions using the RHM, because such a model was mainly developed to account for bilingual adults with less than two years of fluency in the L2 (Dufour & Kroll, 1995). This is not the case for the biliterate Afrikaans-English bilingual children in this study. In general, the results of the present study suggest that monolingual and bilingual-related differences in children's development reflect differences in experience, not just differences in ability. Thus, any potential effects of bilingualism on acquiring literacy in a second language are subject to change, depending upon how each language is used / not used at home and in school each day.

McElree *et al.* (2000) and Ardilia (2003) emphasise that in unbalanced / emergent Russian-English bilingual adults, L2 words function as low frequency words. Consequently, word recognition is slower than it would be for a monolingual and balanced / biliterate bilingual. This time delay affects language understanding, and hence reading comprehension. This explains the low vocabulary and reading comprehension scores in the emergent Zulu-

English bilinguals, which is not the case for the biliterate Afrikaans-English bilinguals. Tatsuno and Sakai (2005) find that in Japanese-English bilinguals aged 13-19, who have achieved proficiency with L2 English, less effort is needed to process with increased proficiency, compared to less proficient bilinguals. These results fit the pattern reported in the present study, in that biliterate Afrikaans-English bilinguals outperformed emergent Zulu-English bilingual children on English vocabulary and English reading measures. This effect was observed despite the fact that both bilingual groups were from homes with comparable SES, were of a similar age, started school at the same age, and had been learning to read in English for an equivalent length of time. The findings suggest that balanced bilingual children effectively access both lexical and conceptual links across L1 and L2, whereas less fluent bilinguals rely heavily on lexical links from L2 to L1.

According to RHM, for less fluent bilinguals, translation from L2 to L1, which is from English to Zulu in this case, is faster and more accurate than translation from L1 to L2, namely, Zulu to English, due to stronger lexical links. The reasoning behind this argument stems from the issue of degree of fluency. It is argued that, for less fluent bilinguals, in the early stages of L2 learning, both languages may not equally activate shared conceptual representations (Dufour & Kroll, 1995). In general, the results of this study indicate that language experience and dual medium instruction contribute to bilingual children’s vocabulary and reading performance. Thus, when examining the vocabulary and reading performance of bilinguals, a number of factors need to be considered, including the language of the child’s school experience, and the quality and quantity of the child’s exposure to each language.

The working memory advantage for bilinguals learning to read in dual medium schooling reported by Morales, Calvo, and Bialystok (2013) in Spanish-English bilinguals, was replicated in this study with a new set of tasks that involve control demands for manipulating the information held in mind and increased with each subsequent task, thereby supporting research hypothesis 2a. It is important to note that a raw score difference can equal a standard score difference of the same number. The statistical significance of the working memory data may be sufficient to warrant complete acceptance that cognitive development proceeds differently in monolingual and bilingual children and for the first time shows that bilingual children receiving dual medium instruction in South Africa demonstrate a working memory advantage. At the same time, the working memory data indicates a need for some caution when psychologists or others draw inferences from scores on the AWMA in monolingual and bilingual children. The effect size of .26 and range of .10 - .54 indicates that differences in working memory capacities or control processes related to monolingual and bilingual group-factors and within-bilingual group-factors can be very large indeed. As a measure of academic achievement, tests such as the AWMA are most relevant when they assess individuals against their own culture, language background, and educational context. Therefore, practitioners need to consider a child's language background and education context in which cognitive and reading skills are demonstrated, to help conduct fair and appropriate reading assessment of linguistically and culturally diverse children (Lopez & Greenfield, 1997).

Further research from a longitudinal perspective is needed to examine differences in working memory capacity in the three linguistic groups in more detail. Nonetheless, given the empirically established findings between working memory and reading achievement and that children who have poor working memory capacities do not obtain comparable scores when compared with their peers (Alloway, 2008; Gathercole & Alloway, 2004; Gathercole *et al.*, 1992) and, the differences in working memory and reading achievement found in the present study, there is a need for dual medium instruction that supports the academic and linguistic development of first language and L2 across the first three grades in emergent Zulu-English bilinguals to provide these children the necessary support to "catch up" to their EL1 peers or biliterate Afrikaans-English bilinguals. This is necessary because although working memory capacities increase with age, children with initially low working memory capacities will not develop at the same rate as their peers so that, as they grow older, they lag behind more and more (Alloway, 2008). Furthermore, explicit vocabulary instruction and encouraging conceptual development, which is not found in many L1 English literacy instruction programmes, means that monolingual English or emergent Zulu-English children's working memory capacities and reading comprehension may not be developed to the same extent as that of biliterate Afrikaans-English bilinguals. Thus, we must advocate for educational enrichment through dual medium education for all types of children.

In order to understand the dynamics between languages, cognition and reading one must take into consideration the developing relationship between the two languages of a bilingual, as well as the cognitive demands of the task. Any potential language effects on memory are subject to change depending upon how each language of a bilingual is used / not used at home and in school each day. Literacy acquisition in bilingual children in an evolving field (Bialsytok, 2010). As a result, models of reading that can be adapted (such as the revised Frith (1995) framework for reading used in this study), that recognise and translate words from more than one language and that demonstrate how performance on cognitive and reading tasks alters as a function of level of proficiency, are needed to explain reading development in bilingual children. This universal dualism common to all learning is a contrast between slow, unskilled performance and rapid, automated skilled performance. According to Share (2007), such a universal dualism applies to *all* monolingual and bilingual children in *all* orthographies, transparent or opaque. This universal dualism is present in the revised Frith (1995) model of reading and is thus a step towards a unifying theory in the reading field. At the same time, the history of psychology (e.g. Freud, Piaget, Skinner, Newell and Simon) shows that all theories are constrained by a finite set of observations, bound by time and circumstances. Thus, future research must examine the effects of language related variables on cognitive functioning and reading competency in linguistically diverse children, using a longitudinal study. In addition, more measures are needed of the relevant factors to definitively conclude that the revised Frith (1995) framework for reading is a complete picture of how reading works and a unifying theory in the reading field.

The significant differences found (including effect size of .26 and range of .10 - .54) on cognitive and reading tasks between monolingual and bilingual children provide evidence to support a claim that cognitive and reading development is mediated by linguistic and social factors. These interact with bilingualism to determine how children's cognitive capacities for L1 and L2 reading achievement are enhanced, or constrained, through the social context (Bialystok, 2007). A most elegant version of this is found in Hoff (2006, p. 78):

> *The environment provides support only to those with the capacity to make use of it. That capacity includes the capacity to achieve and find satisfying the state of mutual engagement with another and the capacity to find underlying patterns in the speech signal and in its relation to meaning. In the normal course of events, a human environment that provides other people with whom the child may engage and from whom the child hears meaningful speech meets these innate capacities. Language development is the reliable result of the mental processes set in motion when the child meets the social and linguistic world. To the degree that contexts*

differ in how they meet the child, language development takes different forms in different contexts.

A comparison of cognitive processing and reading skills in L1 English and L2 English children makes it also possible to investigate further the relationship between the development of reading and language related variables. Correlational analyses were carried out for each linguistic group. These results are presented in Tables 4.7-4.8.

In the English monolinguals, word reading was significantly and strongly positively correlated with visual-spatial working memory ($r = .44$, $p < .001$), verbal working memory ($r = .40$, $p < .001$), visual-spatial short-term memory ($r = .34$, $p < .001$), vocabulary-breadth dimension of vocabulary knowledge ($r = .29$, $p < .01$), and similarities-depth dimension of vocabulary knowledge. ($r = .20$, $p < .05$).

In the emergent Zulu-English bilinguals, word reading was significantly and strongly positively correlated with vocabulary-breadth dimension of vocabulary knowledge ($r = .44$, $p < .001$), similarities-depth dimension of vocabulary knowledge. ($r = .42$, $p < .001$), verbal working memory ($r = .40$, $p < .001$), verbal short-term memory ($r = .34$, $p < .001$), verbal working memory ($r = .24$, $p < .01$), and visual-spatial short-term memory ($r = .21$, $p < .05$).

In the biliterate Afrikaans-English bilinguals, word reading was significantly and strongly positively correlated with similarities-depth dimension of vocabulary knowledge. ($r = .53$, $p < .001$), verbal working memory ($r = .44$, $p < .001$), visual-spatial short-term memory ($r = .30$, $p < .05$), visual-spatial working memory ($r = .22$, $p < .05$), verbal short-term memory ($r = .19$, $p < .05$), and vocabulary-breadth dimension of vocabulary knowledge ($r = .21$, $p < .05$).

These significantly different relationships demonstrate that each group goes through distinct developmental paths, at varying rates, depending on a child's language background and educational context, thus supporting research hypothesis 2b.

4.3.2.1 The relationship between cognitive and literacy tasks in English for EL1, EL2 (ZL1), and EL2 (AL1) groups

Pearson correlation analyses were performed to investigate relationships between L1 / L2 English phonological awareness, vocabulary, working memory and reading measures, in order to determine whether these relationships alter as a function of proficiency level (i.e. monolingual *vs*. bilingual) and context in which the L2 is acquired (i.e. subtractive *vs.* additive bilinguals). These results are shown in Tables 4.6-4.8.

Table 4.6: Correlation of cognitive processing and reading tasks in the L1 English group.

Measure	Onset	Rime	Phoneme	Read	Comp	SIM	VOC	VSTM	VSSTM	VWM	VSWM
Onset	-										
Rime	.60***	-									
Phoneme	.24**	.30**	-								
Read	.21*	.38***	.27**	-							
Comp	.31***	.31***	.35***	.66***	-						
SIM	.30**	.23*	.23*	.20*	.35***	-					
VOC	.30**	.26**	.20*	.29**	.33***	.55***	-				
VSTM	.29**	0.12	0.04	0.07	0.18	0.15	0.06	-			
VSSTM	.27**	.24**	0.13	.34***	.45***	0.17	.36***	0.05	-		
VWM	.55***	.44***	.26**	.40***	.57***	.30**	.38***	0.05	.56***	-	
VSWM	.37***	.25**	0.13	.44***	.36***	0.13	.30***	0.16	.66***	.60***	-

Note: Onset = onset level of phonological awareness, rime = rime level of phonological awareness, phoneme = phoneme level of phonological awareness, read = reading, comp = reading comprehension, sim = similarities-depth dimension of vocabulary, voc = vocabulary-breadth dimension of vocabulary, VSTM = verbal short-term memory of AWMA, VSSTM = visuospatial short-term memory of AWMA, VWM = verbal working memory of AWMA, VSWM = visuospatial working memory of AWMA.

Table 4.7: Correlations among and between cognitive processing and reading tasks in the L2 English of emergent Zulu-English bilinguals with Zulu spoken L1 only and L2 English literacy instruction

Measure	Onset	Rime	Phoneme	Word read	Comp	SIM	VOC	VSTM	VSSTM	VWM	VSWM
Onset	-										
Rime	.33***	-									
Phoneme	.37***	.32***	-								
Word read	.36***	.58***	.64***	-							
Comp	.31***	.51***	.56***	.67***	-						
SIM	.20*	.35***	.37***	.42***	.44***	-					
VOC	.37***	.32***	.32***	.44***	.58***	.37***	-				
VSTM	0.14	0.18	.29**	.34***	.41***	.23*	.36***	-			
VSSTM	.20*	0.18	.29**	.21*	.46***	.26**	.50***	.25**	-		
VWM	.37***	0.13	.39***	.24**	.22*	0.03	.37***	0.17	.36***	-	
VSWM	.20*	.29**	.39***	.40***	.45***	.34***	.52***	.33***	.60***	.30**	-

Note: Onset = onset level of phonological awareness, rime = rime level of phonological awareness, phoneme = phoneme level of phonological awareness, read = reading, comp = reading comprehension, sim = similarities-depth dimension of vocabulary, voc = vocabulary-breadth dimension of vocabulary, VSTM = verbal short-term memory of AWMA, VSSTM = visuospatial short-term memory of AWMA, VWM = verbal working memory of AWMA, VSWM = visuospatial working memory of AWMA.

Table 4.8: Correlations among and between cognitive processing and reading tasks in the L1 Afrikaans (shaded area) L2 English biliterate Afrikaans-English bilinguals.

Measure	Onset	Rime	Phoneme	Word read	Comp	SIM	VOC	VSTM	VSSTM	VWM	VSWM
Onset	-	.31***	.56***	.35***	.28**	.27**	.30**	0.14	.23*	.32***	0.19
Rime	.52***	-	.24*	.21*	.43***	.41***	.33***	0.04	.41***	.36***	.20*
Phoneme	.22*	.28**	-	.29**	.29**	.27**	0.13	.40***	.26**	.28**	.38***
Word read	.39***	.44***	.21*	-	.66***	.35***	0.19	.20*	.42***	.25**	.23**
Comp	.39***	.46***	.21*	.73***	-	.45***	.21*	0.12	.51***	0.11	.38***
SIM	.24*	.41***	.29**	.53***	.59***	-	.28**	0.1	.45***	.26**	0.19
VOC	.19*	0.13	0.08	.21*	.22*	.50***	-	0.11	.31***	.34***	0.17
VSTM	.20*	.34***	.38***	.19*	0.17	0.15	0.09	-	.25**	0.17	.33***
VSSTM	.21*	.55***	0.07	.30***	.53***	.60***	.31**	.25**	-	.36***	.60***
VWM	.32***	.28**	0.13	.44***	.32***	.26**	.41***	0.17	.36***	-	.30**
VSWM	.20*	.47***	.22*	.22*	.37***	.49***	.25**	.33****	.60***	.30**	-

Note: Onset = onset level of phonological awareness, rime = rime level of phonological awareness, phoneme = phoneme level of phonological awareness, read = reading, comp = reading comprehension, sim = similarities-depth dimension of vocabulary, voc = vocabulary-breadth dimension of vocabulary, VSTM = verbal short-term memory of AWMA, VSSTM = visuospatial short-term memory of AWMA, VWM = verbal working memory of AWMA, VSWM = visuospatial working memory of AWMA.

4.3.2.2 Predicting English reading skills from phonological, vocabulary, and working memory measures for EL1, EL2 (ZL1), and EL2 (AL1) groups

The final stage in the analyses utilised stepwise multiple regression to investigate whether predictors of English reading ability showed distinctive cognitive strategies and processing skills that developed within a particular language environment. These results are shown in Table 4.9. As expected, children's language background and educational environments contributed variability in children's reading development. Different predictors were found across monolingual and bilingual groups and within bilingual groups, suggesting that the nature of variability in children's reading development, is, in part, driven by contextual variability in children's language learning environments.

Table 4.9: Predictors of English word reading in EL1, EL2 (ZL1), and EL2 (AL1) groups.

EL1			
Variables in the equation	**R^2**	**R^2 % change**	**Sig. F change**
Counting recall (S-plus-P)-visual	.16	0.17	19.31***
Rime detection-level of PA-visual	.22	0.09	7.00**
EL2 of emergent Zulu-English bilinguals			
Variables in the equation	R^2	R^2 % change	Sig. F change
Phoneme deletion level of PA	.41	0.41	66.94***
Rime detection-level of PA	.56	0.15	34.48***
Listening Recall (S-plus-P)-breadth	.60	0.06	10.24**
EL2 of biliterate Afrikaans-English bilinguals			
Variables in the equation	R^2	R^2 % change	Sig. F change
Similarities-depth of VOC-complex	.28	25%	37.54***
Phoneme-level of PA	.35	7%	11.07**

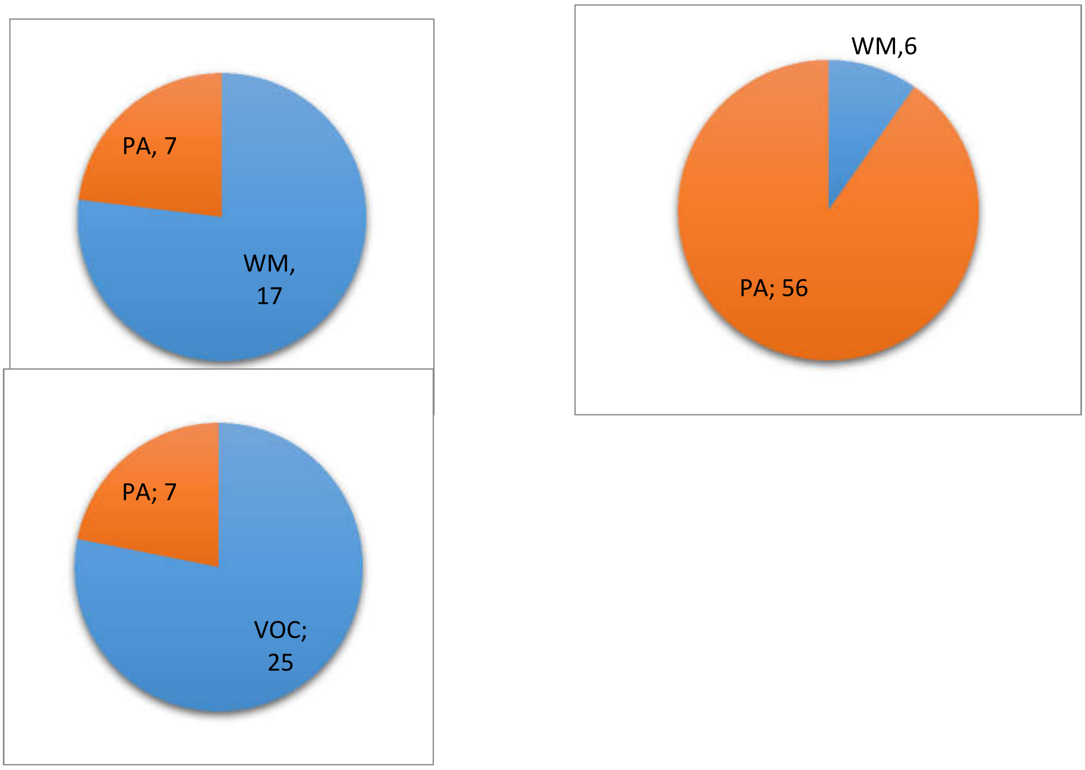


***Figure 4.7*: Predictors of English reading for the EL1, EL2 with (ZL1), and EL2 with (AL1) groups.**

Note: Top left hand corner pie-chart = predictors of reading in L1 English of English monolinguals. Top right hand corner pie-chart = predictors of reading in L2 of biliterate Afrikaans-English bilinguals. Bottom pie-chart = predictors of reading in L2 English of emergent Zulu-English bilinguals with L1 Zulu spoken proficiency only.

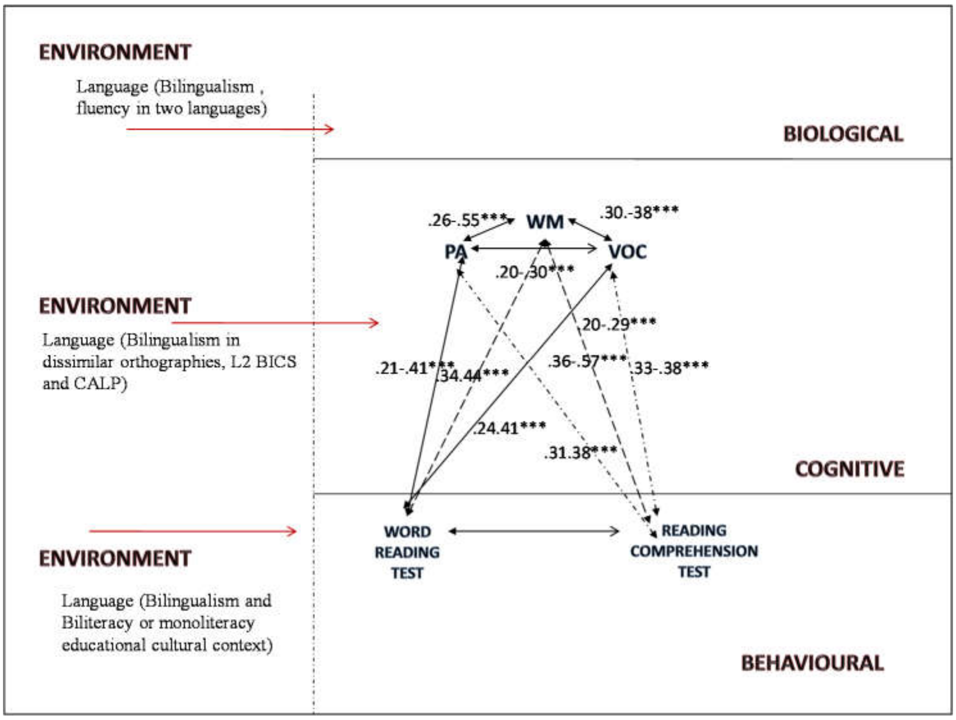


Figure 4.8: **Summary of Frith's adapted reading framework (1995) in L1 English monolinguals**

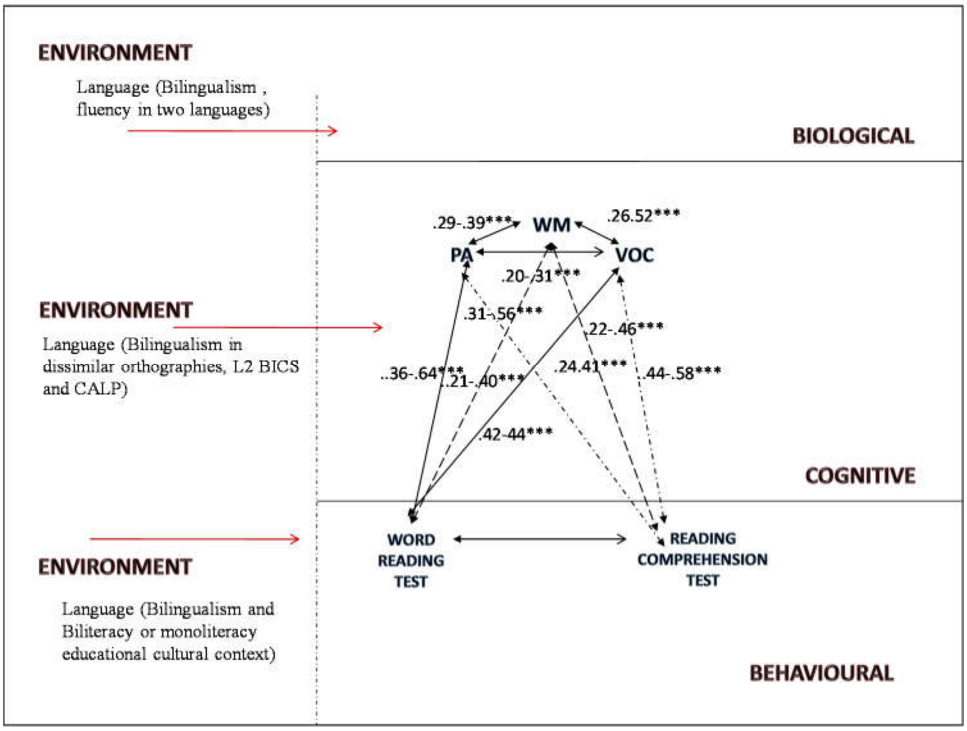


Figure 4.9: **Summary of Frith's adapted reading framework (1995) in emergent Zulu-English bilinguals**

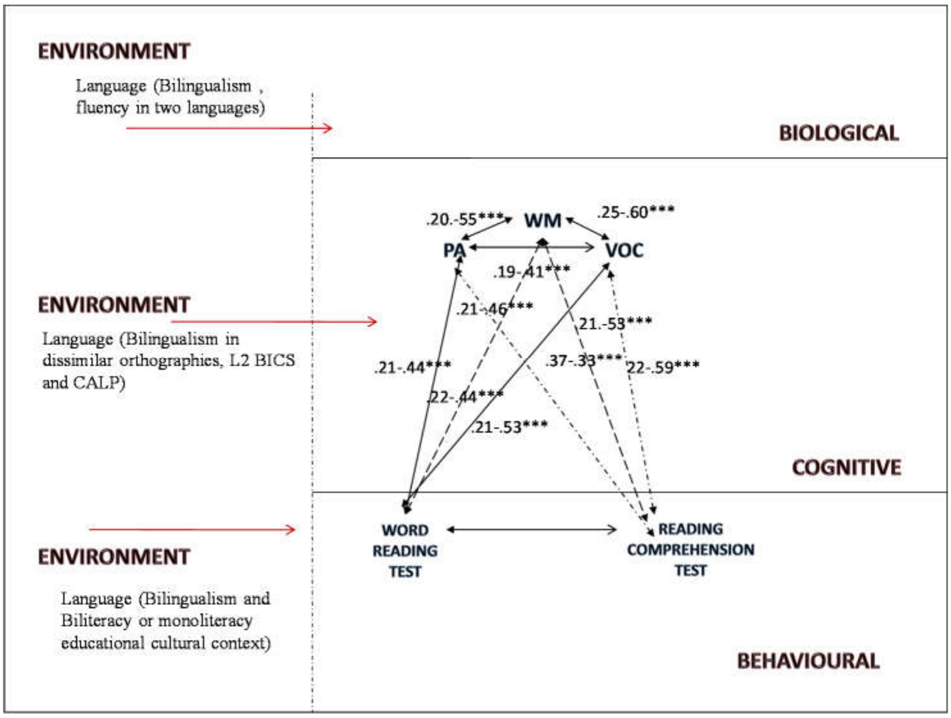


***Figure 4.10*: Summary of Frith's adapted reading framework (1995) in biliterate Afrikaans-English bilinguals.**

Note: Solid line denotes relationships between phonological awareness, vocabulary, working memory and word reading. Dashed line denotes relationships between phonological awareness, vocabulary, working memory and reading comprehension.

By way of concluding the discussion of the results for research hypothesis two, Figures 4.7 – 4.10 address language related influences of the environment influencing the *biological/cognitive and behavioural levels*. In addition, how reading performance at the behavioural level is influenced by a myriad of environmental-related variables, including level of orthographic transparency between the L1 and L2 and level of bilingualism and nature or degree of bilingualism (i.e. additive *vs*. subtractive), is also addressed. These considerations are mirrored in a quotation, concerning the bio-ecological view of cognitive / reading assessment (Armour-Thomas & GoPaul-McNicol, 1997, p. 133):

> *The bio-ecological approach suggests a dynamically interactive relationship between cognitive processes and experiences nested within contexts that cannot be understood apart from each other. Cognition is, in part, a culturally dependent construct. People are born with diverse capacities that predispose them to engage in activities within a given ecology. Behaviour may be described as "intelligent" to the extent that the nature and quality experiences to which people are exposed require the exercise of these capacities.*

In other words, cognitive processing skills required for reading behaviour in one context are different to those in another context, to the extent to which linguistic and educational experiences within one context are different from other contexts. Thus, the expressions of cognitive capacities reflect the context in which they were learned (Armour-Thomas & GoPaul-McNicol, 1997; revised Frith model, 1995). Evidence to support this view is provided by the results of the present study. Based on this, an argument can be made for a bio-ecological approach to reading assessment that allows for an ecologically sensitive assessment system and allows for greater heterogeneity in the expression of reading behaviour. It emphasises the importance of the language experience of the individual and how monolingualism and bilingualism induce distinct developmental changes that influence how reading is acquired. The revised Frith (1995) model encompasses the roles of language and culture on the cognitive functioning and reading competency in linguistically and culturally diverse L1 and L2 English children. The revised Frith (1995) model emphasises that a bio-ecological perspective is required to assess in a comprehensive and heterogeneous manner, the cognitive functioning and reading competency of linguistically and culturally diverse children. The results of the present study are discussed in-depth in the next section. In addition, implications are discussed and recommendations for future research are stated.

4.3.3 Discussion: Nature (and degree) of bilingualism in learning to read in English: The role that linguistic and educational contexts play in children's L2 reading acquisition.

The critical questions addressed in this study focused on how a spoken and / or written L1 makes the L2 reading acquisition process different from that of the L1 reading acquisition process (Bernhardt, 2003). Beyond this, the present study sought to determine the role that bilingualism plays in the relationships between cognitive processing skills and reading ability, and how degree or additive and subtractive nature of bilingualism determines the effects bilingualism has on cognitive and reading development. The findings of this study contribute to the growing body of literature on the nature of reading acquisition in bilingual children (Bialystok, Luk & Kwan, 2005). First, the relationships between cognitive processing skills and reading ability varied substantially, suggesting a between-group factor and a within-group factor for the bilingual children. Language related theories are able to explain the different relationships demonstrated by the three linguistic groups. Based on this, the necessity of adaptable frameworks, such as that of Frith (1995) to conceptualise reading attainment, is supported. Second, the findings showed a relationship between degree of bilingualism and aspects of linguistic awareness and working memory processes. Biliterate Afrikaans-English bilinguals outperformed both English monolinguals and emergent Zulu-English bilinguals on all working memory tasks of the AWMA. These results provide the first evidence for a beneficial effect of balanced bilingualism and biliteracy on working memory functioning in South African children.

In the English monolinguals, word reading was significantly related to working memory and vocabulary knowledge, suggesting that the opaque spelling-sound code of English obliges readers of English to resort to lexical and extra-lexical or contextual information as most words in English cannot be decoded using sound alone. This is a well-established finding in English-language research (Nation & Snowling, 1998). Consistent with this, in a longitudinal study of early reading acquisition in Hebrew's regular pointed script, Shatil and Share (2003, cited in Share, 2007) find no significant contribution of either vocabulary or a composite speed / accuracy measure to Hebrew word reading. Similarly, neither vocabulary knowledge nor working memory makes a significant contribution to Afrikaans word reading in the biliterate Afrikaans-English bilinguals, or in monolingual Afrikaans children in Greenop's (1997) investigation. This supports the hypothesis of

Seymour, Aro, and Erksine's (2003) of cognitive modularity in early reading in a highly regular and transparent orthography. According to this hypothesis, the development of English reading is more than twice as slow as it is in a transparent orthography as an opaque orthography necessitates the operation of logographic alphabetic foundation that takes twice as long to establish as the single alphabetic foundation that is required for learning to read in transparent orthographies. The effect of predictable grapheme-to-phoneme rules in Afrikaans in the biliterate Afrikaans-English bilinguals, resulted in higher reading performance in Afrikaans than in English as L1 or L2. Thus, both lexical and extra-lexical factors, such as working memory, are unnecessary when spelling-sound relations are straightforward, but are indispensable when the orthography is opaque.

In this study, counting recall - a verbal working memory measure - and rime awareness - a phonological awareness - accounted for 17% of the variance, with vocabulary knowledge mediating these relationships or knowledge of global phonological forms. In this study, the correlations between L1 English and L1 Afrikaans reading measures differed in size, in number, and in significance. These findings point to differences in orthographic transparency resulting in reading differences despite item matching across languages and matching the Afrikaans-medium and English-medium samples by catchment area, by classroom size, and by reading. The magnitude of the between-language differences found in the present study of Afrikaans-English data, replicate Seymour, Aro, and Erksine's (2003) finding, with the English group performing only half, as well as the children learning the more regular Welsh orthography. Similar results were reported in Greenop's (2004) Zulu-English and Sesotho-English investigation.

The results also provide support for psycholinguistic grain-size theory, which states that large grain sizes such as rimes, are robust predictors of reading in preliterate children with smaller grain sizes such as phonemes, playing a dominant role when children learn to read at school (Ziegler & Goswami, 2005). In this study, the opaque orthography facilitated access to rime and phoneme because of L1 English literacy instruction. Dual medium instruction in the biliterate English bilinguals resulted in phonemic awareness as the prominent level in L1 Afrikaans and in L2 English despite the fact that English is a less transparent language. In addition, phoneme and reading measures in L1 Afrikaans were significantly different from L2 English measures, with phoneme awareness the only predictor found for L1 Afrikaans word reading. Taken together, quantitative and qualitative differences in reading processes invoked in opaque versus transparent orthographies, can be explained by psycholinguistic grain-size theory and the orthographic depth hypothesis. Hence it appears that reading in specific scripts requires different reading strategies or is related to different oral language and underlying cognitive processing skills. Different orthographies require different cognitive-linguistic inputs for reading success in Afrikaans and English, as in other transparent-opaque combinations. Hence the effect of orthographic transparency on reading attainment does not appear to be *"a transitory phenomenon but leaves developmental footprints"* on the rate or course of reading attainment in different languages (Ziegler & Goswami, 2005, p. 429). These results in turn support the necessity of including orthographic transparency at the *environment level* of Frith's (1995) framework.

In the English (L2) of the emergent Zulu-English speakers, word reading was significantly related to working memory and vocabulary knowledge, with these relationships mediated by phonological awareness, suggesting that the integrity of the phonological loop is associated with L2 vocabulary skills. This is the inverse pattern of the relationships between cognitive processing skills related to reading in the L1 English monolinguals. Phoneme deletion and rime awareness measures and listening recall - a verbal working memory measure - accounted for 41% of the variance in reading. This result supports Baddeley's (1979) viewpoint that phonological information, such as phoneme and rime units, are retained in working memory by continuous repetition through an articulatory loop. Consistent with this, phonological working memory in pre-readers is associated with reading skills in beginning English readers (Gathercole & Baddeley, 1991). However, the much higher percentage of variance that is explained, compared with L1 English monolinguals, suggests that working memory and vocabulary knowledge involve access to phonological information, or links between phonological, orthographic processing and holding information in working memory for later synthesis into words or sentences. L2 working memory and L2 vocabulary knowledge and L2 word reading draw on additional oral language proficiency skills that develop alongside L2 reading instruction (Chall, 1996). This result support Bernhardt's (2003) view that the presence of a L1 makes the L2 reading acquisition process different to that of the L1 reading acquisition process.

Further evidence of this view comes from the many positive correlations between cognitive processing skills related to reading measures in English L2 bilinguals compared to the L1 English monolinguals, suggesting a different developmental level. The effect size of

.26 and range of .49 – 2.11, between L1 English monolingual and L2 English of emergent Zulu-English bilinguals adds weight to this view. L1 English monolinguals outperformed the emergent Zulu-English bilinguals on all cognitive processing and reading measures. This effect was, in turn, enhanced by knowledge of the spelling of words as result of first / home language instruction. The L1 English monolinguals relied on rime awareness and working memory factors for reading, since most words in English cannot be decoded using sound alone. De Sousa, Greenop, and Fry (2010) explain that rime and phoneme units play different roles for L1 Zulu and L1 English learners. Rime and phoneme test scores in English were much more strongly mediated by knowledge of the spelling of words than is the case in the transparent Zulu orthography. Similar results are reported in Spencer and Hanley's (2003) Welsh-English investigation. Thus, it appears that the emergent Zulu-English bilinguals failed to recognise the differences in the orthographic depth of their two languages. As a result, they may have transferred or applied a phonological reading strategy that is effective for reading in a transparent Zulu orthography as opposed to the more opaque English orthography.

Given that English is only partially phonetic, most words cannot be read using sound alone; hence, a phonological or alphabetic reading strategy leads to reduced reading success. This in turn means that transfer occurs and it may be influenced by the child's L1. Evidence to support this view is evident in the results across the three linguistic groups showing positive correlations between L1 Afrikaans phonological awareness and reading tasks and L2 English phonological awareness and reading tasks, L1 Afrikaans phonological awareness and reading tasks, L2 English phonological awareness and reading tasks, and L1 English phonological awareness and reading tasks. However, the use of cross-sectional and correlational data does not permit a causal conclusion. Rather, bilingualism is associated with a measured change in L1 phonological and reading processes co-varying with a measured change in L2 phonological and reading processes. In addition, this study did not measure L1 Zulu phonological awareness and reading, thereby not including a language specific control that is typical of cross-linguistic transfer research. The results of this study thus provide a basis on which a more detailed examination of the cognitive and reading abilities of emergent Zulu-English bilinguals can be carried out, possibly using a longitudinal study, and a more rigorous method for measuring the relevant factors. Despite the need for further study, results reinforce Bialystok's (2002) idea that cognitive and reading development proceeds differently in monolinguals than in bilinguals.

D'Anguili *et al.* (2001) report that in Italian-English bilingual children, exposure to Italian (a language with highly predictable grapheme-phoneme-correspondence rules) is associated with enhanced phonological skills in English. However, this was not the case in the present study, despite the fact that Zulu is a language with predictable grapheme-phoneme-correspondence rules (Suzman, 1996). Instead, phonological awareness scores were significantly lower in emergent Zulu-English bilinguals than L1 English monolinguals. In addition, L2 English word reading was more moderate-to-strongly correlated with phonological awareness tasks in the emergent Zulu-English bilinguals than was the case in the L1 English monolingual and biliterate Afrikaans-English bilinguals learning to read in their spoken first / home languages. These results suggest that emergent Zulu-English bilinguals may be utilising simpler and Zulu phonological skills sensitive to spoken syllabic Zulu, to aid their still-developing L2 English phonological and reading skills. This effect, coupled with low oral language proficiency skills and low vocabulary knowledge in both languages, results in the reading achievement gap between emergent Zulu-English bilinguals and L1 English monolinguals or biliterate Afrikaans-English bilinguals. Thus, oral language proficiency plays a significant role in bilingual reading development, because children with higher oral language skills will also learn to read more easily in that language (Bialystok, 2002).

Several past studies have shown that when language of schooling is not the same as language of the home, bilingual children achieve lower levels of reading competency than their monolingual or biliterate bilingual peers and require 5 to 7 years to reach grade level standards in conversational and academic language and reading achievement (Thomas & Collier, 2002). In this study, the results show that an English-only educational environment may not adequately develop their low L1 Zulu and low L2 English oral language skills, which impacts on their L2 English reading ability. The emergent Zulu-English bilinguals may have been experiencing *semi-lingualism* or an inadequate proficiency in both languages (Thomas & Collier, 2002). This occurs when bilingual children gradually lose proficiency in their L1 while being taught in the L2; they end up being limited in both languages and over time perform poorly on measures of language production and comprehension (Thomas & Collier, 2002). Thus emergent Zulu-English bilinguals need to reach a certain threshold of second language ability and intensive experience and practice with more than one language may be required to reap benefits in meta-linguistic awareness, such as those found in biliterate Afrikaans-English bilinguals, or Italian-English bilinguals in D'Anguili *et al.*'s

(2001) study. This view is consistent with other research that shows advantages in phonological awareness depend on the extent to which a child is bilingual. In complex, metalinguistic tasks, the degree of bilingualism (bilingual experience) is linearly predictive of children's performance (Bialystok & Majumder, 1998). In addition, Schwartz *et al.* (2008) report that biliterate Russian-Hebrew bilinguals perform better than both monolinguals and emergent bilingual speakers with limited L2 proficiency on measures of phonological awareness and reading ability. Therefore, the results of this study point to the importance of considering the context in which children learn to read, including the orthography of each language and degree or nature of bilingualism at the environmental level of the revised Frith (1995) framework of the present study.

The Zulu-English bilingual children are emergent bilinguals; their L1 is spoken at home while their L2 oral language skills develop with L2 literacy instruction at school. They are L2 English children as they encounter this new language at school and have limited proficiency in that language. The circumstances of these children differ to those of both biliterate Afrikaans-English bilinguals and L1 English monolinguals. To the extent that children's learning environments include language related variables, the acquisition of reading is influenced by the interaction between cognitive and social dimensions of bilingualism, resulting in the universal acquisition of reading, but along different developmental paths, at varying rates, and with varying outcomes for bilingual children depending on bilingual experience and model of education provided. For emergent Zulu-English bilinguals, whose L1 is not valued by the larger society, a different educational strategy seems necessary - one that promotes the child's L1 while fostering English language and literacy development (Cummins, 2000; Koch *et al.*, 2009).

L2 English word reading in the emergent Zulu-English bilinguals was predicted by listening recall - a verbal working memory measure. In this task, the child is presented with a series of sentences, the child has to verify the sentence by stating "true" or "false", and recall the final word in the sentence. Test trails begin with one sentence and continue with additional sentences in each block until the child is unable to recall three correct trials in the block (Alloway, 2008). L1 English word reading in the English monolinguals was predicted by counting recall - a verbal working memory measure. In this task, the child is presented with a visual array of red circles and blue triangles. The child is required to count the number of circles in an array and then recall the tallies of circles in the arrays that were presented.

The trail begins with one visual array, and increases by an additional array in each block. Each visual array stays on the computer screen until the child indicates he or she has finished counting all the circles.

These results support that working memory is a unique predictor of L1 and L2 word reading, replicating the results of Baddeley *et al.* (1998) and Siegel and Ryan (1993), but with the result of this study adding to previous research by finding a possible distinction between visual memory span and auditory-verbal span within verbal working memory. L1 English monolinguals appeared to place greater reliance on visual memory span within the counting recall task of verbal working memory, whereas the emergent Zulu-English bilinguals seemed to place a greater reliance on auditory-verbal span with verbal working memory. This pattern of findings suggests that control processes of working memory are related to specific environmental factors and developmental changes that occur when aspects of the child's experience are varied, including aspects such as the differential effect that various L1s may have on L2 working memory development and reading acquisition. English is less predictable at the level of the phoneme than is the case in Zulu (Suzman, 1996).

In addition, verbal working memory was achieved at a significantly lower level in the emergent Zulu-English bilinguals than was the case in the L1 English monolinguals. The effect size of .76 points to a large effect size. This result suggests that emergent Zulu-English bilinguals appear to have smaller spans and might not be capable of holding word order cues in working memory long enough for sentence or word processing. This finding is consistent with fMRI evidence by Majerus, Poncelet, Van der Linden, and Weekes (2008), which suggests that for low-proficiency bilinguals, order encoding may be less efficient in L2 than in L1 word learning. According to Churchill's (2012) multi-componential model of working memory, only when the processing of phonological and lexical information becomes efficient, do processing resources become available for sentence processing. This process requires time and requires the learner to access knowledge and other relevant information in long-term-memory (e.g. L1 conceptual knowledge) and move it into working memory to determine the role relationship between the recognized lexical items, matching of phonemes, recall of word order and comprehension of semantic clues within words. In this study, correlations between working memory and vocabulary, in particular breadth, were similar in size to correlations between working memory and reading in the emergent Zulu-English bilinguals. Consistent with this, McElree *et al.* (2000) and Ardilia (2004) state that in unbalanced / emergent Russian-English bilingual adults, L2 words function as low frequency words. Consequently, word recognition was slower than it would be for a monolingual and balanced / biliterate bilingual. Based on this, developmental working memory differences exist, these affect the importance placed on different strategies in verbal working memory, and these strategies co-vary with level of language proficiency. Further research could track working memory using a longitudinal study to determine developmental changes within working memory and the degree of their dependence on language proficiency and L1 working memory.

Despite the need for further research, although we know that instruction involving intentional development of phonological awareness, vocabulary knowledge and working memory forms a necessary foundation of effective instruction for English learners of all ages (National Panel Report, 2000), “generic” effective instruction is probably not sufficient to promote learning and literacy development in young emergent Zulu-English bilinguals. These children are learning content in a language they are simultaneously learning to speak and understand, and thus need additional support including instruction to help their conceptual development and linguistic development to optimize reading outcomes and to make the content comprehensible to them. Teaching strategies in dual medium language programmes provide clues about what is needed to make L2 instruction effective for young emergent Zulu-English bilinguals. These include explicitly teaching language along with content; using visuals, pictures and real-world objects to clarify terms and concepts, using material with familiar content (in addition, of course, to teaching new content), and, using the home language to support concept and language development, such as books in the home language, previewing key vocabulary terms in the primary language, thereby offering meaningful contexts for learning activities (Thomas & Collier, 2002; Cummins, 2000).

Teachers undoubtedly need to have adequate language skills in both languages of the bilingual child. Teacher-child relationships appear to be important to academic outcomes as well. Chang (2007 cited in Conboy, 2013) has studied monolingual English and bilingual Spanish-English teachers and children in 161 monolingual and dual medium preschool classrooms across the United States. Monolingual English teachers who have little knowledge of the Spanish language are more likely to rate the learning behaviour of the Spanish-speaking students as challenging, and are less likely to converse with them. On the other hand, bilingual Spanish-English teachers view children’s learning behaviour in a positive light. The researcher concludes that having preschool classes with young Spanish-English bilinguals taught by English-only teachers might contribute to the reading achievement gap. The findings of this study highlight that monolingual English teachers feel they need specific training to help L2 English learners learn better to equalise performance of L1 English children and some feel that English should be the only language offered and all speakers of other languages should have to learn to read English.

In the present study, even with top quality English-language teachers, achieving equitable reading outcomes was not possible in young emergent Zulu-English bilinguals. These children had low levels of English proficiency and lower phonemic awareness, word recognition, reading comprehension, and vocabulary that did English monolingual children with higher English language proficiency. In addition, longitudinal data shows that children with low scores on academic and language skills at school entry, - e.g. knowledge of numbers, number order, letters, words, beginning and ending sounds, vocabulary - predict academic achievement and achievement gaps among higher- and lower-achieving students through elementary school and beyond (National Reading Panel Report, 2000). These data suggest that determining and providing effective supports and supplements for young emergent Zulu-English bilinguals is a matter of urgency.

The need for additional supports and instructional enhancements is likely to be important for all bilingual children. Even when bilinguals make gains equivalent to or greater than those of their monolingual peers, young bilinguals tend to begin school with lower scores on a range of pre-literacy assessments. For example, Páez, Bock, and Pizzo (2011) report a gap between monolingual English-speaking children's and dual language learners' oral language skills that persisted through first grade. The use of children's home language in addition to English - often referred to as dual medium education - is probably the most important and most controversial issue in the education of bilingual children. Learners develop literacy in the L1 while developing academic proficiency in the L2, based on the need to address the academic demands of the upper grades supporting language, cognitive and other developmental outcomes. By the end of second grade, learners have developed sufficient fluency in both languages to understand directions and academic content in either language.

Skilled, responsive teachers who are free from language bias are able to foster and support rich language learning environments and provide extensive opportunities to build children's language competencies to support language, cognitive and academic developmental outcomes that are beneficial for all children. For example, Espinoza (2010) finds that additional L2 supports and instructional enhancements result in high levels of academic proficiency in English. In addition, Lindholm-Laeary (2001) finds that L2 English learners who are underachieving in English-only instruction, make phenomenal gains in dual medium language education programmes. Lindholm-Laeary (2001) finds that native English speaking children attending dual medium instruction excel in their native English, scoring higher on reading tasks than English monolinguals attending literacy instruction in English only. Similar findings are reported in Thomas and Collier's (2002) longitudinal study, and in Gomez *et al.*'s (2005) investigation of dual medium education programmes in the United States. Children receiving dual medium instruction implemented in various languages other than English, including Cantonese, Korean, French, Portuguese, Haitian, Creole, Tagalog, Arabic and Japanese, have been shown to develop full conversational and academic proficiency in both languages through the use of both languages for instruction.

In other words, good dual medium instruction should support learning and literacy development of young biliterate Afrikaans-English bilinguals, emergent Zulu-English bilinguals, as well as monolingual English children. To provide this level of language support, monolingual English teachers need ongoing professional development on how to support the early learning and development of young bilingual children. Academic and pre-academic skills (language, reading, and mathematics) are targeted, but not to the exclusion a supportive but stimulating learning environment where children will be encouraged to explore and expand their growing repertoire of language, cognitive, and academic skills. One strategy observed in this study, as well as in other dual medium studies, that takes into account the linguistic and academic growth of children who are developing their L1 and L2 through dual medium instruction, is referred to as *language of the day*. All school and classroom activities (e.g. morning announcements, storytelling, silent reading, and lunch breaks) are conducted in a specific language of instruction, which alternates daily. This promotes bilingualism across the school, develops vocabulary in both languages, including the learner's L2, validates both languages and helps develop both the conversational and academic language of all learners.

4.3.4 Recommendations for education practice

In a recent summary of related research, Espinosa (2010) concludes that the best evidence available points to the value of early reading instruction in the home language and in English contributing to the development of both languages and successful reading development in English. Children's home language should play a prominent role in good dual medium instruction programmes - not to the exclusion of English - but as an additional resource to promote full language, cognitive and academic growth. Use of the home language and use of English are in no way mutually exclusive; both should be used to support children's growth and development. Durgunoglu (2002) reports that children with a strong foundation in language and literacy skills in Spanish are better able to transfer those skills to English than children with a weaker foundation in Spanish language and literacy. More recently, Gorman (2012 cited in Conboy, 2013) has shown that teaching kindergartners phonemic awareness skills in Spanish, produces improvement in phonemic awareness when they are measured in English. Building first language literacy skills not only helps the child to develop conversational and academic proficiency in that language but also provides valuable tools for learning to read in English (Cummins, 2000). Thus, providing young emergent Zulu-English bilinguals with high-quality interactions in both languages is critical.

Although this research supports the implementation of dual medium instruction, and many examples of successful dual medium language programmes can be found both internationally and in developing countries such as Nigeria and Guatemala (Dutcher, 1995), certain potential problems still exist. Effective programmes rely on seeing the value of knowing more than one language and raising the status and importance of languages other than English. In this study, (consistent with other studies in South Africa), Zulu parents preferring English to Zulu instruction due to disadvantages experienced if they did not understand English, (Heugh, 2002), pose a problem for effective implementation of dual medium instruction. Webb (2004) points out that language attitudes towards Zulu cannot change overnight, and can only change if the social-linguistic status of a language changes. An example of this is the history of Afrikaans. Although the English-speaking government and Dutch-speaking cultural leaders were strongly against the use of Afrikaans in public life, community leaders, such as teachers and church leaders were the driving forces behind promoting the Afrikaans language. This eventually led to the written form of the language being developed, literature being published, and over time, Afrikaans developing as a language of educational, economic, and political power (Webb, 2004). A similar process is needed in the case of Zulu. Effective dual medium programmes would balance the tension between social and political concerns and enable effective schooling practices for educating bilingual children. Until the cultivation of positive attitudes on the part of parents, raises the status and importance of Zulu instruction and teacher training includes special focus on bilingual methodology, there is always a risk that critics of dual medium education will seize upon results from poorly designed and implemented programmes and use these results to condemn dual- language programmes and promote English-only instruction (Heugh, 2010).

In the English (L2) of the biliterate Afrikaans-English bilinguals, word-reading was significantly related to the similarities-depth measure of vocabulary knowledge, working memory, and phonological awareness. This is a distinct developmental pattern from that of L1 English monolinguals and L2 English emergent Zulu-English bilinguals, suggesting that relative amounts of experience relate to how the brain processes words. Similarities-depth measures of vocabulary knowledge and phonemic awareness, complex, high-order skills accounted for 25% of the variance in word reading, suggesting that WM mediates the relationships between vocabulary and phonological awareness. This percentage of variance explained is slightly higher than the percentage of variance explained in L1 English monolinguals (17%), but significantly lower than the percentage of variance explained in the L2 of the emergent Zulu-English bilinguals.

These findings are important for three reasons. Firstly, they show that L2 reading acquisition differs in bilinguals relative to the L1 English monolinguals; English reading measures capture additional variance related to language proficiency. This result supports Bernhardt's (2003) view that the presence of a L1 makes the L2 reading acquisition process different to that of the L1 reading acquisition process. This in turn, underscores why monolingual standards are inappropriate for assessing bilingual children learning to read in one or both of their languages.

Different levels of reading were achieved in monolingual and bilingual children due to different strategies for word recognition based on learning experience in particular literacy-learning environments. In addition, amounts of exposure to first and second language make a difference in level of reading attainment, thus supporting the idea that the brain becomes established for each language based on experience with that language, and that this process requires time, as well as rich input in each language (Kim *et al.*, 1997). Thirdly, the significantly higher level of performance on tasks requiring high levels of analysis of knowledge within and across the two languages of the biliterate Afrikaans-English bilinguals, supports a consistent trend reported on in previous studies (Lindholm-Leary, 2001, cited in Muter *et al.,* 2004; Morales, Calvo, & Bialystok, 2013; Thomas & Collier, 2002). This finding is important as it shows that bilingualism that is valued philosophically and supported pedagogically, results in high levels of bilingualism, biliteracy and cognitive ability. The data promotes a view of bilingualism as an opportunity to increase the brain's capacity to process information more effectively and efficiently, and to improve reading attainment in general, as seen in the following examples from Afrikaans-English bilingual teachers of biliterate Afrikaans-English bilinguals.

- Content needs to be altered to meet L2 English learner needs, including:
  - Teaching basic vocabulary, explaining and contrasting language structures and grammatical rules between the L1 and L2,
  - Introduce a story by drawing out key concepts / themes in child's native-language; next apply same strategy in English until learners have grasped reading comprehension strategy, and conclude by writing practice in both languages.
  - Use illustration and context cues to deduce meanings before directly teaching vocabulary. In this way reducing cognitive demands in L2 English reading and scaffolding reading of a new text.

4.3.5 Conclusion

The foregoing research findings on the relationship between children's language and learning environments to their L2 reading development, has suggested that L2 literacy acquisition makes use of cognitive processing skills resulting in the universal acquisition of reading, but along different developmental paths, at varying rates, and with different outcomes. These are dependent on the extent to which a child is bilingual and the additive or subtractive model of education provided. The results support the central hypothesis that variations in language development and educational context contribute to individual and group differences in L2 English reading attainment (revised Frith framework, 1995). That is, monolingual and dual medium classroom environments develop children's cognitive and reading abilities, but do so in different ways and to different degrees with consequences for the rate or course of L2 English reading development in monolingual and bilingual children in South Africa.

Two central conclusions are: first, the mechanisms of reading acquisition are both social and cognitive / linguistic in nature and second, language is not a unitary concept or fixed-effect. The bio-ecological reading framework of this study predicts both of these effects (revised Frith model, 1995). The reading development of a typically developing child may be altered given small variations in language experience, such as amounts or types of language input. At the same time, in any group of learners (monolingual, L2, or multilingual), differences in learning experiences will affect cognitive functioning and reading attainment. When children are learning two languages, differences in experience with each language could lead to slightly different patterns of activity for the cognitive functioning of each language, affecting subsequent learning to read in each language. There are other differences in early childhood experiences that are relevant to understanding the reading development of bilingual children, such as an additive or subtractive bilingualism context (Cummins, 2000). These shape and determine patterns of language input to children, which then lead to different patterns of cognitive activity and hence different language learning and reading attainment in monolingual and bilingual children in South Africa (revised Frith model, 1995).

A rich description of the effects of language related variables on the cognitive functioning and developing language proficiency and reading competency is one component for a comprehensive picture of how monolingual and bilingual South African children learn to read supported (or not) by the varying social-cultural influences and education contexts in which they live. A rich description of learning mechanisms that mediate the effects of the environment on language, cognitive and reading development is the other necessary component. To this end, the next section examines the results on the relationship of balanced bilingualism and biliteracy experience to working memory and L2 reading development.

4.3.6 Discussion: Cognitive consequences of bilingualism: the interaction of language in society and additive bilingual environments on children's cognitive functioning, language and literacy development

Research has demonstrated that working memory supports children's development in a variety of other areas, such as general IQ, reading, language development, and higher cognitive functioning (Gathercole & Baddeley, 1991). In this study, all children were nine years old, and thus good working memory ability was expected across the monolingual and bilingual children. However, the present study found that biliterate Afrikaans-English bilinguals significantly outperformed both emergent Zulu-English bilinguals and L1 English monolinguals on working memory, phonological decoding and reading comprehension. This finding supports the findings Vejnovic, Milin, and Zdravkovic (2010) who compare reading spans of Serbian-English bilinguals in L1 and L2 as a function of L2 proficiency and report that L2 working memory span is significantly longer for high-proficiency bilinguals than for low-proficiency bilinguals. In addition, the data supports the findings of Morales, Calvo and Bialystok (2013) who report that Spanish-English bilingual children taught to read using dual medium instruction, outperform native English monolinguals on measures of working memory. Thus, the data shows that the cognitive benefits of being fully bilingual and biliterate (i.e. using both languages interchangeably and equally often and continuing to develop) lead to greater working memory capacity, which, in turn, aids reading achievement across both languages.

In this study, there were quite high correlations between L1 and L2 phonological, vocabulary and reading measures in biliterate Afrikaans-English bilinguals, suggesting bi-directional transfer. Hence, balanced bilinguals develop a qualitatively different mechanism of lexical selection to unbalanced or emergent Zulu-English bilinguals who demonstrated transfer influenced by the L1. Consistent with this, Costa and Santesteban (2004) report that in partial bilinguals, there is a cost when switching languages and a larger switching cost when switching to the dominant language. In contrast, in balanced Spanish-Catalan bilinguals (who use both languages interchangeably and equally often), the language-switching cost is symmetrical, equally large in both directions. Similarly, Prior and Gollan (in press), compare a group of balanced Spanish-English bilinguals who regularly switches between languages, to a group of balanced Mandarin-English bilinguals who switches between languages less often. Only the Spanish-English bilinguals show a reduced task switching cost, suggesting that continual language control and the repeated practice of language switching result in bilinguals possessing efficient control mechanisms. Thus, less effortful L2 word processing or word recognition comes with increased L2 proficiency.

When form-to-meaning mappings are weak, (such as in less proficient bilinguals), conceptual information between each of their languages cannot be retrieved directly. The non-dominant lexical form is associated with its corresponding dominant lexical form to facilitate conceptual retrieval, resulting in a time delay. This time delay affects language understanding and hence reading comprehension (Ardila, 2003). As the bilingual becomes more proficient in the L2, the size of the conceptual set activated by the L2 will eventually be comparable to that accessed by the L1. At this point, the bilingual is able to use the L2 to directly access meaning. Furthermore, the bilingual will also be able to mediate access from the L1 to the L2 through shared conceptual representations (Dufour & Kroll, 1995). In the present study, the differential reliance on vocabulary and similarities as predictors of L2 word reading in the emergent Zulu-English and biliterate Afrikaans-English bilinguals, suggests that the degree of L2 fluency influences the role bilingualism plays on L2 learning. It also suggests the time in L2-learning where bilingualism is mostly likely to have beneficial effects on cognitive and reading development. This in turn means that the existence and distinction between additive and subtractive bilinguals is important for understanding the cognitive functioning and L2 reading competence of bilingual children.

Further support for cognitive and reading abilities comes from neuroimaging studies. For example, García-Sierra *et al.* (2011) cited in Conboy (2013), present bilinguals with English and Spanish speech sound contrasts in an ERP oddball paradigm. Infants who hear more English in the home show a larger discriminatory response for the English than for the Spanish contrast, whereas infants who hear more Spanish at home show the opposite pattern. Infants with more balanced input across languages show similar discrimination for each language. These results suggest that relative amounts of experience with each language correlate with how the brain processes. In the present study, distinct developmental patterns for L2 reading were evidenced for the three linguistic groups of this study.

Gathercole and Baddeley (1991) report an increase in the efficiency of the central executive function over the course of reading development. In this study, superior performances by the biliterate Afrikaans-English bilinguals on complex phoneme, similarities and reading tasks that place high demands on attention, support this view. This is consistent with previous research that bilingual and biliterate bilinguals possess high levels of analysis of linguistic knowledge and control of attentional processing (Bialystok, 1988; Bialystok & Majumder, 1998). However, the central executive function has no storage capacity, and thus does not have the means by which to maintain and associate a series of letters with their phonetic counterparts: this process calls for visual-verbal integration. Baddeley (2000a, 2001) suggests that the episodic buffer is responsible for verbal-visual integration. Therefore, it is possible that the episodic buffer as opposed to the central executive function is called upon when task demands require the active storage and processing of both visual and verbal forms of information on the AWMA.

Kormi-Nouri, Moniri, and Nilsson (2003) assess monolingual Swedish and Persian - Swedish bilingual Grade 2 to 6 learners on tests and find positive effects of bilingualism in tests of two types of memory. Episodic memory – memory for experienced events – is tested by presenting children verbal statements or activities (e.g. hug this doll), and semantic memory – memory for ideas, concepts, and meanings – is tested by having children encode word lists of common words. Bilinguals show a moderate advantage compared with monolingual children, thereby suggesting that bilingualism has a positive effect on children's long-term memory. Thus, good performance of working memory and L2 reading comprehension, both requiring immediate storage and processing, by the biliterate Afrikaans-English bilinguals is either due to integration from long-term memory or direct integration from the phonological loop and visual-spatial sketchpad (Baddeley, 2000). Since the present study did not include a measure of the episodic buffer, future research will need to examine this finding in more detail, possibly using longitudinal study and the evolving technology of fMRI and ERP to shed light on the role of episodic buffer in L2 reading acquisition. form than observed indirectly based on behavioural measures. A bio-ecological perspective within Frith's (1995) multi-level reading framework would also provide a global framework from which specific theories about the important interplay between brain maturation and experience could be tested.

4.3.7 Recommendations for education practice

Across cognitive processing and reading measures, the cognitive advantages of bilingualism were strongest when children were proficient in both languages, and they were not visible when children's experience with one language was limited. This finding is consistent with other research showing that advantages in cognitive performance depend on the extent to which a child is bilingual (Costa & Santesteban, 2004). The results of this study show that dual language instruction does not delay cognitive and reading development in both languages. Developing conversational and academic language skills in English and the child's home language will lead to competency in both languages over time, and even have cognitive benefits. This replicates findings of previous meta-analytic studies with over 100 studies reporting a *"positive association between additive bilingualism (involving maintenance and continual development of the mother-tongue* [sic]*) and students' linguistic, cognitive, or academic growth"* (Cummins, 1999, p. 3).

This knowledge has implications for supporting the learning and reading development of young bilingual children in the foundation phase. Educators need to provide bilingual children with language experiences that support and promote the full oral and written mastery of both of their languages, including many opportunities to practise, interact, and speak with other proficient users of both languages. The efforts of teachers should be complemented by those of parents. Parents need to speak to their child in his / her home language to continue developing L1 proficiency in the home language. In addition, parents need to speak to their child in English to complement learning experience in English, such as occurs in biliterate Afrikaans-English bilinguals and is absent in emergent Zulu-English bilinguals.

Differences in cognitive, language, and literacy development, depend on which other languages a child speaks, and thus the teaching of reading should be adjusted according to the language pairs the child is learning to read. In this study, the transparent L1 Afrikaans orthography resulted in higher reading performance than the opaque English (L2) orthography in biliterate Afrikaans-English bilinguals. This has implications for learning to read the other nine transparent languages in South Africa. In this study, developing proficiency in two or more languages did not hurt a bilingual child's ability to read. However, one cannot overlook the similarities between the two languages, the language of the child's school experience, and the quality and quantity of the child's exposure to each language as additional factors in explaining the reading performance of bilingual children.

4.3.8 Conclusion

The advantages for dual-language learning appear to be associated with developing proficiency and competency in both languages. Hence, providing bilingual children with opportunities to develop both conversational and academic language skills in both languages is a critical factor. Given the growing literature examining working memory and perceptual learning (Shipstead, Redick, & Engle, 2010), the present study shows that training working memory is possible, which extends to reading ability and hence is beneficial to language learning for learners in dual medium instruction. This is an important finding as it shows that bilinguals adapt their processing of words in ways that allow them to remain “open” to multiple linguistic cues. Recent studies point towards important cognitive benefits of being fully bilingual. Bialystok, Craik, and Freedman (2007), for example, report that the age of onset of dementia is on average four years later in bilinguals than in monolinguals. Considering these findings and the trainability of working memory observed in this study, biliterate bilinguals who are proficient in both languages in terms of learning to speak and read both languages from birth and continuing at school, are able to simultaneously access words in their two lexicons stored in long-term memory and retrieve the appropriate word when reading the target language. The non-relevant language does not interfere with the relevant one; the biliterate Afrikaans-English bilingual outperformed English monolinguals on working memory and reading tasks. According to Morales, Calvo, and Bialystok (2013) working memory tasks involve conflict inhibition; this ability has been shown to develop more rapidly in bilinguals and predict bilingual children’s good performance on cognitive and language tasks (Bialystok, 1988). However, working memory involves both working memory and inhibition control (Alloway, 2007).

In the biliterate Afrikaans-English bilinguals, L2 English word reading was predicted by the similarities- and phoneme-deletion tasks. These tasks were highly correlated with working memory and reading tasks. The similarities and phoneme tasks involve the ability to remember a list of words and re-order them (working memory) and inhibit the non-relevant language when reading in the target language (inhibition control). These kinds of skills are mediated by working memory. The results of the similarities, phoneme, working memory and reading tasks, clearly showed a biliterate bilingual advantage. This is an important finding for two reasons. First, previous research comparing monolingual and bilingual children on the aforementioned tasks did not always consider socio-economic measures (Wang & Geva, 2003). Second, balanced bilinguals may promote reading success through advanced levels of working memory functioning. In other words, working memory tasks in balanced bilingual children involve keeping two mental lexicons in mind: one in English and one in Afrikaans (storage of items) and selecting the appropriate words, given the language of the task (manipulation or processing of words). English monolinguals learning to read in the same spoken and instruction language do not need to consider the language of the task as bilinguals do, and thus they are likely to have less practice with maintaining and simultaneously storing and processing items of information. This result is consistent with Morales, Calvo, and Bialystok, (2013) study that show a bilingual advantage in working memory using the Simon-task in biliterate bilingual Spanish-English children. The Simon-task is largely non-verbal, whereas in the current study, the advantage in biliterate Afrikaans-English children was demonstrated in verbal and visual information.

Thus, bilingual environments, such as dual medium instruction and home-school connections, that encourage bilingual children to use information held in working memory consistently and continually during reading instruction, allows bilingual children to access words in their two mental lexicons and retrieve the appropriate words from long-term memory. Given the language context, balanced bilingualism does not slow down the acquisition of L2 English reading. Instead, dual medium instruction supports and enhances the learning and development of L2 English by providing continuing support for children's home language as they learn English, since home language proficiency is foundational for learning and development across languages and cognitive domains (Cummins, 1999; Thomas & Collier, 2002).

By promoting working memory, dual language instruction can transcend any initial lower verbal ability relative to monolinguals, which is highly predictive of L2 English reading achievement (Snow *et al*., 1999). In this regard, the results of the present study clearly show that language proficiency needed to reach reading scores superior to that of monolinguals, can be attributed to balanced bilingualism or bilingual culture. Emergent bilinguals limited in both their languages due to their language learning situation, are unlikely to be able to use information held in working memory appropriately during reading instruction to compensate for the needed language proficiency to reach reading scores that are comparable to that of English monolinguals. Furthermore, the present study is the first to examine all three factors: levels of bilingualism, cognition and reading in South Africa. In general, the results of the present research support intentional findings that a full bilingual upbringing has positive cognitive consequences (Bialystok, 2007; 2010; Cummins, 1999; Thomas & Collier, 1992). Bilingual environments in South Africa that encourage children to use information held in memory during language learning situations, bridge the gap between L1 and L2 oral and academic language proficiency. Future longitudinal research would add more weight to this claim.

4.4 ARGUMENT FOR AND (MISGUIDED) ARGUMENTS AGAINST DUAL MEDIUM INSTRUCTION

> *The research in South Africa does not as yet have data to echo what bilingual research in the USA, such as Thomas and Collier (2002), has found after decades of large-scale research. We are not convinced, either that these findings can be applied to the South African contexts, as most of the research in that vast literature concerns Spanish and English, or French and English. In the case of Canadian research, languages from the Indo-European group share may similarities in syntax and morphology with English. This is not the case with indigenous South African languages.*
>
> Henning and Dampier (2012, p. 105)

4.4.1 The languages in education situation in South Africa

On the one hand, recent research in South Africa attests to the growing number of studies in the area of language in education (De Sousa, Greenop, & Fry, 2010*;* Koch *et al.*, 2009; Henning & Dampier, 2012; Ramadiro, 2012). What is troubling about Henning and Dampier's (2012) point of view, is a discourse that suggests that international research pointing to the importance of mother tongue education and continual maintenance of the mother tongue alongside the L2 instruction for successful education in the mother tongue and in English, has little bearing on the linguistic, cognitive and reading development of children in South Africa (Heugh, 2002; 2013). This implies the replacement of the first language with English mainly, and ignores early research carried out in South Africa into academic advantages (Ianco-Worrall, 1972). The answers to Henning and Dampier's (2012) questions have been addressed by the findings in the present study.

Research in the area of language in education has a long history in South Africa. Furthermore, South African research has been taken outside this country and used to further international research on dual medium education (Cummins, 1984). Ianco Worrall's research in 1972 on bilingual Afrikaans-English-speaking children contributed to Cummins' (1984) later work on bilingualism and bilingual education in Canada and the United States. Baker and Garcia (1996, p. 133) quote one of Ianco-Worrall's (1977) conclusions that *"bilingual children have greater cognitive flexibility than do monolingual children and this is an advantage"*. What she might have added, is that the 'health' of a language depends on its ability to empower. English has certainly found favour with people who were previously disadvantaged and especially within the liberation movements from the early years of the apartheid regime (Alexander, 2004). In South Africa, with its eleven official languages, Heugh (2002) has pointed to the perception by some language groups that English is the only language which has the capacity to deliver quality education to the majority. This affects the perception of the ten other languages in South Africa in terms of their capacity to deliver quality education (Alexander, 2004; Heugh, 2002).

In apartheid South Africa, segregated education, a language policy designed for separate development, unequal resources, and a cognitively impoverished curriculum, resulted in the massive under-education of the majority of the population (Heugh, 2002). In this context, no quick solution or single approach that tackles one area of a dysfunctional education system can be successful in reversing the effects of apartheid for the learners in question. A broader picture needs to be considered. The big picture includes the explicit or implicit goals for language education, a clear understanding of the precise conditions regarding the power of language to foster national identity and cohesiveness within South Africa, and a grasp of how to bring about effective change (Heugh, 2002; 2010). A framework is needed that explicitly specifies language outcomes, tied to teaching techniques, activities and supported by written materials. This framework needs to also include a sufficient number of trained and experienced teachers who are fluent speakers of the language(s) of instruction and who are trained to teach via that(those) language(s). At the same time, such a framework would contribute to the big picture of how social contexts facilitate and support the academic achievement of bilingual children in one or both languages (revised Frith framework, 1995).

Table 4.10 presents a compendium of research findings that points to the importance of considering the social connotations placed on certain languages in the multicultural South African context, which includes the *environmental level* of the revised Frith (1995) reading framework. It is important to note that how a child acquires a second language has implications for academic development. In effect, bilingualism needs to be discussed in the context in which it occurs. In the present study, the bilingual children are mostly bilingual due to a diverse language environment, and / or due to attending school in one or both of their languages. In subtractive bilingualism, the social prominence placed on English leads to the perception that only English instruction is desirable as compared to the mother tongue (Chapter 3). This perception should be borne in mind when viewing the results in Table 4.10, which seem to favour the biliterate Afrikaans-English child (i.e. additive bilingualism) which show high levels of bilingualism, biliteracy (i.e. mother tongue plus L2 language instruction) and academic achievement in both languages.

Table 4.10: Compendium of research findings of language in education in South Africa (2009 – present).

Koch, Landon, Jackson, and Foli (2009)	Henning and Dampier (2012)	Present Study
Sample: 11 rural isiXhosa-English bilinguals with dual medium instruction and 16 rural emergent isiXhosa-English bilinguals.	***Sample:*** 71 bilinguals in all English instruction. 73 Zulu and Sesotho children received instruction in the mother tongue.	***Sample:*** 100 English monolinguals, 100 emergent Zulu-English bilinguals with L1 Zulu spoken proficiency only and L2 English instruction, and 100 biliterate Afrikaans-English bilinguals attending dual medium instruction in urban Johannesburg schools.
***Design*:** Cross-sectional bilingual groups design differing in all-English or dual medium instruction. All children were in Grade 1	***Design:*** Cross-sectional bilingual groups design differing in all-English or mother tongue instruction. All children were in Grade 1.	***Design*:** Cross-sectional mixed group and mixed-method design. All children were in Grade 3 (i.e. three years of schooling in English-only or dual medium instruction). All children were matched on socio-economic status.
Key Findings: No reading advantage (also no harm) on reading achievement by isiXhosa-English bilinguals with one-year dual medium instruction compared with native English peers in English. Koch *et al.* (2009) also reported a gap between oral language proficiency and academic language proficiency.	***Key Findings**:* Bilingual Children in all-English schooling performed better on language measures (i.e. naming objects and actions using subject and verb structures) than children attending mother tongue instruction.	***Key Finding:*** Dual-medium education that values both languages provides second language instructional support with the addition of vocabulary enrichment activities in both languages is critical and results in higher levels of reading attainment than all-English programmes in helping bilingual children to acquire both conversational and academic language skills in English.
Recommendation for Education Developing full oral language proficiency occurs outside of the classroom.	***Recommendation for Education*** Early immersion into English to avoid negative effects of mother tongue instruction.	***Recommendation for Education**:* Ideal dual-medium education implementation occurs when both languages are valued philosophically and supported pedagogically by trained and experienced teachers who are fluent speakers of the language(s) of instruction and who are trained to teach via those language(s).

From Table 4.10, it can be seen that beliefs and knowledge affect literacy acquisition for English language-learners. All researchers agree that learning subject matter in the first language helps learning subject matter in the second language (which in turns helps English language development by providing more comprehensible input), and also agree that developing literacy in the first language facilitates literacy development in the second language. Despite this, the findings of Koch *et al.* (2009) and those of Henning and Dampier (2012) create the impression that bilingual education does not result in full conversational and academic proficiency using two languages for instruction. I would like to suggest a somewhat different approach in evaluating and reviewing research on bilingual education, taking into consideration that effective dual language education programmes have the following conditions as noted by Krashden (1999, p. 1):

1. Providing background knowledge through the first language via subject matter teaching in the first language in such a way that subject matter instruction in English is comprehensible.
2. Providing literacy in the first language.
3. Providing comprehensible input in English, through English as second language pedagogy: direct, explicit teaching (or explanations) of features of English, such as vocabulary, scaffolding language with sentence frames and connecting the home language to English when telling and dramatizing stories. These teaching strategies help children learn skills and concepts. Providing material with familiar content (in addition, of course, to teaching new content), thereby allowing learners to acquire a second language in a comprehensible way in addition to using the home language to support concept- and language- development in both languages. Teachers of the biliterate Afrikaans-English bilinguals indicated use of many of these teaching strategies.
4. Using an adequate sample size and running the programmes run for at least one year (which may be far too short to show an effect).

According to Krashden (1999) when these above conditions are met, dual medium education achieves higher levels of academic proficiency in reading than those in English-only programmes and produces English speakers who are as good as or better than native speakers of English (Krashden 1999; Espinoza, 2010). Furthermore, he argues that apparent counterexamples of failure of dual medium instruction or cases in which bilingual education is thought to be inferior to inferior to English-only instruction goals, do not meet the conditions outlined above. In these comparisons, dual medium education language and literacy programmes are poorly conceived, implemented, or inaccurately described, sample sizes are small, and incorrect comparisons are made.

Koch *et al.* (2009) report no advantage (also no harm) to reading achievement by isiXhosa-English bilinguals with one-year dual medium instruction compared to native English peers in English. Koch *et al.* (2009) also report a gap between oral language proficiency and academic language proficiency and attribute this finding to developing full oral language proficiency outside of the classroom. However, as Krashden (1999) points out, well-designed and implemented dual medium programmes, facilitate and promote full conversational and academic proficiency using two languages for instruction. Developing oral and academic language skills in the first language helps develop the L2. Furthermore, Koch *et al.* (2009) fail to consider the impact of diglossia on their findings. That is, literacy instruction in isiXhosa is taught via an informal rural variety that differs from the standard written variety. This may have affected the results obtained, because intensive experience and practice is needed in the L1 to reap benefits in reading attainment in the L2. This is consistent with other research showing that advantages in reading performance depend on the extent to which a child is bilingual (Carlson & Meltzoff, 2008; Thomas & Collier, 2002).

Koch *et al.* (2009) also report that teachers are motivated to teach literacy in isiXhosa and believe in the value of knowing more than one language. However, this is not a true evaluation, because no interview or quantitative data is reported to substantiate these claims. In addition, it is not clear whether dual medium education included classroom activities to support L2 vocabulary development or how knowledge gained in one language could be applied to the other language. Both of these components are addressed in good dual medium education programmes (Thomas & Collier, 2002). Based on this, Koch *et al.*'s (2009) study does not meet the conditions outlined above for high levels of academic proficiency in reading One year is too short to show dual language benefits on academic language skills; mismatch between rural and urban language varieties may have compromised isiXhosa literacy acquisition that impacted on ability to acquire literacy skill in both languages and an incomplete understanding or misreading of principles underlying bilingual education during implementation of dual medium education in the classroom, could account for failing to show high levels of academic achievement.

Henning and Dampier (2012) reported that their findings demonstrated the superiority of submersion and that the effect of an all-second language environment was stronger than use of the first language for language development. This is a particularly serious finding in light of past and current research on the benefits of mother tongue instruction (Snow *et al.,* 1998; De Sousa, Greenop and Fry, 2010). The "superiority of submersion" most probably has nothing to do with the absence of mother tongue education. The comparison between monolingual and bilingual groups was problematic. It appears that the groups compared may be quite different. Bilingual children in all-English instruction had two years' experience in spoken and written English proficiency prior to entering Grade 1 making instruction in English much more comprehensible. This was not the case for Zulu and Sesotho children who typically are exposed to the spoken form of Sesotho or Zulu only and not written Sesotho or Zulu form at home due to the strong oral tradition found in these communities coupled with the belief that reading instruction commences at school and not earlier (Buthelezi, 2003). This trend was also seen in the present study (Chapter 3).

Thus, cultural beliefs and differing levels of language exposure and proficiency in the language of instruction rather than programme effects, may account for the differences reported and not the "negative effects of mother tongue instruction." Researchers who conclude that all-English instruction is superior to mother tongue education or to mother tongue-plus L2 instruction are inaccurate and misleading. This is because they invariably violate one or more of the conditions previously mentioned, and hence put forward misguided arguments against bilingual education (Krashden, 1999; Heugh, 2002).

In the present study, bilinguals in dual language education outperformed their counterparts in all-English instruction on tests of cognitive and academic achievement and scored higher or equal to native English speakers on tests of cognitive and academic achievement. This finding is consistent with the findings of other dual medium instruction programmes in Canada, the United States, South America, Australia and South-East Asia (Heugh, 2002). Five meta-analytic studies also provide clear support for bilingual education as a means of helping children succeed academically in English (Espinoza, 2010; Krashden-McField, 2002). For researchers – and, one would hope, for policymakers - it is highly significant that reviews of the literature, which were conducted independently, reach similar conclusions. Such consistency provides strong evidence that research findings are reliable, rather than merely the result of chance. They also cast strong doubt on claims that all-English approaches are superior to dual medium education. There is no doubt that, when it comes to English literacy acquisition, mother tongue instruction is part of the solution, not part of the problem. Just as the early research on bilingualism that warned of disastrous effects of bilingualism on cognitive development was found to lack proper control groups, thereby undermining any interpretation of those findings, so too this problem requires consideration in the literacy of bilingual children. In the present study, when bilinguals attending dual medium education were matched for amount of time in the language(s) of instruction, socio-economic status and intelligence (that potentially impact on learning and school performance) these individuals exceeded their counterpart monolinguals in performance. In other words, the better the research design, the stronger the effects of dual medium education on high levels of academic achievement in both languages.

The principal point is that equity of educational outcome for all bilingual children in South Africa cannot be achieved just by providing quality education, the same facilities, textbooks and curriculum. In particular, children who speak Zulu at home and do not understand English sufficiently to make their classroom learning experiences fully meaningful, will not benefit. The high prestige of English and negative social status of the Zulu language has resulted in a strong preference for English as medium of instruction. Consequently, schools adopt an English medium policy. Such a policy presents a serious problem for many learners whose English (L2) is not sufficiently well developed to make L2 English literacy acquisition successful. English acts as an obstacle to educational development, rather than promoting academic success, thereby not promoting access to the competitive global job market that is perceived by Zulu parents to be associated with English (Chapter 3). Instead, children who are learning content in a language they are simultaneously learning to speak and understand, probably need additional support to make the content comprehensible to them by using the home language to support linguistic, conceptual and language development in both languages. For this to happen, parents and teachers need to become aware of the relationship between a bilingual child's first language and L2, and the possible benefits of using Zulu as a medium of instruction alongside English. Support for this view comes from the fact that the skills required for reading in Zulu and Afrikaans are similar; both languages have predictable grapheme-to phoneme mapping rules. Reading accuracy was higher in Afrikaans than in English in the biliterate Afrikaans-English bilinguals. Thus, reading accuracy in Zulu can be expected to be high. Hence emergent Zulu-English bilinguals would achieve higher levels of reading proficiency if they received mother tongue instruction. On the other hand, English alongside the home language instruction provides access to optimal conditions for high level of literacy attainment in both languages, as biliterate Afrikaans-English bilinguals demonstrate high levels of academic language proficiency in both Afrikaans and English.

Research findings regarding medium of instruction are important in South Africa so that policy makers, educators and parents can make decisions in the best interest of their children. This is particular pressing since children who suffer most because of discriminatory language practices are those from historically disadvantages sections of the population. If emergent Zulu-English bilinguals continue to perform poorly, then discriminatory language in education practices that existed during apartheid regime have not changed very much (Heugh, 2002).

South Africa prides itself on having a multilingual education policy but its effective implementation requires attention as does understanding the roles of language and culture on children's cognitive functioning and reading competence. This is important because the social and cultural connotations placed on different languages can be used as ammunition against dual medium education in favour of English-only goals imposed on bilingual Zulu-English speaking children by critics of bilingual education that seize on poorly designed or implemented dual medium education programmes. This criticism could take away the opportunity to participate in dual medium education that promotes high levels of bilingualism, biliteracy and the power of language to foster national identity and cohesiveness through the use of teaching activities that help learners transfer vocabulary knowledge already learned in one language to the other language. These activities promote conceptual learning and linguistic development and are designed to support the full development of both conversational and academic language, which ensures that learners can perform well on tests of cognitive processing and reading ability and comprehend content in either language. The effect size of .26 and range of .10 - .51, between dual and single language learning is consistent with other five meta-analyses (Krashden-Mcfields, 2002) and adds weight to this view. The high levels of reading achievement by biliterate Afrikaans-English bilinguals demonstrates the value of a well-conceived and implemented dual medium education, both languages used equally in instruction by suitably trained bilingual Afrikaans-English teachers who see the value in knowing more language and effectively imparting this belief in how they use both languages for literacy instruction, including vocabulary and conceptual activities.

The broader conclusion of this study with regard to debates about language and education is encapsulated in the following statements:

Language and knowledge about language are no longer a central focus of the educational process. It is time for critical pedagogy to take seriously and to heart issues of language, since not doing so will continue to lead to a flawed understanding of oppression in and the liberating potential of education.

Regan (2009, p. viii)

> *Evidence-based practice implies the use of the current best evidence in making decisions about the care of individual patients by integrating individual clinical expertise with the best available external clinical evidence from systematic research.*

Dollaghan, (2004, p. 4)

Through such an approach, we can better appreciate how to develop cognitive-processing skills and reading attainment of monolingual and bilingual learners to an appropriate level, permitting these learners to able to adequately cope with the current context of education, and also, empowering these learners to attain their full academic potential. Successful education culminates in well-adjusted individuals who are able to significantly contribute to the general welfare of South Africa's 'rainbow-nation' (Heugh, 2010).

4.5 REFLECTIONS: GLANCING BACK AND LOOKING FORWARD

> *A Newtonian image of an inalterable, mechanical universe biased social scientists toward avoiding the messy aspects of humanity.* [It mentally prepared them] *for a bold exploration of the icy depths of interplanetary space. Instead, they found themselves completely unprepared for the tropical nightmare of a Darwinian jungle: A steaming green Hell, where everything is alive and keenly aware of you, most things are venomous or poisonous or otherwise dangerous, and nothing waits passively to be acted upon by an external force ... The sweltering space suits ... had to come off.*
>
> (Sechrest & Figueredo, 1993, p. 647-48).

Utilising less colourful metaphors, but still making an important point, Bonfenbrenner (1979) reprimands the developmental research community for neglecting the cultural influences, as well as social contexts in which children develop. Consistent with Bronfenbrenner's (1979) emphasis on contextual influence on development, the present research has shed light on the effects of language related variables on the cognitive functioning and reading attainment of monolingual and bilingual children. By taking "the sweltering space suits" off and comparing contexts, the results of this study provide valuable information on how to enhance the learning experiences of monolingual and bilingual children.

Taking account of the "steaming green Hell" of context effects necessitates re-thinking the way language has been conceptualized in conjunction with a bio-ecological approach to assess, in a more comprehensive and heterogeneous manner, the cognitive functioning and reading competence of linguistically diverse children (Armour-Thomas & GoPaul-McNicol, 1997; Share, 2007). Ecological psychology moves away from computer models of human cognition and towards a study of cognition as it occurs in real-life situations. This approach uses the brain instead of the computer as a model for viewing cognitive behaviour. It is well-accepted that connections between neurons at the synaptic juncture are strengthened with repeated activity; this process is called Hebbian learning.

The bio-ecological approach accounts for differences in experience with language in monolingual and bilingual learners, how this affects cognitive functioning and subsequent reading attainment. This approach also accounts for how, when children are learning two languages, differences in experience with each language lead to slightly different patterns of activity for the functioning of each language, affecting subsequent learning to read in each language. The use of different cognitive processing skills for L2 word reading also explains differences in structural and functional properties of the mind that result from various learning situations (e.g. bilingualism versus monolingualism). Thus, certain experiences with language could determine the organization of the neural systems involved in language processing, and hence language learning. Furthermore, the cognitive demands that learning two languages creates, including selectively attending to each language's sound patterns and grammatical rules and inhibiting the retrieval of words in one language when using the other language, mean that full bilingualism should not be viewed as a deficit. Instead, it should be viewed as an opportunity for expanding the brain's working memory capacity (Morales *et al.*, 2013). At the same time, the slight differences in monolingual and bilingual reading underscore why monolingual standards are inappropriate for assessing cognitive functioning and reading attainment in bilingual learners (Armour-Thomas & GoPaul-McNicol, 1997; Bialystok, 2007).

Although there are similarities between monolingual and bilingual language processing, there are many differences. Literacy acquisition is achieved in bilingual children as it is in monolingual children, but is achieved in different ways. Differences in learning to read in different languages and orthographies underscore why English reading models and assessment standards are inappropriate for assessing cognitive and reading development in bilingual children. How a child becomes bilingual and the extent to which a child is bilingual, means that experience shapes learning mechanisms, which, in turn, determine how cognitive capacities for biliteracy are heightened through social context, underscore why monolingual models are inappropriate for assessing cognitive and reading development in bilingual children. Monolingual models do not reflect that bilingual children learn differently from monolingual children. Monolingual models do not reflect that bilinguals need to discover different sound systems, stress patterns in words, and grammatical rules. Nor do they reflect that language systems interact during language and word processing in bilinguals (Bialsytok, 2002; 2010). Monolingual models do not reflect that language and literacy acquisition in bilinguals become established for each language. This process requires time, as well as rich input in each language (Kim *et al.*, 1997).

This study has demonstrated that the inclusion of language related variables on cognitive and reading development is useful and appropriate for the South African monolingual and bilingual children. In this way, it contributes to understanding that mechanisms of language and literacy development are both social and cognitive-linguistic in nature, and that literacy development takes on different forms in different learning environments, thereby producing group and individual differences in the rate or course of literacy development in monolingual and bilingual children in South Africa (Bialystok, 2007; 2010; Hoff, 2006). Thus, how reading works, requires contributions from cognitive-neuropsychological and social context variables, which, in turn makes cognitive development and reading acquisition possible, while making language outcomes variable. In essence, a reading framework should be applied, based on a child's language background and educational context, to assess and remediate monolingual and bilingual children (Armour-Thomas & GoPaul-McNicol, 1997; Bialystok, 2007).

The three linguistic groups of children utilise the levels of the reading framework, but the relationships are different. Figures 4.7-4.10 demonstrate these significantly different relationships. The present study was cross-sectional in nature. More information that is detailed would be gained from a longitudinal study of children with different orthographies learning to read in native, one or more languages, from pre-school. Monolingual English children demonstrated reading development consistent with that of learning to read in orthographically opaque English, with a significant role for vocabulary and working memory to overcome the decoding uncertainties of English spelling. Reading words in the Afrikaans (L1) of the biliterate Afrikaans-English bilinguals was more strongly related to phonological awareness which has been reported in readers of highly transparent languages such as Spanish (Goswami *et al.*, 1998) or Italian (Cossu, 1999). Reading words in the Afrikaans (L1) and L2 English of the biliterate Afrikaans-English bilinguals reached the same end-point of reading (comprehension was not significantly different), but with different strengths and relationships for each language. Reading words in the L2 English of the emergent Zulu-English bilinguals demonstrated strong relationships between phonological awareness but weak lexical and extra-lexical skills (comprehension was significantly different) compared to the biliterate Afrikaans-English bilinguals and the monolingual English children. Thus, level of bilingualism is decisive in determining the effects bilingualism has on cognitive and reading development. Absolute levels of first language / L2 proficiency provide a statistical description of sources of variation in solving cognitive and literacy tasks, while relative levels of first language / L2 proficiency provide an account of the time in L2 learning for which bilingualism influences cognitive development. Combining these two points provides the basis and justification for the necessity of generalised, adaptable frameworks and models of reading, such as Frith’s framework (1995).

The present study demonstrates that children’s literacy development occurs in a complex context: a mix of interpenetrated ecological and cultural factors provides the basis and justification for mixed-method investigations (Armour-Thomas & Go-Paul McNicol, 1997). We no longer need to argue that context matters or that research on literacy acquisition in a multilingual and multicultural South African context requires both qualitative and quantitative designs and methods. The findings of the present study showed that insight into developmental pathway and contexts of children’s literacy development and social and cognitive / linguistic factors influencing group and individual differences in the rate or course of reading attainment are more likely to be illuminated if we use a combination of research methods. Interview data led us to understand that attitudes towards languages, people's wishes regarding language use and development and value of knowing more than one language have implications for children’s literacy development.

Quantitative data allowed us to test hypotheses about the nature of children’s learning experiences and how they vary across social contexts, which led us to discover that levels of bilingualism and orthographic transparency had a significant impact on literacy development and that nature or degree of bilingualism have significant impact on L2 literacy development. Therefore, there is no alternative to using mixed methods and models of bilingualism if we want to develop a comprehensive picture of how context matters and a comprehensive understanding of contextual influences on cognitive and reading development. Sechrest and Figueredo (1993, p. 647-48) point out: “we have no choice but to shed our space suits” (i.e. language-independent and context-free models) and “wade into the steaming green hell” (i.e. the extent to which a child knows language(s), the uses for which language(s) are employed, and the social connotations surrounding its use) and, to determine the effects of level of bilingualism on children’s literacy acquisition in the multilingual and multicultural South African setting.

However, methodological pluralism surely has perils of its own, in the terms of how to evaluate the validity of combinations of methods (Barnes, 2012). In this regard, pragmatism is the key criterion. This criterion states that, *"a mixed-method approach has validity when it can be shown to lead to findings, insights or conclusions, or concepts that lead to social improvement of some sort"* (Sechrest & Figueredo, 1993, p. 19). In this regard, the present study addresses learning to read in different orthographies simultaneously, and concludes that differences reflect adaptation to unique circumstances of learning two languages, which, in turn, can lead to developmental advantages when two or more languages are supported through enriched learning opportunities.

This research also describes components of dual medium education that specifically enhance the learning and development of young dual language learners, including providing continuing support for children's home language as they learn English, as home language proficiency is foundational for learning and development across all domains including English-language development. At the same time, this study demonstrated that young children can successfully learn two languages and do not have to give up their home language in order to learn English when the home language is used in instruction setting.

The validation of alternative models of reading assessment of linguistically and culturally diverse children is important, given the many problems inherent in L2 reading research and practice. The findings of the present study urge psychologists, educators, and remedial teachers to question the customary practice of administering cognitive and reading tests and interpreting results obtained from an Anglo-centric perspective, or monolingual, or education context-free perspective and instead implement alternative assessment paths that can better serve the educational needs of these children. The bio-ecological approach to reading assessment allows for greater heterogeneity in the expression of language effects on the cognitive functioning and reading performance of linguistically and culturally diverse children. In addition, this approach recognises the importance of analysing how attitudes towards languages by families, the academic assistance children receive at home, as well as the classroom environments have contributed to their current cognitive and reading performance levels. Among the questions that could be asked are: (a) "Are the appropriate languages being used for instruction? (b) Is the level of language(s) used in the classroom comprehensible to the learner? and (c) Are the classroom materials appropriate for developing linguistic and academic language skills of the learners?" (Armour-Thomas &

GoPaul-McNicol, 1997, p. 125). These procedures are time-consuming, but they produce a model of reading assessment that takes into account the cultural influences and social contexts in which reading skills are demonstrated, the inseparability of context and cognition, thereby a more appropriate way in which to conceptualise reading acquisition in monolingual and bilingual children in the multilingual and multicultural South African setting.

4.6 CONCLUSION: LANGUAGE AS A LENS FOR VIEWING LITERACY DEVELOPMENT

> *The work of an intellectual is not to mould the political will of others; it is, through the analyses that he does in his own field, to re-examine evidence and assumptions, to shake up habitual ways of working and thinking, to dissipate conventional familiarities, to re-evaluate rules and institutions and to participate in the formulation of a political will (where he has his role as citizen to play).*
>
> Foucault (1986, p. 305-6)

From the preceding section, South Africa represents a case of “unfinished revolution”. Although the transition from an apartheid to a democratic education system which constitutionally enshrines the right to education for all children in any of the 11 official languages, represents praiseworthy and, in some ways, quite revolutionary progress, there are still significant and persistent problems that need to be addressed in terms of educational transformation for those marginalised by apartheid education polices (Heugh, 2010). Connotations placed on languages are one area that needs to be looked at in this regard, as a powerful epistemological tool constituting and contributing to the process of change. It tells us about, is an instance of, and affects the educational trajectories of monolingual and bilingual children in South Africa. By re-examining evidence and assumptions pertaining to beliefs about language learning and types of language learners, this research has raised important questions about the nature of educational discourses in South Africa, the role of research in the process of change, and issues related to context, culture, ideology, and role of language in education in South Africa. The next section reflects on the broad contribution of the present study for the field of bilingual education and wider contexts in South Africa.

Foucault (1967; 1986) has argued that discourse or conceptualisations of social phenomena, change over time and, in the changing, shape and reflect social and institutional practices. Because of this intertwining of discourse and social practice, discourses are determinative of the ways in which we perceive and act within the world. Dominant or hegemonic ways of perceiving actions and events in the world draw from existing power relations within the world. Foucault's context-sensitive notion argues that particular social phenomena, e.g. the treatment of the ill, display particular historical-ideological features. Foucault (1967) notes that conceptualisations of madness in the middle ages were that of the voice of genius or divine inspiration, whereas modern conceptualisations of madness are based on a binary opposition between sanity and insanity. Foucault (1967) posits that madness cannot be viewed as a symptom of personal distress. Instead, it should be viewed as a symptom of social distress that could serve purposes of the groups wielding the diagnostic label. As mental health professionals continued to develop and improve their diagnostic skills, the intellectual lens attempting to understand the complexity of human experiences became multi-dimensional in terms of explanation and treatment of madness (Freeman, 1991). Foucault's context-sensitive (1986) view of mental illness shares similar concerns with that of researchers questioning the assumption that the rate or course of literacy development in native English-speaking is similar to the rate or course of literacy development in other languages and orthographies or in the two languages of bilingual children. In addition, in questioning the applicability of the dominant Anglo-centric perspective of reading research and practices for theorising how children learn to read, the range of variation in multilingual environments and its consequences for language acquisition are only beginning to be documented (Share, 2007).

The social circumstances of bilingualism environments vary. For example, one language is given oral status and the other educational status, or both languages are given space in the community and instructional setting. For language learning children in bilingual homes, their exposure to two languages may be fairly balanced, or one language may dominate. Thus, monolingual models do not consider that social and cognitive / linguistic experiences shape bilingual children's learning mechanism or rate or course of reading development nor do they account for the fact bilingual children learn differently to monolinguals. As such, they are ill-equipped to serve the educational needs of children and adults from diverse cultural groups. Furthermore, English-language models should not be viewed as universal models of reading because they are based on the complex English spelling - to - sound code, and also tend to "overlook a fundamental unfamiliar-to-familiar/novice-to-expert dualism applicable to all words and readers in all orthographies." (Share, 2007, p. 584).

Both of these concerns are taken into consideration in the bio-ecological model used in the present study. Such a model considers the effects of multiple experiential language factors including level of orthographic transparency, level of proficiency in specific languages, nature / type of bilingualism (i.e. subtractive *vs*. additive context), dual language learning vs. English-only, and task context (i.e. what a bilingual has to do) on the cognitive functioning and reading competence of culturally / linguistically diverse children. Moreover, a bio-ecological framework holds the promise of a more complete picture of bilingual reading development involving recognising and translating words from more than one language, as well as how this process alters as a function of proficiency level. This is because it takes into consideration the developing relationship between the two languages of a bilingual, as well as the cognitive demands of the working memory task presented to them. Any potential language effects on cognitive functioning, including working memory or advanced language skills like reading comprehension in each language, are subject to change depending upon how each language of a bilingual is used / not used at home and at school on a daily basis. In sum, knowing how monolingual and bilingual children *do differ* from one another is important if we are to understand the impact of bilingualism on the cognitive and literacy development of young children.

More broadly, South Africa represents a case of unfinished revolution with both opportunities for and constraints against comprehensive educational transformation. Great strides have been made in terms of the non-discrimination within education – the fact that all 11 official languages enjoy 'parity of esteem' and are 'treated equally 'is constitutionally recognised in South Africa as is the importance of ensuring access to and quality of education (Constitution of the Republic of South Africa, 2004, Section 6). Nevertheless, these have not been enough to make a dent in pervasive racialized social injustices still apparent in modern day South Africa. One solution to this is advocating for researchers to carry out research that does not isolate linguistic, pedagogic and cognitive aspects of research into language medium of instruction, from broader social factors in which the South African education system operates, or discourse around educational transformation. Skutnabb-Kangas (2000, p. xx-xxi) explains:

> *Nice people are working with good intentions –and still the results are often a disaster. Why? I share with many researchers worldwide the belief that the education of indigenous peoples and minorities in most countries is organised in*

> *ways, which counteract sound scientific evidence from education and several other disciplines. In many cases, we know in general terms how education could be organised better. We can show that it works, and often it is not even more costly in the short -term and certainly not in the medium or long-term… But it is not done. Why? Many linguists and educationists are working hard, with devotion, to make people literate. The United Nations and UNESCO, the Organisation of African Unity, and many other organisations publish scores of resolutions and declarations about their commitment to literacy and Education for All. Still the world's literacy rates are either not improving or are improving at a much slower rate than any of the …plans have suggested…. Why? I claim that the wrong choice of medium of education is the main pedagogical reason … And most 'development aid' supports the wrong languages. Why?*

Skutnabb-Kangas (2000) believes that answers to the most challenging educational problems lie in not only examining evidence and asking what and how questions but also why that evidence has presented itself. Skutnabb-Kangas (2000) points to the perils of researchers and intellectuals whose feelings and moral and political value judgements are seen as irrelevant to the research and / or are not acknowledged by them. She goes on to quote Gramsci (1971 cited in Skutnabb-Kangas, 2000, p. xxiv-xxv):

> *The intellectual's error consists in believing that one can know without understanding and even more without feeling and being impassioned … in other words that the intellectual can be an intellectual (and not a pure pedant) if distinct and separate from the people-nation, that is, without feeling the elementary passions of the people, understanding them and therefore explaining and justifying them in the particular historical situation and connecting them dialectically to the laws of history and to a superior conception of the world, scientifically and coherently elaborated, i.e. knowledge. One cannot make politics -history without this passion, without this sentimental connection between intellectuals and people –nation.*

Nuanced issues require nuanced approaches. A progressive language lens within the South African education system and wider society, I believe, is vital to making the shift Skutnabb-Kangas (2000) suggests is needed to address the most challenging educational problems involving language. Revolutions are seldom fully successful if isolated from the wave of collective shifts in thinking they bring. By opening ourselves up to the idea that social and cognitive / linguistic, mechanisms mediate the effects of the environment on language development, we gain an understanding of how language background and educational contexts shape cognitive and reading development. In addition, we gain insight into how children's efforts in learning to read are supported (or not supported) by the social circumstances in which they live (Bialystok, 2007). As the world becomes increasingly bilingual, it is hoped that recommendations and implications for educational practice identified in the present study can be used to formulate best practices for supporting the learning and development of young dual language learners, and hence be a valuable resource for education professionals working with bilingual and multilingual children (Bialystok, 2007). It is also hoped that mixed-method and multi-group research, such as in the present study, will stimulate further research on the specific needs of bilingual and multilingual children in other communities.

In moving forward, the relevance of mother tongue or dual medium language instruction to educational success and issues of access, quality and equality and its importance as "a legitimate mechanism for creating equal educational opportunities" (Malherbe, 1977, p. 21) is possible through a better understanding of complex social, linguistic, and cultural factors influencing cognitive-processing skills and reading attainment in monolingual and bilingual learners.

Given this research showing that measures of cognitive and reading activity reflect the varying experiences children raised in bilingual environments have with each of their languages, psychologists, teachers and remedial practitioners should realise that bilingual children would not exactly resemble monolingual children in each of their languages. Therefore, literacy instruction for bilingual children must be as flexible as possible, with the general goal of providing the best social and cognitive fit possible between each bilingual child and her or his daily learning environments. Teachers should be advised that the degree that the phonological inventories of two languages overlap, learning accomplished in one language is useable in both languages. At the same time where a bilingual's two languages differ, there will be no or limited value of cross-linguist transfer. This could be for a number of reasons, including diglossia (i.e. informal *vs*. formal language variety), vastly different phonological-orthographic structures such as Chinese and English, speaking Zulu at home and speaking English at school or sensitivity to global phonological similarity not making a distinctive contribution to reading acquisition in Afrikaans which has a more consistent alphabetic orthography than English. Phonological and orthographic knowledge need to be explicitly taught in each language in which the child learns to read. Additionally, limited use of the home language in the instruction setting may have negative influences on the second language reading development of bilingual children. Evidence for this is view is provided by the data in this study. Dual medium instruction, not English-only educational environment, was able to bridge the reading achievement gap between bilinguals and monolinguals. Thus, it is imperative that the cognitive and academic benefits of dual medium education be brought to the forefront of investigation.

Bilingual children tend to have vocabulary knowledge distributed across both their languages, thus a bilingual child may not always know the same words in both language (Pearson *et al.*, 1997). Given this distributed nature of bilingual language development, bilinguals would appear to develop in each language at a slightly slower pace if assessed using monolingual norms. Additionally, research indicates that vocabulary knowledge becomes established for each language based on experience with each language over time, and this process could affect the efficiency with which learning of more advanced language skills, such as reading comprehension or working memory, in each respective language, occurs. The effect size of .26 and range of .57 – 3.64 across vocabulary, reading comprehension and working memory measures between the emergent Zulu-English bilinguals and biliterate Afrikaans-English bilinguals, demonstrates that degree or nature of bilingualism results in different cognitive and reading abilities. Furthermore, the high levels of academic achievement and cognitive functioning of the latter children relative to their L1 English peers is an important finding, because it shows that social contexts that support bilingualism philosophically and pedagogically result in bilingual children developing knowledge and skills they need to succeed in school and society. These children are better able to cope with the cognitive demands and to allow acceleration in cognition to achieve high levels of academic proficiency in reading in both languages (Cummins, 2000; Lindholm-Leary, 2001, cited in Muter et al., 2004; Thomas and Collier, 2002).

This research can be used to inform best assessment practices for practitioners working with bilingual children. Instead of using monolingual standards that carry the potential for cultural and linguistic bias and lead to misinterpretations by members of the educational community that may be used to justify questionable educational practices, bilingual children's cognitive and reading performance should be compared to bilingual children with similar levels of orthographic transparency and language proficiency in the L1 and the L2. Research providing a coherent profile of the cognitive functioning and academic progress of South African children, and dual language and all-English programme effects is sorely lacking and any research adding to the field is beneficial. Better educational decisions could be made if cognitive and reading profiles of bilingual children are available and adequately sensitive to capture important developmental changes over time, as well as dual language and all-English programme effects. A uniform monolingual landscape is not the norm in South Africa; linguistic, cultural and educational factors need to be considered in the reading assessment of bilingual children to help practitioners conduct fair and appropriate assessments.

It is also important for teachers and parents to understand the roles that the social and linguistic contexts play on children's reading acquisition and the consequences of a complete bilingualism and biliteracy experience so that improved teaching strategies can be implemented by all early literacy programmes to support the learning and reading development of young bilingual children. Psychologists, teachers and remedial practitioners should bear in mind that no research accepts that the brain is a limited capacity system (Baker & Garcia, 1996; Baker, 2000). Young children can successfully learn two languages and do not need to give up their native language in order to learn English if it is given space in the instruction setting alongside English. As a specific example, teachers can enhance language learning and reading attainment of bilingual children by providing rich learning opportunities in the home language at the same time as the school language through bilingual materials, and activities and interactions with others who are fluent speakers of the languages.

Although bilingual learners share many characteristics of language / literacy development with monolingual learners of each of the same languages, differences in relationships between cognitive processing and reading skills across groups influence how each group learns to read and how the brain processes language. Past research indicates that in bilinguals, both languages are activated for the same concept, so that a bilingual speaker needs to select from a wider range of words than a monolingual speaker, to retrieve the correct word, and therefore bilinguals use cognitive (executive) control mechanisms during word retrieval to a greater extent than monolinguals (McElree *et al.*, 2000). In the present study, the higher percentage of variance explained in L2 word reading in both bilingual groups compared with English monolinguals is related to language proficiency, as bilinguals go through an extra stage in literacy development whereby they need to acquire oral language proficiency and cognitive processing skills related to reading in L1 and L2 (Bialystok, 2002). Differences in dual versus monolingual language processing have been observed as early as seven months of age, even before vocabulary is developed, and therefore greater use of executive control comes about from the need for bilingual children to pay attention to different linguistic cues (sound patterns or grammatical rules) across languages (Kuhl *et al.*, 2005). Thus, differences in dual versus monolingual language processing should not be interpreted as indicative of language delay or deficit. Instead, they should be viewed as adaptations to the special circumstances of learning more than one language. Using additional cognitive resources can lead to cognitive advantages when both languages are supported through enriched learning opportunities. In sum, the fact that the brain adapts to bilingual input means that parents and teachers should not worry that the use of both languages will confuse a child or create a developmental delay; instead, they need to know that bilingual children's developing brains are capable of learning, processing, and reading two languages (Baker, 2000).

The present research also suggests that, because experience shapes children's learning mechanisms, models of learning need to reflect that bilingual children may learn differently from monolingual children. Monolingual reading models do not account for the fact that the bilingual children need to discover different sound system patterns since two systems label the same concept and linguistic features may change even though meaning remains constant. Thus, psychologists, educators and remedial teachers should consider that language systems interact during word recognition, which, in turn, affects performance on reading tests. Parents and teachers should be advised that bilingual children need rich input in both languages and need to be able to practise using both languages for academic success in both languages (Baker, 2000).

Investigations exploring how bilingual children perform in cognitive measures within a bio-ecological assessment system can shed light on the nature of systematic language bias when assessment results for such children from linguistically and culturally diverse backgrounds are interpreted (Armour-Thomas & GoPaul-McNicol, 1997). The use of a bio-ecological framework such as the revised version of Frith (1995), enables one to view reading development in children from diverse linguistic and cultural backgrounds holistically. This study included the environmental variables of multiple language factors when conceptualising reading development. Cognitive processing skills were shown to support reading attainment in different languages and in first and second language contexts, but with clear, unique features for children in different learning environments, thereby producing group and individual differences in the rate or course of reading development in monolingual and bilingual children. Given the many problems with most L2 English reading research, and growing appreciation for the role of bilingualism in children's reading, bio-ecological approaches to reading development that take into account the roles that language and culture play in the reading development and cognitive functioning, are vital to implement assessment paths that better serve the needs of linguistically and culturally diverse children.

In general, the results of this study demonstrate that young children can successfully learn two languages and do not need to give up their home language in order to learn English if both the home language and English are given space in the educational setting. In this context, teachers can enhance the language learning of bilingual children by providing rich learning opportunities in each language through encouraging family involvement and using bilingual materials. At the same time, the rate or course of reading attainment is influenced by communicative competence in oral and written forms in both languages, and by the relevance of cognitive inputs in each language to the acquisition of the other language. The role of bilingualism on literacy development thus depends on which aspect of language development is considered, and on the similarity between the two languages that the child is learning.

This is not the whole story, of course. The success of dual language programmes in promoting high levels of literacy achievement in both languages has been replicated in different orthographic-transparent language pairs (Uchikoshi, 2012). In addition, research evidence exists that shows that children who had failed to make gains in academic language skills in English-only instruction programmes, when placed in dual medium language instruction programmes, make phenomenal gains (Lindholm-Leary, 2001 cited in Gomez, Freedman, & Freedman, 2005). Furthermore, mother tongue English-speaking children in dual medium language instruction programmes, despite learning through two languages, showed high levels of academic achievement, and scored higher than their peers learning in English-only (Lindholm-Leary, 2001 cited in Gomez, Freedman, & Freedman, 2005).

This suggests that dual medium instruction holds great promise for developing high levels of academic achievement, bilingualism and biliteracy, and hence the environment provides support only to those who make use of it.

Successful language development in multilingual environments views bilingualism as a valuable resource (Ruiz, 1984). Children's home language should play a prominent role - not to the exclusion of English – but as an additional resource to promote language and cognitive growth more fully. To provide this level of home language support, schools need to enhance their efforts to recruit, hire, or retain staff representing the cultures and languages of the children and families enrolled. All teachers will also need on-going professional development on how to support the early learning and literacy development of young bilingual children. To the extent that learning experiences are mostly in English (not optimal, but sometimes unavoidable due to community perception and needs) additional support must be provided to teachers so that teaching experiences are meaningful and understandable to bilingual children by using the home language to support concept and language development and promote accelerated cognitive development. Such endeavours are most likely to provide the strongest possible foundation for developing the knowledge and skills needed to succeed in school and society (Gomez, Freedman, & Freedman, 2005).

Successful bilingual education targets language and reading development in both languages based on pedagogical theories and research into medium of instruction, but not to the exclusion of a supportive and stimulating learning environment where bilingual children are encouraged to explore and expand their growing repertoire of language, cognitive, and reading skills. This process culminates in well-adjusted individuals who will be able to contribute significantly to the general welfare of the 'rainbow-nation' (Alexander, 2005; Heugh, 2010). Language is a cultural factor. Dual medium language and literacy instruction programmes aim to promote high levels of academic achievement, bilingualism and biliteracy, and cross-cultural awareness. Dual medium programmes raise the status and importance of languages other than English. This is because they emphasise the value in knowing more than one language in the process of helping children to develop conversational and academic language proficiency in two languages. At the same time, it is becoming increasingly recognised that as monolingual English-speaking children become bilingual, parents and learners alike will see the value of knowing more than one language. Finally, as communities, schools, and teachers work together to implement dual medium language programmes, cooperation among groups, enriches all parties (Thomas & Collier, 22).

Viewing bilingualism as a resource serves as a better orientation for language in education than earlier approaches that viewed bilingualism as a problem and more recently bilingualism as a language right. The cognitive advantages of bilinguals in dual medium language programmes provide a strong justification for bilingual education programmes in the Foundation Phase. Dual medium language programmes provide the best example of how language, once learned, becomes an important tool of the mind and fosters cognitive development. The goals of schooling, therefore, should include helping all children become fully bilingual and biliterate, thereby fostering the cognitive, language, and cultural enrichment of the entire 'rainbow nation.'

We have learned that it is educationally defeating to isolate language from its social, cultural, and political surroundings (Cummins, 2000; Skutnabb-Kangas, 2000; Vygotsky, 1962). South Africa prides itself on having a multilingual education policy. High quality programmes balance the tension between social and political concerns and effective schooling practices for educating dual language learners. Effective dual-language programme implementation depends on the level of "fit" or "match" between programme guidelines, teachers' instructional strategies, and actual use of the languages as mediums of instruction to achieve the programmes' specified goals and objectives. A meta-analysis of The National Association for Bilingual Education (1995) concludes that, when taught by teachers who understand and believe in the important role of primary language in literacy learning, bilingual children have access to conditions for high levels of academic achievement in both languages.

Teachers and researchers working with bilingual children who interpret theories and assumptions articulated in a multilingual education policy incorrectly, such as through inadequate or contradictory administrative guidelines and policies or at the classroom level through improper or inadequate instruction in one or both languages (Henning & Dampier, 2012; Koch *et al.*, 2009), incorrectly conclude that dual medium programmes fail to achieve high levels of academic achievement. Instead, lack of congruence between the multilingual theoretical principles and programmatic practices leads to dual medium programmes failing to achieve the desired high level of academic success. Therefore, one must consider that the level of congruence between values and beliefs about bilingual education and patterns of use of the two languages as mediums of instruction, larger context and status conflicts within languages, could preclude the positive effects of high levels of bilingualism, biliteracy and academic achievement in bilingual children in South Africa. (De Sousa & Broom, 2012).

If bilinguals in dual medium education equated for socioeconomic status, basic health, and other factors that potentially affect learning and school performance, exceed monolinguals' performance on tests of general cognitive functioning, as well as those that have a strong cognitive component such as literacy acquisition, then, it is imperative that the cognitive and academic benefits of dual language education be brought to the forefront of reading research and practice. This is a pressing issue since approximately half the children in the world live in multilingual environments with this estimate being likely to increase in the coming years for children in South Africa (Bialystok, 2007). The present study represents the results of comprehensive research on mother tongue and dual medium language education programmes and the importance of the role that bilingualism plays in cognitive and reading development. Its well-considered conclusion is encapsulated in the following statement: *"Knowing more has never been a disadvantage when compared to knowing less"*. (Bialystok, 2002, p. 192).

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APPENDIX A:
PERMISSION FROM THE HUMAN RESEARCH ETHICS COMMITTEE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (NON MEDICAL)
R14/49 De Sousa

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER H0 91010**
PROJECT	To be or not to be bilingual: Cognitive processing and literacy development in English L1, English L2 and bilingual Afrikaans-English Speaking childre
INVESTIGATORS	Ms D De Sousa
DEPARTMENT	Psychology
DATE CONSIDERED	16.10.2009
DECISION OF THE COMMITTEE*	Approved Unconditionally

NOTE:

Unless otherwise specified this ethical clearance is valid for 2 years and may be renewed upon application

DATE 25.11.2009

CHAIRPERSON ....
(Professor R Thornton)

cc: Supervisor : Prof Y Broom

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

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

Signature

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX B: PERMISSION FROM THE DEPARTMENT OF EDUCATION TO CONDUCT RESEARCH IN PUBLIC GOVERNMENTAL SCHOOLS

Lefapha la Thuto

UMnyango WezeMfundo

Departement van Onderwys

Enquiries: Nomvula Ubisi (011)3550488

Office of the Chief Director: Information and Knowledge Management

Room 501, 111 Commissioner Street, Johannesburg, 2000 P.0.Box 7710, Johannesburg, 2000

Tel: (011) 355-0809 Fax: (011) 355-0734

Date:	23 March 2009
Name of Researcher:	Diana Soares de Sousa
Research Topic:	To Be or Not To Be Bilingual: Cognitive Processing Skills and Literacy Development in EnglishL1, EnglishL2 and Bilingual Afrikaans-English-Speaking Children
Number and type of schools:	4Primary 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: 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.

1. *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.*
2. *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.*

3. *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.*
4. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and 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.*
5. *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 Director (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.*
6. *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.*
7. *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.*
8. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
9. *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.*
10. *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.*
11. *On completion of the study the researcher must supply the Director: Knowledge Management & Research 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.*
12. *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.*
13. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director 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

CHIEF DIRECTOR: INFORMATION & KNOWLEDGE MANAGEMENT

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

APPENDIX C:
LETTER OF INFORMED CONSENT TO THE SELECTED PUBLIC GOVERNMENTAL SCHOOLS

Dear Principal of School

My name is Diana De Sousa I am conducting research for the purpose of obtaining a Doctor of Philosophy (PhD) degree at the University of the Witwatersrand. My research study aims to explore how different cognitive skills (alphabetic knowledge, oral vocabulary, semantic knowledge. phonological awareness, non-verbal abilities and working memory) contribute to reading and spelling development in monolingual speaking and bilingual speaking children. This study will generate valuable information for the development of first and second language literacy achievement and therefore, for reading and spelling instruction. I would like to ask permission for your learner's participation in this study.

In this study, children will be tested by me of and one of my research assistants on a test battery consisting of: alphabetic knowledge, oral vocabulary, working memory, phonological awareness, (awareness of onset, rimes and isolated letter sounds), non-verbal abilities, word spelling, word and sentence reading as well as reading comprehension. Testing time is estimated to be 45 minutes per learner over two assessment sessions, at times and a venue that is most convenient for teachers and learners at your school. All information gathered during the research will be strictly confidential. All of your learner's results will be kept confidential, and will not be seen by anyone other than myself or my research assistants. The school will receive a summary of the results of this study.

Participation is voluntary, and no learner will be advantaged or disadvantaged in any way for choosing to participate or not to participate in the study. Your learners may refuse to answer any questions and may choose to withdraw from the study at any point. There is no personal risk involved for any learner participating in the study. I can be contacted telephonically at 083 452 3626. Contact with my dissertation advisor Dr Yvonne Broom can be made via email yvonne.broom@wits.ac.za or telephonically: 011 717-4516.

If you choose to let your learner's participate in the study, please the principal consent form attached to this letter.

Yours sincerely,

Diana De Sousa

APPENDIX D:
PRINCIPAL CONSENT FORM

Date

To whom it may concern:

As principal of ____________________________________ school, I authorize Diana De Sousa to carry out her research on third grade learner's literacy achievement.

This research is Diana's doctoral dissertation at the University of the Witwatersrand. This study will generate valuable information for the development of first and/or second language literacy achievement and therefore, for reading and spelling instruction.

In this research children will be tested on alphabetic knowledge, oral vocabulary, working memory, phonological awareness, (awareness of onset, rimes and isolated letter sounds), spelling, word and sentence reading as well as reading comprehension.

I understand that:

- A learner's participation in this study is voluntary,
- A learner's may refuse to answer any question he/she would prefer not to,
- A learner's may withdraw from the study at any time,
- No information that may identify a learner will be included in the final dissertation, his/her responses will remain confidential, and
- There is no personal risk involved for any learner participating in the study.

All information gathered during the research will be strictly confidential. The school will receive a summary of the results of this study.

Sincerely yours

Signed: ______________________

Telephone number where I can be reached: _______________________

School Stamp:

APPENDIX E:
LETTER OF INFORMED CONSENT TO PARENTS

Dear Parent/Guardian of Learner

My name is Diana De Sousa I am conducting research for the purpose of obtaining a Doctor of Philosophy (PhD) degree at the University of the Witwatersrand.

My research study aims to explore how different cognitive skills (alphabetic knowledge, oral vocabulary, semantic knowledge. phonological awareness, non-verbal abilities and working memory) contribute to reading and spelling development in monolingual speaking and bilingual speaking children. This study will generate valuable information for the development of first and second language literacy achievement and therefore, for reading and spelling instruction.

I would like to ask permission for your child's participation in this study.

In this study, children will be tested by myself of and one of my research assistants on a test battery consisting of: alphabetic knowledge, oral vocabulary, working memory, phonological awareness, (awareness of onset, rimes and isolated letter sounds), non-verbal abilities, word spelling, word and sentence reading as well as reading comprehension. Testing time is estimated to be 45 minutes per learner over two assessment sessions, at times and a venue that is most convenient for teachers at your child's school. All information gathered during the research will be strictly confidential. All of your child's results will be kept confidential, and will not be seen by anyone other than myself or my research assistants. The school will receive a summary of the results of this study.

Participation is voluntary, and no child will be advantaged or disadvantaged in any way for choosing to participate or not to participate in the study. Your child may refuse to answer any questions and may choose to withdraw from the study at any point. There is no personal risk involved for any child participating in the study. I can be contacted telephonically at 083 452 3626. Contact with my dissertation advisor Dr Yvonne Broom can be made via email yvonne.broom@wits.ac.za or telephonically: 011 717-4516. If you choose to let your child participate in this study, please fill in the parental consent form attached to this letter.

Yours sincerely,

Diana De Sousa

School of Human & Community Development

PARENT CONSENT FORM:

Date

To whom it may concern:

As parent of ______________________________________, I provide consent for my child to be tested for Diana De Sousa's research study on third grade children's literacy achievement.

I understand that:

- My child's participation in this study is voluntary,
- My child may refuse to answer any question he/she would prefer not to,
- My child may withdraw from the study at any time,
- No information that may identify my child will be included in the research report, his/her responses will remain confidential, and
- There is no personal risk involved in my child's participation in the study.

Sincerely yours

Signed ………………………..

APPENDIX F:
LETTER OF INFORMED CONSENT TO LEARNERS

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

UMTHOMBO WOPHUHLISO LOLUNTU School of Human & Community Development

CHILD ASSENT FORM:

Date

Hello

My name is Diana De Sousa and I'm learning Psychology at the University of the Witwatersrand. I'm doing some research on children's reading and spelling and I'm here to ask you if you would like join my research study.

If you don't want join you don't have to and you won't get any special rewards if you do join.

If you take part, you will do activities on the computer, play word and sound games, read and spell words, and solve picture patterns on paper. No one but I will see your answers to the activities. If you want to be a part of my research, please write your name in the empty space below.

I …………………………………………………. provide permission to be tested by Diana De Sousa for her study on reading and spelling skills.

I understand that:

- Doing the sound, word, reading and spelling activities is my choice,
- I may stop at any time,
- No one but Diana will see my answers, and
- I will not be in any danger if I choose to join the study.

Signed ………………………..

APPENDIX G: HOME LITERACY AND LANGUAGE ENVIRONMENT QUESTIONNAIRE

Home Literacy and Language Environment (English-L1)

Confidential Questionnaire

Dear parent, please complete the following questionnaire by filling in the relevant information and placing an X over the appropriate block. Please answer honestly; the results of this survey are treated confidentially, the information collected is useful to the school so that teachers can help children read and write better.

1. Name of child: _________________
2. Gender of child: O Male O Female
3. Date of birth: ___________________
4. Home Language(s): _____________
5. How long has your child attended XX school? ____________
6. Does your child currently have any of the following problems?

   Problems learning language O Yes O No

   Problems expressing ideas with words O Yes O No

   Difficulties in school or learning O Yes O No

   Problems learning to read O Yes O No

   If you have answered yes, please give details

   ____

7. Is there anything else you would like to add about your child?

   ____

Home Language Use and Exposure: (Place a X over the appropriate response)

a) What language does the MOTHER use when speaking to the child?

O English O Other (please specify) ___________________

b) What language does the FATHER use when speaking to the child?

O English O Other (please specify) ___________________

c) What language do other adults (aside from the mother and father) use when speaking to your child?

O English O Other (please specify) ___________________

d) What language do SIBLINGS use when speaking to his or her brother or sister participating in this study?

O English O Other (please specify) ___________________

e) What language does your child use when speaking to his/her MOTHER at home?

O English O Other (please specify) ___________________

f) What language does your child use when speaking to his/her FATHER at home?

O English O Other (please specify) ___________________

g) What language does your child use when he/she speaks to other adults (not the mother or father)?

O English O Other (please specify) ___________________

h) What language does your child use when he/she speaks to his/her friends outside of the home?

O English O Other (please specify) ___________________

Parental Help: (Place a X over the appropriate response)

a) How often does your child ask you to read with him/her?

O Daily O Twice a week O Three times a week O Never

b) How often do you respond to your child's reading requests?

O Daily O Twice a week O Three times a week O Never

c) How often does an adult or older sibling read or look at books, with your child in ENGLISH? O Daily O Twice a week O Three times a week O Never

d) How often does an adult or older sibling tell your child a story in ENGLISH?

O Daily O Twice a week O Three times a week O Never

e) How often does an adult or older sibling help your child with learning (e.g. numbers, letters, and words) in ENGLISH?

O Daily O Twice a week O Three times a week O Never

f) How often does someone from your family or household go to the library with your child?

O Daily O Twice a week O Three times a week O Never

g) How often does your child read or look at books at home on his/her own?

O Daily O Twice a week O Three times a week O Never

h) k) How often do you teach your child to read words?

O Daily O Twice a week O Three times a week O Never

i) l) How often do you teach your child to write words?

O Daily O Twice a week O Three times a week O Never

5. How old was your child when you started to read to him/her?

Please estimate age _______________

Parental Education: (Place a X over the appropriate response)

a) What is the highest grade or year of school the MOTHER has completed?

Please provide highest-grade passed _______________

a) What is the highest grade or year of school the FATHER has completed?

Please provide highest-grade passed _______________

c) Mother's Present Occupation: _______________

d) Father's Present Occupation: _______________

Parental Income:

a) Which of the following ranges best describes the current annual income in your household?

O 0-100 000 O 100 001-160 000 O 160 001-220 000

O 220 001-300 000 O 300 001-400 000 O 400 001 and above

O Other _______________

Parental Reading:

a) How often does the MOTHER read a book, magazine or newspaper?

O Daily O Twice a week O Three times a week O Never

b) How often does the FATHER read a book, magazine or newspaper?

O Daily O Twice a week O Three times a week O Never

Books at Home:

a) How many books are there in your home?

O 1-10 O 11-20

O 21-30 O 31-40

O 41-50 O more than 50

Why did you choose to place your English-speaking child in an English medium class? (Please provide reasons)

____

____

I, parent of ____________________ hereby consent to his/her inclusion in the research study. I understand that my child's identity, the contents of this questionnaire will remain confidential.

Signed: ______________ Date: ----------------------

Thank you for completing the questionnaire.

Home Literacy and Language Environment (ZULU-L1-English-L2)

School of Human & Community Development

Confidential questionnaire

Dear parent, please complete the following questionnaire by filling in the relevant information and placing an X over the appropriate block. Please answer honestly; the results of this survey are treated confidentially, the information collected is useful to the school so that teachers can help children read and write better.

1. Name of child: ________________
2. Gender of child: O Male O Female
3. Date of birth: __________________
4. Home Language(s): ____________
5. How long has your child attended XX school? ___________
6. Does your child currently have any of the following problems?

   Problems learning language O Yes O No

   Problems expressing ideas with words O Yes O No

   Difficulties in school or learning O Yes O No

   Problems learning to read O Yes O No

   If you have answered yes, please give details

   ____

7. Is there anything else you would like to add about your child?

   ____

Home Language Use and Exposure: (Place a X over the appropriate response)

a) What language does the MOTHER use when speaking to the child?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

b) What language does the FATHER use when speaking to the child?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

c) What language do other adults (aside from the mother and father) use when speaking to your child?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

d) What language do SIBLINGS use when speaking to his or her brother or sister participating in this study?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

e) What language does your child use when speaking to his/her MOTHER at home?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

f) What language does your child use when speaking to his/her FATHER at home?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

g) What language does your child use when he/she speaks to other adults (not the mother or father)?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

h) What language does your child use when he/she speaks to his/her friends outside of the home?

O Only Zulu O Mostly Zulu O Equal Amounts of Zulu & English

O Mostly English O Only English O Other (please specify) ____________

Parental Help: (Place a X over the appropriate response)

a) How often does your child ask you to read with him/her?

O Daily O Twice a week O Three times a week O Never

b) How often do you respond to your child's reading requests?

O Daily O Twice a week O Three times a week O Never

c) How often does an adult or older sibling read or look at books, with your child in ENGLISH? O Daily O Twice a week O Three times a week O Never

d) How often does an adult or older sibling tell your child a story in ENGLISH?

O Daily O Twice a week O Three times a week O Never

e) How often does an adult or older sibling tell your child a story in ENGLISH?

O Daily O Twice a week O Three times a week O Never

f) How often does an adult or older sibling help your child with learning (e.g. numbers, letters, and words) in ZULU?

O Daily O Twice a week O Three times a week O Never

g) How often does an adult or older sibling read or look at books, with your child in ZULU?

O Daily O Twice a week O Three times a week O Never

h) How often does an adult or older sibling tell your child a story in ZULU?

O Daily O Twice a week O Three times a week O Never

i) How often does someone from your family or household go to the library with your child?

O Daily O Twice a week O Three times a week O Never

j) How often does your child read or look at books at home on his/her own?

O Daily O Twice a week O Three times a week O Never

k) How often do you teach your child to read words?

O Daily O Twice a week O Three times a week O Never

l) How often do you teach your child to write words?

O Daily O Twice a week O Three times a week O Never

5. How old was your child when you started to read to him/her?

Please estimate age: _______________

Parental Education:

a) What is the highest grade or year of school the MOTHER has completed?

Please provide highest-grade passed _______________

b) What is the highest grade or year of school the FATHER has completed?

Please provide highest-grade passed _______________

c) Mother's Present Occupation: _______________

d) Father's Present Occupation: _______________

Parental Income: (Place a X over the appropriate response)

a) Which of the following ranges best describes the current annual income in your household?

O 0-100 000 O 100 001-160 000 O 160 001-220 000

O 220 001-300 000 O 300 001-400 000

O 400 001 and above O Other _______________

Parental Reading: (Place a X over the appropriate response)

a) How often does the MOTHER read a book, magazine or newspaper?

O Daily O Twice a week O Three times a week O Never

b) How often does the FATHER read a book, magazine or newspaper?

O Daily O Twice a week O Three times a week O Never

Books at Home: (Place a X over the appropriate response)

a) How many books are there in your home?

O 1-10 O 11-20 O 21-30

O 31-40 O 41-50 O more than 50

***Why did you choose to place your Zulu-speaking child in an English medium class? (Please provide reasons)*____**

I, parent of ______________________ hereby consent to his/her inclusion in the research study. I understand that my child's identity, the contents of this questionnaire will remain confidential.

Signed: ________________ Date: _________________

Thank you for completing the questionnaire.

Home Literacy and Language Environment (L1-Afrikaans-L2-English)

Confidential questionnaire

Dear parent, please complete the following questionnaire by filling in the relevant information and placing an X over the appropriate block. Please answer honestly; the results of this survey are treated confidentially, the information collected is useful to the school so that teachers can help children read and write better.

1. Name of child: _________________
2. Gender of child: O Male O Female
3. Date of birth: ___________________
4. Home Language(s): _____________
5. How long has your child attended XX school? ____________
6. Does your child currently have any of the following problems?

   Problems learning language O Yes O No

   Problems expressing ideas with words O Yes O No

   Difficulties in school or learning O Yes O No

   Problems learning to read O Yes O No

   If you have answered yes, please give details

   ____

7. Is there anything else you would like to add about your child?

   ____

Home Language Use and Exposure: (Place a X over the appropriate response)

a) What language does the MOTHER use when speaking to the child?

O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

b) What language does the FATHER use when speaking to the child?

O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

c) What language do other adults (aside from the mother and father) use when speaking to your child? O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

d) What language do SIBLINGS use when speaking to his or her brother or sister participating in this study? O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

e) What language does your child use when speaking to his/her MOTHER at home?

O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

f) What language does your child use when speaking to his/her FATHER at home?

O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

g) What language does your child use when he/she speaks to other adults (not the mother or father)? O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

h) What language does your child use when he/she speaks to his/her friends outside of the home? O

O Only Afrikaans O Mostly Afrikaans

O Equal Amounts of Afrikaans & English

O Mostly English O Only English O Other (please specify) ____________

Parental Help: (Place a X over the appropriate response)

a) How often does your child ask you to read with him/her?

O Daily O Twice a week O Three times a week O Never

b) How often do you respond to your child's reading requests?

O Daily O Twice a week O Three times a week O Never

c) How often does an adult or older sibling read or look at books, with your child in ENGLISH? O Daily O Twice a week O Three times a week O Never

d) How often does an adult or older sibling tell your child a story in ENGLISH?

O Daily O Twice a week O Three times a week O Never

e) How often does an adult or older sibling help your child with learning (e.g. numbers, letters, and words) in ENGLISH?

O Daily O Twice a week O Three times a week O Never

f) How often does an adult or older sibling help your child with learning (e.g. numbers, letters, and words) in AFRIKAANS?

O Daily O Twice a week O Three times a week O Never

g) How often does an adult or older sibling read or look at books, with your child in AFRIKAANS?

O Daily O Twice a week O Three times a week O Never

h) How often does an adult or older sibling tell your child a story in AFRIKAANS?

O Daily O Twice a week O Three times a week O Never

i) How often does someone from your family or household go to the library with your child?

O Daily O Twice a week O Three times a week O Never

j) How often does your child read or look at books at home on his/her own?

O Daily O Twice a week O Three times a week O Never

k) How often do you teach your child to read words?

O Daily O Twice a week O Three times a week O Never

l) How often do you teach your child to write words?

O Daily O Twice a week O Three times a week O Never

5. How old was your child when you started to read to him/her?

Please estimate age _______________

Parental Education: (Place a X over the appropriate response)

a) What is the highest grade or year of school the MOTHER has completed?

Please provide highest-grade passed _______________

b) What is the highest grade or year of school the FATHER has completed?

Please provide highest-grade passed _______________

c) Mother's Present Occupation: _______________

d) Father's Present Occupation: _______________

Parental Income: (Place a X over the appropriate response)

a) Which of the following ranges best describes the current annual income in your household?

O 0-100 000 O 100 001-160 000 O 160 001-220 000

O 220 001-300 000 O 300 001-400 000

O 400 001 and above O Other _______________

Parental Reading: (Place a X over the appropriate response)

a) How often does the MOTHER read a book, magazine or newspaper?

O Daily O Twice a week O Three times a week O Never

b) How often does the FATHER read a book, magazine or newspaper?

O Daily O Twice a week O Three times a week O Never

Books at Home: (Place a X over the appropriate response)

a) How many books are there in your home?

O 1-10 O 11-20

O 21-30 O 31-40

O 41-50 O more than 50

Why did you choose to place your Afrikaans and English-speaking child in an Afrikaans and English dual-medium class?

(Please provide reasons)

____

____

I, parent of_____________ hereby consent to his/her inclusion in the research study. I understand that my child's identity, the contents of this questionnaire will remain confidential.

Signed: _______________ Date: -----------------------

Thank you for completing the questionnaire.

APPENDIX H:
TEST BOOKLET

Name of participant: ______________________________________

Code number allotted to participant: _________________________

1.1 Raven's Coloured Progressive Matrices (Raven, Raven, & Court, 1998)

Instructions: Do: Open the book on the first problem, A1. Say: Look at this. Do: Point to the upper figure. Say: You see; it is a pattern with a piece cut out of it. Each of these pieces below... Do: Point to each in turn. Say: is the right shape to fill the space, but only one of them is the right pattern. Number 1 is the right shape, but it is not the right pattern at all. Number three is quite wrong. Number 6 is nearly right here, but is wrong here. The same guidance is given with each remaining problem of sets AB and B. Do: Record the participant's answer on the score sheet, by writing down the number of the piece chosen next to the problem number. If a mistake is made, or the participant taking the test wants to change his or her answer, put a cross through the incorrect answer, and then write the number of the final choice.

Score Sheet for RCPM:

No.	Participant's Answer	No.	Participant's Answer	No.	Participant's Answer
A_1		AB_1		B_1	
A_2		AB_2		B_2	
A_3		AB_3		B_3	
A_4		AB_4		B_4	
A_5		AB_5		B_5	
A_6		AB_6		B_6	
A_7		AB_7		B_7	
A_8		AB_8		B_8	
A_9		AB_9		B_9	
A_{10}		AB_{10}		B_{10}	
A_{11}		AB_{11}		B_{11}	
A_{12}		AB_{12}		B_{12}	

No.	Participant's Answer	No.	Participant's Answer	No.	Participant's Answer
Total Score for Set A		Total Score for Set AB		Total Score for Set B	

1.2 Peabody Picture Vocabulary Revised (PPVT-R, Dunn & Dunn, 1981)

Say word and ask child to point to the picture that represent the word spoken

Score Sheet for the PPVT-R (From L)

No.	From L (English L1/L2)	Participant's Answer
65	human	
66	nostril	
67	disagreement	
68	exhausted	
69	vine	
70	ceremony	
71	casserole	
72	vehicle	
73	globe	
74	filing	
75	clamp	
76	reptile	
77	island	
78	spatula	
79	co-operation	
80	scalp	
81	twig	
82	weasel	
83	demolishing	
84	balcony	
85	locket	
86	amazed	

87	tubular	
88	tusk	
Total Score		

No.	Form M-Afrikaans (L1)	Participant's Answer	Form M-Zulu (L1)	Participant's Answer
65	gasheer (entertainer)		umlingisi	
66	direkteur (director)		bonisa	
67	arties (artist)		umpenda	
68	strand (shore)		ibhishi	
69	paar (pair)		okubili	
70	plafon (ceiling)		isilingi	
71	sekretaris (secretary)		umbhali	
72	krans (cliff)		Iwa	
73	flamink (flaming)		ilangabi	
74	skoorsteen (funnel)		ushimula	
75	wollerig (wooly)		iwulu	
76	kos (nutritious)		umzimba	
77	konstruksie (construction)		ukuwakha	
78	vingerhoed (thimble)		imfimbolo	
79	graankorrel (grain)		inhlamvu	
80	woedend (furious)		ukuchasuka	
81	sorteer (sorting)		uhlobo	
82	musikant (musician)		umshayi wopiyane	
83	groeteboodskap (greeting)		isibingelelo	
84	kompetisie (competition)		impikiswano	
85	moegheid (weary)		khathele	
86	bokram (antler)		inyamazane	

87	oes (harvesting)		umvuno	
88	geknor (growl)		ukuvungama	
89	pleistering (plastering)		udaka lokunameka	
90	drieling (triplet)		hlanganasi kathathu	
	Total Score for Afrikaans (L1)		Total Score for Zulu (L1)	

1.3 The Phonological Awareness Test Battery:

1.3.1 English (L1/L2) Onset Awareness Test:

Instruction:

Say: I am going to say three words to you, two of the words start with the same first sound, but one of them doesn't, which one is it that doesn't have the same first sound? Administer the sample item to check that the participant understands what is expected of him/her.

Practice item: 'slim, slip, flip'

Say: 'slim, slip, flip', then what word is the odd one out?

Response: 'flip'

Do: After the practice item, record the participant's answer on the score sheet by writing down his/her answer next to the test item.

Score Sheet for the English (L1/L2) Onset Awareness Test:

No.	Stimuli	Correct response	Participant's Answer
1	rot rod box	/b/	
2	miss lick lid	/m/	
3	pip pip hill	/h/	
4	ham tap had	/t/	
5	well peg pen	/w/	
6	kid fill kiss	/f/	
7	leap mean meal	/l/	
8	seed seal deep	/d/	
9	rug bun bus	/r/	
10	fun pin gun	/p/	
Total Score			

1.3.2 Afrikaans (L1) Onset Awareness Test:

Instruksie: Sê: Ek gaan vir jou drie woord sê. Twee woorde het die selfe klank, maar een woord het nie die selde klank nie. Noem hierdiw woord. Wend die vorbeeld item aan om te kyk dat die kind verstaan wat van hom/haar verwag word. Voorbeeld item: Sê: ‘pot pop kol’ Antwoord: ‘kol’ Doen: Skyf die kind se antwoord in die telling tabel.

Score Sheet for the Afrikaans (L1) Onset Awareness Test:

No.	Stimuli	Korrekte antwoord	Kind se antwoord
1	ruk rus bul	/b/	
2	dik min dis	/m/	
3	wit sin wig	/s/	
4	bek bel pen	/p/	
5	sin sit lip	/l/	
6	meer hoor keer	/h/	
7	rug veg lug	/v/	
8	krag krap trap	/tr/	
9	stall braaf staan	/br/	
10	rook room koop	/k/	
Total Telling			

1.3.3 English (L1/L2) Rime Awareness Test:

Instruction: Say: I am going to say three words, two of them rhyme or sound the same and one doesn't. I want you to tell me which one doesn't rhyme. Administer the sample item to check that the participant understands what is expected of him/her. Practice item: Say: 'fan cat mat' Response: 'fan' Do: Record the participant's answer on the score sheet by writing down his/her answer next to the test item.

Score Sheet for the English (L1/L2) Onset Awareness Test:

No.	Stimuli	Correct response	Participant's Answer
1	pin sit fin	/sit/	
2	doll hop top	/doll/	
3	bun hut sun	/hut/	
4	map gap pal	/pal/	
5	men red bed	/men/	
6	wig pin dig	/pin/	
7	weed peel deed	/peel/	
8	pack back sad	/sad/	
9	sand bank hand	/bank/	
10	mint pink wink	/mint/	
Total Score			

1.3.4 Afrikaans (L1) Rime Awareness Test:

Instruksie: Sê: Ek gaan vir jou drie woord sê. Twee woorde rym, maar een woord nie ryme nie. Noem hierdie word. Wend die vorbeeld item aan om te kyk dat die kind verstaan wat van hom/haar verwag word.

Voorbeeld item:Sê: ‘dag sag pas’

Antwoord: ‘pas’

Doen: Skyf die kind se antwoord in die telling tabel.

Score Sheet for the Afrikaans (L1) Rime Awareness Test:

No.	Stimuli	Korrekte antwoord	Kind se antwoord
1	ruk rus bul	/b/	
2	dik min dis	/m/	
3	wit sin wig	/s/	
4	bek bel pen	/p/	
5	sin sit lip	/l/	
6	meer hoor keer	/h/	
7	rug veg lug	/v/	
8	krag krap trap	/tr/	
9	stall braaf staan	/br/	
10	rook room koop	/k/	
Total Telling			

1.3.5 English (L1/L2) Phoneme Deletion Awareness Test:

Instruction: Say: I am going to say a word to you, then I am going to say part of the word, and I want you to tell me the rest of the word. Administer the sample items to check that the participant understands what is expected of him/her.

Practice item (1): Say: 'keyhole'; Now say it again but don't say /key/ Response: 'hole'

Practice item (2): Say: 'address'; Now say it again but don't say /ad/; Response: 'dress'

Do: Record the participant's answer on the score sheet by writing down his/her answer next to the test item.

Score Sheet for the English (L1/L2) Phoneme Deletion Awareness Test:

No.	Say	Now say it again but don't say	Correct response	Participant's Answer
1	cowboy	/boy/	/cow/	
2	steamboat	/steam/	/boat/	
3	sunshine	/sun/	/shine/	
4	picnic	/pic/	/nic/	
5	cucumber	/cu/	/cumber/	
6	coat	/k/	/oat/	
7	meat	/m/	/eat/	
8	take	/t/	/ache/	
9	same	/m/	/sae/	
10	wrote	/t/	/row/	
11	please	/se/	/plea/	
12	clap	/k/	/lap/	
13	play	/p/	/lay/	
14	stale	/t/	/sale/	
15	smack	/m/	/sack/	
Total Score				

1.3.6 Afrikaans (L1) Phoneme Deletion Awareness Test:

Instruksie: Sê: Ek gaan 'n woord sê. Dan gaan ek die selfde woord sê, en jy moet die vermisde part van die woord noem. Wend die vorbeeld item aan om te kyk dat die kind verstaan wat van hom/haar verwag word.

Voorbeeld item (1): Sê: 'spoorweg';Nou sê dit weer maar moenie /weg/ sê.; Antwoord: 'spoor'

Voorbeeld item (2): Sê: 'slaap'; Nou sê dit weer maar moenie /sl/ sê.Antwoord: 'aap'

Doen: Skyf die kind se antwoord in die telling tabel.

Score Sheet for the Afrikaans (L1) Phoneme Deletion Awareness Test:

No.	Say	Nou sê dit weer maar moenie sê	Korrekte antwoord	Kind se antwoord
1	toonbank	/toon/	/bank/	
2	laerskool	/laer/	/skool/	
3	stoomboot	/stoom/	/boot/	
4	sonskyn	/son/	/skyn/	
5	digter	/dig/	/ter/	
6	komkommer	/kom/	/kommer/	
7	koud	/k/	/oud/	
8	skaap	/sk/	/aap/	
9	trou	/t/	/rou/	
10	geen	/g/	/een/	
11	skoen	/t/	/row/	
12	klap	/k/	/lap/	
13	plat	/p/	/lat/	
14	skool	/k/	/sool/	
15	smaak	/m/	/saak/	
Total Telling				

1.4 The Expressive Vocabulary-Semantic Test Battery:

1.4.1 English (L1/L2) Expressive Vocabulary Test:

Instruction:Say: I am going to say a word to you. I want you to tell me what the word means. Administer the sample items to check that the participant understands what is expected of him/her. Practice item: 'what is a hat?' Response: 'something you wear on your head'

Do: Record the participant's answer on the score sheet by writing down his/her answer next to the test item.

Score Sheet for the English (L1/L2) Expressive Vocabulary Test:

No.	Stimuli	Participant's Answer
1	car	
2	flower	
3	train	
4	bucket	
5	hat	
6	umbrella	
7	clock	
8	cow	
9	thief	
10	bicycle	
11	alphabet	
12	leave	
13	ancient	
14	pest	
15	brave	
16	obey	
17	island	
18	nonsense	
19	absorb	

No.	Stimuli	Participant's Answer
20	transparent	
Total Score		

1.4.2 Afrikaans (L1) Expressive Vocabulary Task:

Instruksie:

Sê: Ek gaan vir jou ‘n woord sê. Sê wat hierdie woord beteken. Wend die vorbeeld item aan om te kyk dat die kind verstaan wat van hom/haar verwag word.

Voorbeeld item: Sê: ‘wat is ‘n hoed’ Antwoord: ‘Iets wat jy dra op jou kop.’

Doen: Skyf die kind se antwoord in die telling tabel.

Score Sheet for the Afrikaans (L1) Expressive Vocabulary Test:

No.	Stimuli	Kind se antwoord
1	Kar	
2	Blom	
3	Trein	
4	Emmer	
5	Hoed	
6	Sambreel	
7	Klok	
8	Koei	
9	Dief	
10	Fiets	
11	Alphabet	
12	Verlaat	
13	Antiek	
14	Pes	
15	Dapper	
16	Luister	
17	Eiland	
18	Twak	
19	Absorber	

No.	Stimuli	Kind se antwoord
20	Deurskynend	
Total Telling		

1.4.3 English (L1/L2) Similarities Test:

Say: I am going to say two words. I want you to tell me how the two words are alike? Administer the sample items to check that the participant understands what is expected of him/her.

Practice item: In what way are RED and BLUE alike? How are they the same?

Response: ‘Red and blue are both colours.’

Do: After the practice item, record the participant’s answer on the score sheet by writing down his/her answer next to the test item.

Score Sheet for the English (L1/L2) Similarities Test:

No.	Stimuli	Participant’s Answer
1	milk-water	
2	pen-pencil	
3	apple-banana	
4	shirt-shoe	
5	cat-mouse	
6	butterfly-bee	
7	winter-summer	
8	anger-joy	
9	elbow-knee	
10	wood-bricks	
11	painting-statue	
12	frown-smile	
Total Score		

1.4.4 Afrikaans (L1) Similarities Test:

Instruksie:Sê: Ek gaan vir jou twee woorde sê. Sê hoe die twee woorde is geluk? Wend die vorbeeld item aan om te kyk dat die kind verstaan wat van hom/haar verwag word.

Voorbeeld item: Sê: 'How is BLOU en ROOI geluk'Antwoord: 'Blou en rooi is albei kleure.'Doen: Skyf die kind se antwoord in die telling tabel.

Score Sheet for the Afrikaans (L1) Similarities Test:

No.	**Stimuli**	**Kind se antwoord**
1	melk-water	
2	pen-potlood	
3	appel-piesang	
4	hemp-skoen	
5	kat-muis	
6	skoenlapper-by	
7	winter-somer	
8	kwaad-bly	
9	elmboog-knie	
10	hout-baksteen	
11	skildery-standbeeld	
12	frons-glimlag	
Total Score		

1.5 The Working Memory Test Battery:

1.5.1 Verbal Short-Term Memory Tests:

Digit Recall: The participant hears a sequence of digits and attempts to recall each sequence in the correct order.

Example of a 6-number trial: Trail: 2 9 1 5 3 7; Recall: '2 9 1 5 3 7'

Practice Trials: The practice trials are for 1, 2 and 3 numbers.

Test Trials: The test begins with a block of 1 number and increases to a block of 9 numbers.

Scoring: In order for the participant to receive a correct score for each trial, each number must be recalled in the correct order.

Word Recall*:* The participant hears a sequence of words and attempts to recall each sequence in the correct order.

Example of a 3-word trial: Trail: drink table bus; Recall: 'drink table bus'.

Practice Trials: The practice trials are for 1, 2 and 3 words.

Test Trials: The test begins with a block of 1 number and increases to a block of 9 numbers.

Scoring: In order for the participant to receive a correct score for each trial, each word must be recalled in the correct order.

Non-word Recall*:* The participant hears a sequence of nonsense words (non-words) and attempts to recall the sequence in the correct order.

Example of a 3-word trial: Trail: nop jitch garm Recall: 'nop jitch garm'

Practice Trials: The practice trials are for 1, 2 and 3 numbers.

Test Trials: The test begins with a block of 1 non-word and increases to a block of 6 non-words.

Scoring: In order for the participant to receive a correct score for each trial, each non-word must be recalled in the correct order.

1.5.2 Verbal Working Memory Tests:

Listening Recall: The participant hears a series of individual sentences and judges if each sentence is true or false. At the end of each trial, the participant attempts to recall the final word of each sentence, in the correct order.

Example of a 2-sentence trial:

Trail: Bananas live in water; Response 'true'

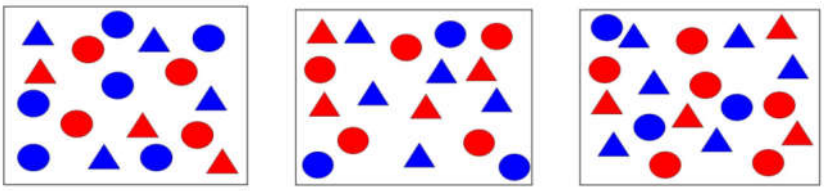
Trail: Flowers smell nice.

Response: 'false'; Recall: 'water, nice'.

Practice Trials: The practice trials are for 1, and 2 sentences. During practice trials, you may need to prompt the participant for recall of the final word once they have answered 'true' or 'false'. Test Trials: The test begins with a block of 1 sentence and increases to a block of 6 sentences. Scoring: There are two scores for this test. The participant receives a score for responding true or false correctly to each sentence. This score is referred to as a processing score. The participant also receives a score for recalling the final word in each sentence correctly.

Counting Recall: The participant counts the number of red circles in an array of circles and triangles and then attempts to recall the tally of the numbers in sequence.

Example of a 3-array trial:



Response: 4, 5, 6

Practice Trials: The practice trials are for 1, 2, and 3 arrays of circles and triangles.

Test Trials: The test begins with a block of 1 array and increases to a block of 7 arrays of circles and triangles. Scoring: There are two scores for this test. The participant receives a score for counting the correct number of red circles in the array. This score is referred to as a processing score. The participant also receives a score for recalling the tallies correctly in sequence.

Backward Digit Recall: The participant hears a sequence of digits and attempts to recall each sequence in backwards order.

Example of a 6-number trial: Trail: 3 9 2 5 Response: '5 2 9 3 '

Practice Trials: The practice trials are for 2, and 3 numbers.

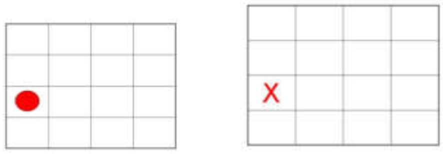
Test Trials: The test begins with a block of 2 numbers and increases to a block of 7 numbers.

Scoring: In order for the participant to receive a correct score for each trial, each number must be recalled in the correct backwards order.

1.5.3 Visuospatial Short-term Memory

Dot Matrix**:** The participant is shown the position of a red dot in a series of 4 X 4 matrices and attempts to recall this position by tapping the squares on the computer screen.

Example of a 2-dot trial:



Practice trials: The practice trials are for 1, 2, and 3 dots.

Test trails: The test begins with a block of 1 dot and increases to a block of 9 dots.

Scoring: In order for the participant to receive a correct score for each trial, each dot must be recalled in the correct order by placing their finger on the computer screen of where the dot was located.

Maze Memory**:** The participant views a maze with a red path drawn through it. The task is to use his or her finger to trace the same path on a blank maze presented three second later on the computer screen.

Example of a trial with a small maze:

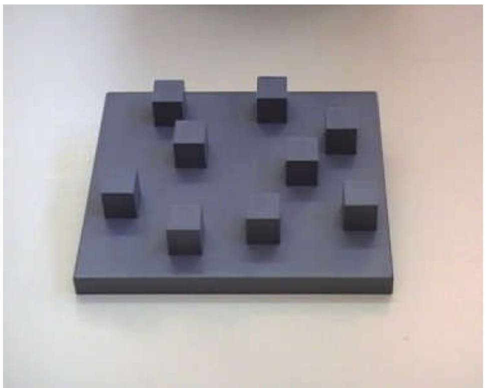
Practice trials: The practice trials are for 3 mazes.

Test trails: The test begins with small mazes and increases to larger mazes.

Scoring: In order for the participant to receive a correct score for each trial, he or she must touch the blank maze on the computer screen in order to trace the route in exactly the same way.

***Block Recall*:** The participant views a series of blocks being tapped, and attempts to reproduce the sequence in the correct order by tapping on an image of the blocks.

Example of a 2-block trial:



Practice trials: The practice trials are for 1, 2, and 3 blocks.

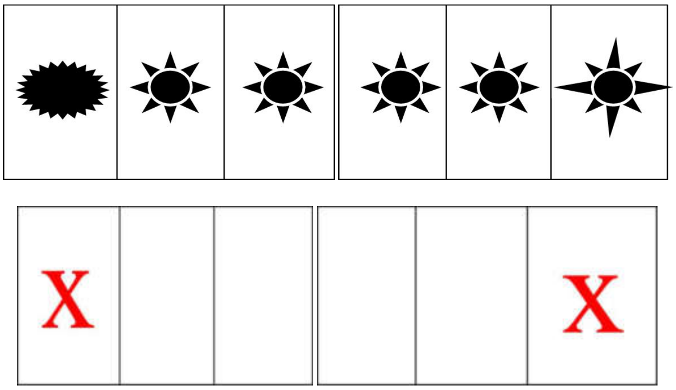
Test trails: The test begins with a block of 1 block and increases to a block of 9 blocks.

Scoring: In order for the participant to receive a correct score for each trial, each block must be tapped in the correct order.

1.5.4 Visuospatial Working Memory

***Odd-One-Out*:** The participant views three shapes, and attempts to identify the odd-one-out shape. At the end of each trail, the participant is asked to recall the location of each odd one out shape, in the correct order, by tapping the correct box on the screen.

Example of a 2-shape trial:



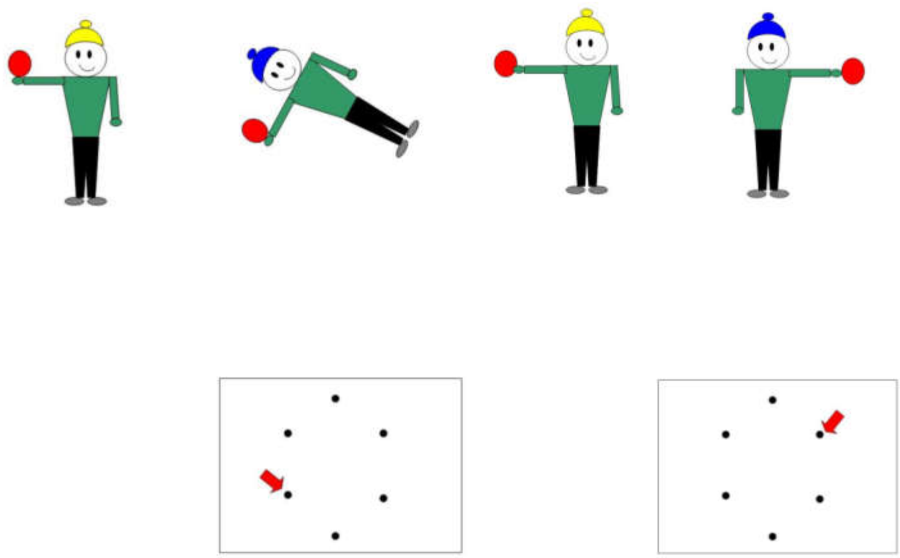
Practice Trials: The practice trials are for 1, and 2 sets of shapes.

Test Trials: The test begins with a block of 1 set of shapes and increases to a block of 7 set of shapes.

Scoring: There are two scores for this test. The participant receives a score for pointing to the correct odd-one-out shape. This score is referred to as a processing score. The participant also receives a score for recalling the position of each odd-one-out correctly.

Mr. X: The participant views a picture of two Mister X figures and identifies whether the Mister X with the blue hat is holding the ball in the same hand as the Mister X with the yellow hat. The Mister X with the blue hat may also be rotated. At the end of each trial, the participant is asked to recall the location of each ball in the correct order, by pointing to a picture with the six possible positions marked.

Example of a Mister-X trial:



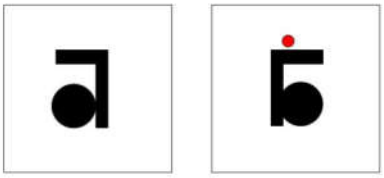
Practice Trials: The practice trials are for 1, and 2 sets of Mister X.

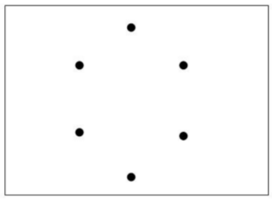
Test Trials: The test begins with a block of 1 set of Mr X and increases to a block of 7 sets of Mr X.

Scoring: There are two scores for this test. The participant receives a score for correctly identifying whether Mr X with the blue hat is holding the ball in the 'same' or 'different' hand as the Mr X with the yellow hat. This score is referred to as a processing score. The participant also receives a score for correctly recalling the position of each ball in sequence.

Spatial Recall**:** The participant views a picture of two shapes where the shape on the right has a red dot above it. The participant is then asked to identify whether the shape on the right is the same or opposite of the shape on the left. The shape with the red dot may also be rotated. At the end of each trial, the participant is asked to recall the location of each red dot on the shape, in the correct order, by pointing to a picture with three possible positions marked.

Example of a 2-shape trial:





Practice Trials: The practice trials are for 1, and 2 sets of shapes. The practice items are designed to increase the child's familiarity with the shapes and how they rotate.

Test Trials: The test begins with a block of 1 set of Mr X and increases to a block of 7 sets of Mr X.

Scoring: There are two scores for this test. The participant receives a score for correctly identifying whether the shape with the red dot is the same or opposite of the shape on the left. This score is referred to as a processing score. The participant also receives a score for correctly recalling the position of each dot in sequence.

1.6 Literacy Skills Test Battery:

1.6.1 English (L1/L2) Word Reading Test:

Word	Participant's Score	Word	Participant's Answer	Word	Participant's Answer	Word	Participant's Answer
The		ocean		apology		topography	
Up		knock		pier		naive	
you		fruit		ruin		subtle	
school		shut		dozing		bureau	
into		carefully		useless		plethora	
So		goal		ideally		reminisce	
then		sight		deputy		conscience	
Fly		crowd		cutlery		indefatigable	
Sea		enough		phonograph		malign	
swim		during		poise		indigenous	
how		flexible		unique		euphemism	
people		known		pathetic		milieu	
because		equal		cleanse		antithesis	
again		fraction		chord		ethereal	
where		design		acquire		hierarichal	
small		smudge		scholar			
closed		oxygen		treacherous			
know		column		veterinary			
stood		thumbnail		ridicule			
size		rhythm		vicinity			
wrong		courage		negotiate			
between		determine		catastrophe			
instead		ajar		infamous			

Total score for words read correct: ____

1.6.2 Afrikaans (L1) Word Reading Test:

Woord	Telling	Woord	Telling	Woord	Telling	Woord	Telling
die		oseaan		apologie		topografie	
op		klop		seehoof		naief	
jou		vrugte		bouval		subtiel	
skool		sluit		sluimering		kantoor	
in		versigtig		nutteloos		oordaad	
so		doel		ideaal		herineer	
dan		gesig		adjunk		gewete	
vlieg		klomp		eetgerei		onvermoeid	
see		genoeg		fonografies		kwaadspreek	
swem		tydens		kalmte		aangebore	
hoe		fleksiel		enig		eufemisme	
mense		ken		pateties		ongewing	
omdat		gelyke		suiwer		teenoorgestelde	
weer		fraksie		verwerf		delikaat	
wanneer		ontwerp		acquire		hieragie	
klein		besmeer		leerling			
gesluit		oksigeen		verraderlik			
weet		kolom		veearts			
staan		duimsnael		belaglik			
grootte		ritme		nabyheid			
onreg		heldhaftig		verhandel			
tussen		besluit		katastrofe			
keuse		half-oop		eerloos			

Total telling vir woorde dat korrek gelees is: ____

1.6.3 English (L1/L2) Reading Comprehension Tests:

Instruction: Read the following short story very carefully. You will need to answer questions about is later.

CIRCUS (PASSAGE 1)

The lion's final act was in progress. Jack stood waiting to clear the ring. The thunder outside the circus tent had made the lions restless. Suddenly Tina, the lion trainer, stumbled. Her whip fell. The youngest lion sprang towards her. Jack leaped swiftly inside the cage, cracking the whip with great skill. His prompt action enabled Tine to regain control quickly. After that brief adventure, Jack decided upon his future work.

QUESTIONS: Answer the following questions using full sentences.

1 Where did this story take place?

____

2 Were the lions near the beginning, near the middle, or near the end of their act?

____

3 What was Jack waiting for?

____

4 Why were the lions restless?

____

5 What happened to Tina?

____

6 What did Jack do?

____

7 Who finished the act?

____

8 What did Jack decide after this adventure?

9 ______________________________

Mark: ____/8

Instruction: Read the following short story very carefully. You will need to answer questions about is later.

DRAGON (PASSAGE 2)

The fearful roaring of the dragon guided the Knight to the monster's territory. As the intruder crossed the dreaded marshes, the dragon charged furiously, whipping its enormous tail around the legs of the Knight's steed. Horse and rider collapsed. The Knight now realised he must attack when the creature was off-guard. He crouched as though wounded. The monster, accustomed to speedy victory, prepared to seize its prey. Then the Knight struck powerfully beneath the beast's outstretched wing. A despairing groan told the villagers that they would be troubled no more.

QUESTIONS: Answer the following questions using full sentences.

1 How did the Knight know exactly where to find the dragon?

____

2 What kind of land did the Knight have to cross?

____

3 How did the dragon knock the Knight down?

____

4 What did the Knight realize would be a good moment to attack the dragon?

____

5 What did the Knight pretend?

____

6 Why did the dragon think that it's very first blow could kill the Knight?

____

7 What part of the dragon's body did the Knight strike?

____

8 Why were the people in the village pleased?

____

Mark: ____/8

1.6.4 Afrikaans (L1) Reading Comprehension Test:

Instruksie: Lees die volgende storie met versigtighied. Jy sal 'n paar vrae laer moet antwoord.

ALI (1)

Terwyl Ali in 'n ou tempel skuilpek gesoek het, het sy skouer 'n geheime sprong ondek. Onmiddelik was hy in 'n ondergronds se kamer gegooi. In die donkerte het die mure gevoel as of hulle in juwele bedek was. Ali het 'n bietjie gerus. Hy het geweet dat woestyn reisigers dikwels vreemde dinge verbeel. Later het hy die plek vir 'n pad omte ontsnap geondersoek. Tot sy verbasing was die juwele nog steeds daar. Hy het 'n paleis givind wat lank gelede begrawe was.

English Translation

As Ali sheltered in an old temple, his shoulder knocked a secret spring. Instantly, he was thrown into an underground room. In the darkness the walls seemed covered with jewels. Ali rested awhile. He knew desert travellers often imagine strange things. Later, he explored the place for a way to escape. To his amazement, the jewels were still there. Ha had found a palace that had been buried long ago.

VRAE: Gebruik vol sinne om die volgende vrae to beantwoord.

1 Hoekom het Ali in die temple in gegaan?

____

2 Hoe het hy die geheime spong ontdek?

____

3 Wat het gebeur toe hy die sprong aan geraak het?

____

4 Wat hey hy gesien?

____

5 Hoekom het Ali nie gewag om na die juwele to kyk nie?

____

6 Wat her Ali prober vind nadat hy gerus het?

____

7 Hoekom was hy so verras?

____

8 Hoe het die juwele daar gekom?

____

Telling: ____/8

Instruksie: Lees die volgende storie met versigtighied. Jy sal ‘n paar vrae laer moet antwoord.

JAN (2)

Jan het sy duikersbelt metaal gewigte gespe, en van die boot afgeval. Kaptein Kells het oor haar asemshalings-pyp toesig gehou om te verseker dat dit nie koop nie. Leo, het die lugbelle gevolg, en die klein boot oor die duiker gelei terwyl hy die geheimsinnige onderwater wêreld geondersoek het. Jan het gereeld opgeknommet kreef wat hy in sy hand gegrup het. Die vereiste nommer van eksemplaars was amper bygekom toe ‘n grys haai reguit na hom toe swem. Jan het versigtig terruggetrek sonder om vir hulp te sein. Die kreatuur het saggies aan homgeraak, sonder om hom te pla, toe baba haaie van doe rotsagtige groewe verskyn. Hulle welsyn was meer belangkrik vir die haai as due duiker se stil figuur.

English Translation:Jan buckled on her driving belt of metal weights and dropped from the launch. Skipper Kells supervised her air-hose to prevent tangling. Leo, followed the bubbles, guided the dinghy above the diver as she searched the mysterious underwater world. Jan surfaced frequently clutching crayfish. The required number of specimens was almost obtained when the grey nurse shark advanced directly towards her. Jan retreated cautiously without signalling for assistance. The creature passed by, ignoring her as baby sharks emerged from some rocky grooves. Their welfare was more important to the shark then the diver’s now motionless figure.

VRAE: Gebruik vol sinne om die volgende vrae to beantwoord.

1 Watter toerusting het Jan gebruik in sy onderwater verkenning?

____

2 Wat het Kaptein Kells gedoen om Jan te help?

____

3 Hoe het Leo geweet waar die duiker is?

____

4 Waar voor dink jy het Jan geduik?

____

5 Hoekom het dit gelyk of die haai hom kon aanval?

____

6 Hoe het Jan moeilikheid met die haai vermy?

____

7 Wat se tiepe huis het die baba haaie beskerm teen vyande?

____

8 Hoekom was die haai nie geintereseerd in Jan nie?

____

Telling: ____/8

Appendix I: Psycholinguistic Test Properties

1.1 English (L1/L2) Onset Awareness Test

No.	Stimuli	Correct response	SF	AoA	I	WL	SyLb
1	rot rod box	/b/	4.33	3.59	1.33	3.00	1.00
2	miss lick lid	/m/	5.00	5.26	2.59	3.33	1.00
3	pip pip hill	/h/	5.00	5.83	1.75	3.00	1.00
4	ham tap had	/t/	5.00	4.21	1.21	3.00	1.00
5	well peg pen	/w/	5.00	4.52	1.38	3.00	1.00
6	kid fill kiss	/f/	5.00	4.81	2.53	3.00	1.00
7	leap mean meal	/l/	4.67	6.12	2.30	4.00	1.00
8	seed seal deep	/d/	4.67	7.12	2.63	4.00	1.00
9	rug bun bus	/r/	5.00	4.31	1.00	3.00	1.00
10	fun pin gun	/p/	5.00	3.71	1.00	3.00	1.00

Note. SF=spoken frequency; AoA= age of acquisition, I = imageability; R/Ir = regularity-irregularity; WL = word length; SybL = syllable length.

1.2 Afrikaans (L1) Onset Awareness Test

No.	Stimuli	Correct response	SF	AoA	I	WL	SyLb
1	ruk rus bul	/b/	4.33	5.89	1.33	3.00	1.00
2	dik min dis	/m/	5.00	4.04	2.59	3.00	1.00
3	wit sin wig	/s/	4.67	5.61	1.75	3.00	1.00
4	bek bel pen	/p/	5.00	2.56	1.21	3.00	1.00
5	sin sit lip	/l/	5.00	2.60	1.38	3.00	1.00
6	meer hoor keer	/h/	5.00	5.47	2.53	4.00	1.00
7	rug veg lug	/v/	4.67	5.63	2.30	3.00	1.00
8	krag krap trap	/tr/	5.00	6.12	2.63	4.00	1.00
9	stall braaf staan	/br/	4.33	8.40	1.00	4.00	1.00
10	rook room koop	/k/	5.00	4.70	1.00	4.00	1.00

Note. SF=spoken frequency; AoA= age of acquisition, I = imageability; R/Ir = regularity-irregularity; WL = word length; SybL = syllable length.

1.3 English (L1/L2) Rime Awareness Test

No.	Stimuli	Correct response	SF	AoA	I	WL	SyLb
1	pin sit fin	/sit/	4.84	3.96	2.22	3.00	1.00
2	doll hop top	/doll/	4.37	3.70	2.29	3.00	1.00
3	bun hut sun	/hut/	4.71	4.39	1.48	3.00	1.00
4	map gap pal	/pal/	4.26	3.93	1.12	3.00	1.00
5	men red bed	/men/	4.87	2.71	1.59	3.00	1.00
6	wig pin dig	/pin/	3.80	5.44	1.18	3.00	1.00
7	weed peel deed	/peel/	3.68	6.20	3.30	4.00	1.00
8	pack back sad	/sad/	4.67	4.94	2.45	4.00	1.00
9	sand bank hand	/bank/	4.63	4.44	1.20	4.00	1.00
10	mint pink wink	/mint/	4.62	4.50	1.21	4.00	1.00

1.4 Afrikaans (L1) Rime Awareness Test

No.	Stimuli	Correct response	SF	AoA	I	WL	SyLb
1	ruk rus bul	/b/	4.76	4.22	2.29	3.00	1.00
2	dik min dis	/m/	4.02	3.92	1.33	3.00	1.00
3	wit sin wig	/s/	4.59	2.92	1.00	3.00	1.00
4	bek bel pen	/p/	4.93	3.79	1.68	3.00	1.00
5	sin sit lip	/l/	3.71	4.08	1.43	3.00	1.00
6	meer hoor keer	/h/	4.47	4.92	2.11	3.00	1.00
7	rug veg lug	/v/	3.67	3.20	1.85	4.00	1.00
8	krag krap trap	/tr/	5.00	3.28	1.32	3.00	1.00
9	stall braaf staan	/br/	4.97	5.43	1.68	4.00	1.00
10	rook room koop	/k/	4.76	5.32	2.50	4.00	1.00

1.5 English (L1/L2) Phoneme Deletion Awareness Test

No.	Say	Now say it again but don't say	Correct response	SF	AoA	I	WL	SyLb
1	cowboy	/boy/	/cow/	4.53	2.97	1.00	6.00	2.00
2	steamboat	/steam/	/boat/	4.17	3.70	1.00	9.00	2.00
3	sunshine	/sun/	/shine/	4.70	3.60	1.00	8.00	2.00
4	picnic	/pic/	/nic/	4.50	2.77	1.00	6.00	2.00
5	cucumber	/cu/	/cumber/	4.17	3.43	1.00	8.00	3.00
6	coat	/k/	/oat/	4.07	3.77	1.00	4.00	1.00
7	meat	/m/	/eat/	4.53	2.97	1.00	4.00	1.00
8	take	/t/	/ache/	4.67	4.23	2.13	4.00	1.00
9	same	/m/	/sae/	4.60	4.67	2.63	4.00	1.00
10	wrote	/t/	/row/	4.90	2.33	1.00	5.00	1.00
11	please	/se/	/plea/	5.00	2.73	1.00	6.00	1.00
12	clap	/k/	/lap/	4.80	2.83	1.00	4.00	1.00
13	play	/p/	/lay/	5.00	2.76	2.10	4.00	1.00
14	stale	/t/	/sale/	4.17	3.77	2.20	5.00	1.00
15	smack	/m/	/sack/	4.40	3.10	2.17	5.00	1.00

1.6 Afrikaans (L1) Phoneme Deletion Awareness Test

No.	Say	Now say it again but don't say	Correct response	SF	AoA	I	WL	SyLb
1	toonbank	/toon/	/bank/	4.70	3.60	1.40	8.00	2.00
2	laerskool	/laer/	/skool/	5.00	7.30	1.37	9.00	2.00
3	stoomboot	/stoom/	/boot/	4.17	3.70	1.00	9.00	2.00
4	sonskyn	/son/	/skyn/	5.00	3.60	1.00	7.00	2.00
5	digter	/dig/	/ter/	4.80	2.60	1.00	6.00	1.00
6	komkommer	/kom/	/kommer/	4.17	3.43	1.00	9.00	3.00
7	koud	/k/	/oud/	4.00	3.40	1.20	4.00	1.00
8	skaap	/sk/	/aap/	4.53	2.97	1.00	5.00	1.00
9	trou	/t/	/rou/	4.10	7.17	2.70	4.00	1.00
10	geen	/g/	/een/	4.10	5.20	2.20	4.00	1.00
11	skoen	/t/	/row/	4.20	4.47	1.03	5.00	1.00
12	klap	/k/	/lap/	5.00	2.83	1.00	4.00	1.00
13	plat	/p/	/lat/	4.70	3.60	2.20	4.00	1.00
14	skool	/k/	/sool/	5.00	3.10	1.00	5.00	1.00
15	smaak	/m/	/saak/	4.53	1.77	2.00	5.00	1.00

1.7 English (L1/L2) Expressive Vocabulary Test

No.	Stimuli	SF	AoA	I	WL	SyLb
1	car	5.00	1.50	2.00	3.00	1.00
2	flower	5.00	1.77	2.00	6.00	1.00
3	train	4.00	1.50	2.00	5.00	1.00
4	bucket	5.00	3.77	2.00	6.00	1.00
5	hat	5.00	2.97	2.00	3.00	1.00
6	umbrella	5.00	1.77	2.00	8.00	2.00
7	clock	5.00	6.90	2.00	5.00	1.00
8	cow	5.00	2.97	1.37	3.00	1.00
9	thief	5.00	7.37	2.00	5.00	1.00
10	bicycle	5.00	1.50	1.50	7.00	2.00
11	alphabet	5.00	4.37	1.03	8.00	3.00
12	leave	4.00	3.47	1.63	5.00	1.00
13	ancient	3.00	7.50	6.63	7.00	2.00
14	pest	4.00	7.80	4.47	4.00	1.00
15	brave	5.00	7.50	6.23	5.00	1.00
16	obey	5.00	4.23	2.00	4.00	1.00
17	island	4.00	7.30	1.37	6.00	2.00
18	nonsense	3.00	8.13	6.80	8.00	2.00
19	absorb	3.00	8.57	2.00	6.00	2.00
20	transparent	3.00	9.07	2.00	11.00	3.00

1.8 Afrikaans (L1) Expressive Vocabulary Test

No.	Say	SF	AoA	I	WL	SyLb
1	Kar	5.00	1.50	2.00	3.00	1.00
2	Blom	5.00	1.77	2.00	4.00	1.00
3	Trein	4.00	1.50	2.00	5.00	1.00
4	Emmer	5.00	3.77	2.00	5.00	2.00
5	Hoed	5.00	2.97	2.00	4.00	1.00
6	Sambreel	5.00	1.77	2.00	8.00	1.00
7	Klok	5.00	6.90	2.00	4.00	1.00
8	Koei	5.00	2.97	1.37	4.00	1.00
9	Dief	5.00	7.37	2.00	4.00	1.00
10	Fiets	5.00	1.50	1.50	5.00	1.00
11	Alphabet	5.00	4.37	1.03	7.00	2.00
12	Verlaat	4.00	3.47	1.63	7.00	1.00
13	Antiek	3.00	7.50	6.63	6.00	1.00
14	Pes	4.00	7.80	4.47	3.00	1.00
15	Dapper	5.00	7.50	6.23	6.00	2.00
16	Luister	5.00	4.23	2.00	7.00	2.00
17	Eiland	4.00	7.30	1.37	6.00	2.00
18	Twak	3.00	8.13	6.80	9.00	1.00
19	Absorber	3.00	8.57	2.00	9.00	1.00
20	deurskynend	3.00	9.07	2.00	11.00	2.00

1.9 English (L1/L2) Similarities Test

No.	Stimuli	SF	AoA	I	WL	SyLb
1	milk-water	5.00	6.70	1.00	7.00	1.00
2	pen-pencil	5.00	6.87	1.00	6.00	2.00
3	apple-banana	5.00	6.10	1.00	8.00	2.00
4	shirt-shoe	5.00	6.20	1.00	7.00	1.00
5	cat-mouse	5.00	3.73	1.00	5.50	1.50
6	butterfly-bee	4.67	3.77	1.00	10.50	2.50
7	winter-summer	4.20	7.30	2.13	9.00	3.00
8	anger-joy	4.20	7.50	2.43	6.50	1.50
9	elbow-knee	4.53	2.83	1.00	7.00	1.50
10	wood-bricks	3.37	7.03	1.17	9.00	3.00
11	painting-statue	3.00	7.50	2.63	11.00	2.50
12	frown-smile	4.27	8.13	4.67	7.50	1.50

1.10 Afrikaans (L1) Similarities Test

No.	Say	SF	AoA	I	WL	SyLb
1	melk-water	5.00	6.70	1.00	6.50	1.50
2	pen-potlood	5.00	6.87	1.00	6.50	2.00
3	appel-piesang	5.00	6.10	1.00	8.50	3.00
4	hemp-skoen	5.00	6.20	1.00	6.50	1.50
5	kat-muis	5.00	3.73	1.00	5.00	1.50
6	skoenlapper-by	4.67	3.77	1.00	12.00	2.50
7	winter-somer	4.20	7.30	2.13	8.50	3.00
8	kwaad-bly	4.20	7.50	2.43	6.50	1.50
9	elmboog-knie	4.53	2.83	1.00	9.00	2.50
10	hout-baksteen	3.37	7.03	1.17	8.00	2.00
11	skildery-standbeeld	3.00	7.50	2.63	13.00	3.00
12	frons-glimlag	4.27	8.13	4.67	8.50	2.00

1.11 English (L1/L2) Word Reading Test

Stimuli	SF	AoA	I	R/Ir	WL	SybL
the	5.00	8.00	6.00	1.00	3.00	1.00
up	5.00	8.00	1.00	1.00	2.00	1.00
you	5.00	8.00	2.00	1.00	3.00	1.00
school	5.00	8.00	1.00	2.00	6.00	1.00
into	5.00	8.00	1.00	1.00	4.00	1.00
so	5.00	8.00	2.00	1.00	2.00	1.00
then	5.00	8.00	3.00	2.00	4.00	1.00
fly	4.00	9.00	2.00	1.00	3.00	1.00
sea	4.00	9.00	2.00	1.00	3.00	1.00
swim	5.00	8.00	3.00	1.00	4.00	1.00
how	5.00	8.00	6.00	2.00	3.00	1.00
people	5.00	8.00	1.00	1.00	6.00	1.00
because	5.00	8.00	2.00	1.00	7.00	2.00
again	5.00	8.00	6.00	1.00	5.00	1.00
where	5.00	8.00	4.00	1.00	5.00	1.00
small	5.00	8.00	3.00	1.00	5.00	1.00
closed	4.00	9.00	1.00	1.00	6.00	1.00
know	5.00	8.00	2.00	2.00	4.00	1.00
stood	4.00	9.00	1.00	1.00	5.00	1.00
size	4.00	9.00	4.00	1.00	4.00	1.00
wrong	4.00	9.00	4.00	1.00	5.00	1.00
between	5.00	8.00	2.00	1.00	7.00	2.00
instead	4.00	9.00	2.00	1.00	7.00	2.00
ocean	4.00	9.00	2.00	1.00	5.00	1.00

Stimuli	SF	AoA	I	R/Ir	WL	SybL
knock	4.00	9.00	1.00	1.00	5.00	1.00
fruit	4.00	9.00	1.00	1.00	5.00	1.00
shut	4.00	9.00	1.00	1.00	4.00	1.00
carefully	4.00	9.00	3.00	1.00	9.00	2.00
goal	4.00	9.00	2.00	1.00	4.00	1.00
sight	4.00	9.00	2.00	2.00	5.00	1.00
crowd	4.00	9.00	1.00	1.00	5.00	1.00
enough	5.00	8.00	3.00	2.00	6.00	1.00
during	5.00	8.00	3.00	1.00	6.00	2.00
flexible	4.00	9.00	1.00	1.00	8.00	2.00
known	5.00	8.00	3.00	2.00	5.00	1.00
equal	4.00	9.00	3.00	2.00	5.00	1.00
fraction	4.00	9.00	3.00	1.00	8.00	2.00
design	4.00	9.00	4.00	2.00	6.00	2.00
smudge	4.00	9.00	4.00	2.00	6.00	1.00
oxygen	4.00	9.00	5.00	2.00	6.00	2.00
column	4.00	9.00	2.00	2.00	6.00	2.00
thumbnail	4.00	9.00	5.00	1.00	9.00	2.00
rhythm	5.00	8.00	5.00	2.00	6.00	1.00
courage	5.00	8.00	4.00	2.00	7.00	2.00
determine	4.00	9.00	4.00	2.00	9.00	3.00
ajar	3.00	9.00	1.00	1.00	4.00	1.00
apology	5.00	7.00	2.00	1.00	7.00	2.00
pier	1.00	9.00	2.00	2.00	4.00	1.00
ruin	5.00	9.00	2.00	2.00	4.00	1.00

Stimuli	SF	AoA	I	R/Ir	WL	SybL
dozing	3.00	8.00	2.00	1.00	6.00	2.00
useless	3.00	8.00	2.00	1.00	6.00	2.00
ideally	5.00	9.00	3.00	1.00	7.00	2.00
deputy	5.00	7.00	3.00	1.00	6.00	2.00
cutlery	3.00	9.00	3.00	1.00	7.00	2.00
phonograph	2.00	9.00	3.00	1.00	10.00	2.00
poise	1.00	10.00	5.00	2.00	5.00	1.00
unique	2.00	9.00	5.00	1.00	6.00	1.00
pathetic	3.00	10.00	4.00	1.00	8.00	3.00
cleanse	3.00	10.00	4.00	2.00	7.00	1.00
chord	4.00	10.00	3.00	2.00	5.00	1.00
acquire	5.00	10.00	5.00	1.00	7.00	2.00
scholar	5.00	10.00	5.00	1.00	7.00	1.00
treacherous	5.00	11.00	5.00	1.00	11.00	3.00
veterinary	3.00	11.00	3.00	1.00	10.00	4.00
ridicule	5.00	10.00	5.00	1.00	8.00	2.00
vicinity	5.00	10.00	5.00	2.00	8.00	2.00
negotiate	5.00	10.00	4.00	1.00	9.00	4.00
catastrophe	5.00	10.00	5.00	2.00	11.00	3.00
infamous	5.00	12.00	5.00	2.00	8.00	3.00
topography	5.00	9.00	5.00	1.00	10.00	3.00
naive	5.00	10.00	5.00	2.00	5.00	1.00
subtle	5.00	10.00	5.00	2.00	6.00	2.00
bureau	5.00	9.00	5.00	2.00	6.00	2.00
plethora	5.00	12.00	5.00	2.00	8.00	2.00

Stimuli	SF	AoA	I	R/Ir	WL	SybL
reminisce	5.00	12.00	5.00	2.00	9.00	3.00
conscience	3.00	12.00	5.00	2.00	10.00	2.00
indefatigable	5.00	12.00	5.00	2.00	13.00	4.00
malign	5.00	12.00	5.00	2.00	6.00	2.00
indigenous	3.00	12.00	5.00	1.00	10.00	4.00
euphemism	5.00	12.00	5.00	1.00	9.00	3.00
milieu	5.00	14.00	5.00	2.00	6.00	2.00
antithesis	5.00	14.00	5.00	1.00	10.00	3.00
ethereal	5.00	14.00	5.00	2.00	8.00	2.00
hierarichal	4.00	14.00	5.00	2.00	11.00	4.00

1.12 Afrikaans (L1) Word Reading Test

Stimuli	SF	AoA	I	R/Ir	WL	SybL
die	5.00	8.00	6.00	1.00	3.00	1.00
op	5.00	8.00	1.00	1.00	2.00	1.00
jou	5.00	8.00	2.00	1.00	3.00	1.00
skool	5.00	8.00	1.00	1.00	5.00	1.00
in	5.00	8.00	1.00	1.00	2.00	1.00
so	5.00	8.00	2.00	1.00	2.00	1.00
dan	5.00	8.00	3.00	1.00	3.00	1.00
vlieg	4.00	9.00	2.00	1.00	5.00	1.00
see	4.00	9.00	2.00	1.00	3.00	1.00
swem	5.00	8.00	3.00	1.00	4.00	1.00
hoe	5.00	8.00	6.00	1.00	3.00	1.00
mense	5.00	8.00	1.00	1.00	5.00	1.00
omdat	5.00	8.00	2.00	1.00	5.00	2.00
weer	5.00	8.00	6.00	1.00	4.00	1.00
wanneer	5.00	8.00	4.00	1.00	7.00	2.00
klein	5.00	8.00	3.00	1.00	5.00	1.00
gesluit	4.00	9.00	1.00	1.00	7.00	1.00
weet	5.00	8.00	2.00	1.00	4.00	1.00
staan	4.00	9.00	1.00	1.00	5.00	1.00
grootte	4.00	9.00	4.00	1.00	7.00	2.00
onreg	4.00	9.00	4.00	1.00	5.00	2.00
tussen	5.00	8.00	2.00	1.00	6.00	2.00
keuse	4.00	9.00	2.00	1.00	5.00	2.00
oseaan	4.00	9.00	2.00	1.00	6.00	1.00

Stimuli	SF	AoA	I	R/Ir	WL	SybL
klop	4.00	9.00	1.00	1.00	4.00	1.00
vrugte	4.00	9.00	1.00	1.00	6.00	2.00
sluit	4.00	9.00	1.00	1.00	5.00	1.00
versigtig	4.00	9.00	3.00	1.00	9.00	2.00
doel	4.00	9.00	2.00	1.00	4.00	1.00
gesig	4.00	9.00	2.00	1.00	5.00	1.00
klomp	4.00	9.00	1.00	1.00	5.00	1.00
genoeg	5.00	8.00	3.00	1.00	6.00	1.00
tydens	5.00	8.00	3.00	1.00	6.00	2.00
fleksiel	4.00	9.00	1.00	1.00	8.00	1.00
ken	5.00	8.00	3.00	1.00	3.00	1.00
gelyke	4.00	9.00	3.00	1.00	6.00	2.00
fraksie	4.00	9.00	3.00	1.00	7.00	1.00
ontwerp	4.00	9.00	4.00	1.00	7.00	1.00
besmeer	4.00	9.00	4.00	1.00	7.00	1.00
oksigeen	4.00	9.00	5.00	1.00	8.00	1.00
kolom	5.00	8.00	6.00	1.00	3.00	1.00
duimsnael	4.00	9.00	5.00	1.00	9.00	2.00
ritme	5.00	8.00	5.00	1.00	5.00	2.00
heldhaftig	5.00	8.00	4.00	1.00	10.00	2.00
besluit	4.00	9.00	4.00	1.00	7.00	1.00
half-oop	3.00	9.00	1.00	1.00	7.00	2.00
apologie	5.00	7.00	2.00	1.00	8.00	2.00
seehoof	1.00	9.00	2.00	1.00	7.00	2.00
bouval	5.00	9.00	2.00	1.00	6.00	2.00

Stimuli	SF	AoA	I	R/Ir	WL	SybL
sluimering	3.00	8.00	2.00	1.00	10.00	3.00
nutteloos	3.00	8.00	2.00	1.00	9.00	3.00
ideaal	5.00	9.00	3.00	1.00	6.00	2.00
adjunk	5.00	7.00	3.00	1.00	6.00	2.00
eetgerei	3.00	9.00	3.00	1.00	8.00	3.00
fonografies	2.00	9.00	3.00	1.00	11.00	2.00
kalmte	1.00	10.00	5.00	1.00	6.00	2.00
enig	2.00	9.00	5.00	1.00	4.00	1.00
pateties	3.00	10.00	4.00	1.00	8.00	3.00
suiwer	3.00	10.00	4.00	1.00	6.00	1.00
snaar	4.00	10.00	3.00	1.00	5.00	1.00
verwerf	5.00	10.00	5.00	1.00	7.00	2.00
leerling	5.00	10.00	5.00	1.00	8.00	2.00
verraderlik	5.00	11.00	5.00	1.00	11.00	3.00
veaarts	3.00	11.00	3.00	1.00	7.00	2.00
belaglik	5.00	10.00	5.00	1.00	8.00	3.00
nabyheid	5.00	10.00	5.00	1.00	8.00	2.00
verhandel	5.00	10.00	4.00	1.00	9.00	2.00
katastrofe	5.00	10.00	5.00	1.00	10.00	3.00
eerloos	5.00	12.00	5.00	1.00	7.00	2.00
topografie	5.00	9.00	5.00	1.00	10.00	3.00
naief	5.00	10.00	5.00	1.00	5.00	1.00
subtiel	5.00	10.00	5.00	1.00	7.00	2.00
kantoor	5.00	9.00	5.00	1.00	7.00	2.00
oordaad	5.00	12.00	5.00	1.00	7.00	2.00

Stimuli	SF	AoA	I	R/Ir	WL	SybL
herinner	5.00	12.00	5.00	1.00	8.00	2.00
gewete	3.00	12.00	5.00	1.00	6.00	2.00
onvermoeid	5.00	12.00	5.00	1.00	10.00	3.00
kwaadspreek	5.00	12.00	5.00	1.00	11.00	2.00
aangebore	3.00	12.00	5.00	1.00	9.00	3.00
eufemisme	5.00	12.00	5.00	1.00	9.00	3.00
omgewing	5.00	14.00	5.00	1.00	8.00	3.00
teenoorgestelde	5.00	14.00	5.00	1.00	15.00	4.00
delikaat	5.00	14.00	5.00	1.00	8.00	2.00
hieragie	4.00	14.00	5.00	1.00	8.00	2.00

APPENDIX I: EDITING CONFIRMATION

Tsimela

* The stars that tell the spade when to dig and the seeds when to grow *

* Isilimela – iinkwenkwezi ezixelela umhlakulo ukuba mawembe nembewu ukuba mayikhule*

P O Box 65251
Erasmusrand
0165

22 March 2016

Dear Ms D. S. De Sousa

CONFIRMATION OF EDITING THE THESISWITH THE TITLE TO BE OR NOT TO BE BILINGUAL: COGNITIVE PROCESSING SKILLS AND LITERACY DEVELOPMENT IN ENGLISH FIRST LANGUAGE, ENGLISH SECOND LANGUAGE, AND BILINGUAL AFRIKAANS-ENGLISH SPEAKING CHILDREN

I hereby confirm that I have edited the abovementioned document as requested.

Please pay particular attention to the editing notes for your revision.

The tracks copy of the document contains all the changes I have effected while the edited copy is a clean copy with the changes removed. Kindly make any further changes to the edited copy since I have effected minor editing changes after removing the changes from the tracks copy. The tracks copy should only be used for reference purposes.

Please note that it remains your responsibility to supply references according to the convention that is used at your institution of learning.

You are more than welcome to send me the document again to perform final editing should it be necessary.

Kind regards

André Hills
083 501 4124