Chapter 1

Introduction

" The limits of my language are the limits of my world."

- Wittgenstein

Becoming literate requires not only learning to read, but also learning to write and spell: to write the conventional word forms, which represent both the sound and the meaning of the language. Unfortunately, society at large often interprets poor spelling as a sign of laziness or a lack of intelligence (vos Savant, 2000). Yet, despite the efforts of teachers and parents, many children continue to struggle with spelling that can, in turn, profoundly affect reading and writing ability throughout their lives. The battle to improve children's spelling in alphabet-based languages such as English is ongoing and serious. So why is learning to spell words so difficult, and why is it important?

Learning to spell is difficult for two main reasons. Firstly, the English orthographic system is complex, as two interrelated linguistic systems represent meaning: *morphology* and *phonology*. These two aspects work *together* in English orthography to represent the meaning of a language to those who already understand and speak it (Chomsky & Halle, 1968). The development of both phonemic and morphemic knowledge is associated with successful acquisition of literacy (Carlisle, 2003). So it

is crucial for young literacy learners to understand that written words represent *more* than speech sounds (Nunes & Bryant, 2006, 2009). Children must also understand that it is the spelling, the written form, that determines its *meaning*. It is, in other words, much more than transcribing what we say, we are also transcribing what we *mean* through the writing of morphemes. Nonetheless, it is crucial, initially, for young literacy learners to become phonemically aware and cognizant of the alphabetic principle where children understand that letters of the alphabet can represent abstract and discrete sounds (phonemes) extracted from a continuous speech stream (Adams, 1990; Byrne, 1998; Fraser, 2006). The English orthographic system is by the nature of its complexity difficult to learn and becoming proficient in spelling is necessarily a protracted process. Consequently, spelling instruction is often marginalized in education, and teachers are inclined to place more importance on teaching reading and other writing skills (Reed, 2012; Simonsen & Gunter, 2001).

While it is commonly understood that the English orthographic system is complex and therefore difficult to learn, researchers and educators do not satisfactorily address *how* spelling is taught and *what* linguistic knowledge teachers need to teach spelling effectively nor how to empower children so they can produce meaningful spelling in their writing. This brings us to the second reason learning to spell is so difficult: the well-intentioned but inadequate teaching of spelling in the classroom.

Many educators have believed that learning to spell depends primarily on rote memorization of whole words and learning spelling rules (Schlagel, 2007). In a comprehensive review of literacy instruction in Australia, de Lemos (2002) reported that teacher practice is dominated by ‘whole-language’ approaches (Mahar &

Richdale, 2008). Later, the Australian National Inquiry into the Teaching of Literacy (2005), observed that the 'Whole Language' approach, that is, the incidental learning of spelling, in the same way that reading is learned in this approach without explicit instruction has dominated literacy teaching practices in Australian schools (Kamil et al., 2000; Westwood, 1999, 2005). This discovery was echoed in the United States of America (USA National Reading Panel 2000) and in the United Kingdom (UK Select Committee on the Teaching of Reading 2005). The incidental learning of spelling is often supported by the common view found in many classrooms and the wider community that spelling is a *mechanical skill* that must be mastered through memorization and drill (Bahr, Silliman & Berninger, 2009). Classrooms worldwide reflect this view with the use of the dominant spelling model the *Look, Say, Cover, Write* and *Check* method (or variations on the theme) introduced by Horn in 1919 (Allal, 1997). Students learn the word lists (lists often created through levelled or thematic spelling words delivered on a Monday), by looking at each word, saying the word out loud, covering the word, writing it from memory and then checking their own spelling for accuracy. If students make a spelling mistake they are often required to write the word out repeatedly until they can spell it accurately from memory. The goal of the following test on Friday is to have no spelling errors. Teachers then hope that their students' performance in these tests will transfer to other writing tasks (Fresch, 2007). However, evidence shows that memorization of word lists provides limited generalization and transfer of learning ability to later independent writing (Beckham-Hungler & Williams, 2003; Bransford & Schwartz, 2001).

If children could spell by memorizing word lists alone, then it could be concluded that words are learned one by one. Thankfully, this is not the case: if it were, learning

English spelling would be an impossible task (Nunes & Bryant, 2009). As it is, we can teach children the significant patterns and consistencies that will predict the spelling of a larger number of words than could possibly be memorized. That is, memorizing words without understanding is not the basis for being able to transfer knowledge from one context to the next. For example, a child using the *Look Cover Say Write Check* strategy may in the short term remember the spellings of *prints* and *prince,* but it may be more important for the child to understand that even though these words *sound* the same, we write them differently to indicate different *meanings*. Similarly, it is important for learners to know that words like *product* and *produce* are related because the same morpheme is used to indicate a related meaning, even though the sound changes: thus, assisting the learner to shift from a dominant sounding-out strategy that causes many errors, to a deeper understanding of how sounds and meaning work together to form words.

Expert teaching is pivotal to the improvement of children's overall literacy outcomes and to do this children require expert teaching with well-founded understandings of the structure of the English spelling system (de Lemos, 2002). However, research to date suggests that teachers have limited spelling resources and limited meta-linguistic knowledge that in turn, profoundly affects the spelling outcomes of their students (Hurry, et al., 2005; Nunes & Bryant, 2009). Current curriculum support directives, such as *Focus on Literacy: Spelling* (NSW Department of Education and Training, 1998) specifically state that spelling must be taught in an, 'explicit and systematic way' (p.18) and teachers must know 'how the spelling system works' (p.19). However, as reported by Buckland and Fraser (2008), the challenge is to provide

teachers with the necessary *deep* language knowledge they need to teach literacy effectively.

Spelling instruction that includes teaching children about phonemes and morphemes is important, because it not only promotes children's confidence and success in meaningful writing at the word level, but it crucially supports reading (Carlisle, 1995, 2000; Champion, 1997; Elbro & Arnbak, 1996; Fowler & Liberman 1995; Leong, 1989; Moats, 2005/2006; Singson, Mahony & Mann, 2000; Nunes & Bryant 2006, 2009; Windsor, 2000). Recently, Bahr, Silliman and Berninger (2009), and Stahl and Nagy (2006) also found that effective spelling instruction that draws on children's phonological, orthographic and morphological awareness is linked to new vocabulary acquisition, which in turn improves children's word recognition and comprehension when reading.

The complex nature of the English orthographic system and the significant implications for children understanding how it works were the inspiration behind this thesis. The current study proposes that in order to teach children how the English spelling system works, teachers need to develop a *relational approach* to teaching spelling. Teaching a relational approach to spelling requires explicit and systematic instruction in the structure of words to reveal the *relationship* between the representation of sounds (phonemes) and the representation of meanings (morphemes) in the form of written words. This approach requires the teacher to direct children's attention to the smaller parts of words, what is inside the words, by first deconstructing words into morphemes and drawing their attention to the meaning or function of those morphemes. In the same instance the teacher would draw the

children's attention to what the morphemes sound like. Many morphemes sound similar, but the letter string is very different indicating different meanings or functions. The relational approach attempts to improve students' spelling performance and understanding by bolting together these two concepts, morphemes and phonemes, and reconstructing children's knowledge about the spelling of words. To this end contrasting morphemes are used to exemplify how different spellings, with similar sounds, can signal different meanings. One example commonly used in this study was the different spelling of the comparative noun forming suffix *-est* and the person noun-forming suffix *–ist*. These two morphemes, or meaningful forms, are pronounced with the same sounds at the end of *fattest* and *artist*, but importantly, children must understand that even though they sound the same, we write these endings differently to indicate that each one has a different meaning, or function. Similarly, when base words change their sound, for example when a verb base word is transformed into a noun, the spelling is usually preserved in order to preserve the meaning (e.g. *heal* to *health*, *know* to *knowledge, or sign* to *signature*).

It is important to understand that the relational approach involves more than *integrating* morphemic knowledge, in a general sense, within the context of learning about other writing or reading skills. The relational approach attempts to reconstruct children's linguistic knowledge about the structure of words in a very specific way that helps them form connections between knowledge about phonemes, which they may already have, and new knowledge about morphemes.

The relational approach attempts to effect important conceptual shifts in the way children think about the linguistic aspects of words for spelling. This needs to be

explored and better understood. Following this commitment, the current study has adapted Karmiloff-Smith's (1992) general cognitive model for the special purpose of interpreting children's verbal justifications and reasoning about spelling choices. By analyzing children's talk about what they know, and how they know the spellings of words, it is possible to uncover much needed insight into the development of children's linguistic knowledge and the impact this knowledge has on their spelling performance and understanding of spelling.

The approach to spelling investigated in the current study was developed in response to a demonstrated need to improve the teaching and learning of spelling. The current study offers for the first time, an account of teachers using a relational approach to teach spelling in real classrooms. The intervention was delivered over a period of one academic school term. Ideally, maximum effects would be achieved teaching the relational approach over a full academic year. It is hoped that this small study will act as a preliminary to experimentation on a larger scale. The next chapter provides an extensive literature review that forms the road map for the current study.

Arising from the literature review is the rationale for the research questions on which the current study is based. There are three main questions:

(1) What do teachers know about spelling?
(2) Does teaching children about the relationship between sounds and meanings in words contribute to spelling achievement in spelling tests?
(3) What knowledge do children use when reasoning about spelling?

Each of these three research questions heads a separate results chapter (Chapters 4, 5, and 6) in an attempt to tease out the complex nature of this research. Chapter 7 follows with a comprehensive discussion of the findings and the theoretical implications for spelling development and teaching practice. Chapter 3 outlines the mechanics and rationale of a necessarily multifaceted methodology, but first the relevant literature will be reviewed.

Chapter 2

Literature Review

"The way of words, of knowing and loving words, is a way to the essence of things, and to the essence of knowing."

- John Dunne

2 Introduction

Learning to spell words is more than an acquired skill it is a fundamental writing process, and the way children *think* about the spelling of words and translate that knowledge into written form can have profound implications for a child's success in reading and writing (Bahr, Silliman & Berninger, 2009; Ehri & Snowling, 2004, Singer & Bashir, 2004). Effective spelling instruction that includes learning about the linguistic systems of written word structure is crucial to help children produce meaningful writing at the word level. Learning to spell words through understanding word structure also significantly supports children's reading skills, yet the importance of effective spelling instruction is not widely understood by classroom teachers despite the increased research in this area (Bahr, Silliman & Berninger, 2009; Fresch, 2007; Moats, 2005; Nunes & Bryant, 2006, 2009). Teachers and researchers need new insights into not only *what* to teach children about written words to improve spelling performance and understanding, but *how* to teach it.

While it is important for teachers to know what children can do at different points in their development, it is also important to understand more about the way children develop conceptual connections between their spoken language and the meanings encoded in the spelling of words they write. Studying children's spelling performance, and in particular their understanding of spelling concepts, provides a unique opportunity to observe the way children *think* about writing at the level of the word.

This chapter reviews what we know about the English spelling system, the emerging evidence from recent spelling intervention studies that inform instruction, and what is clear, and unclear, about children's developing spelling knowledge. The literature raises important questions that serve to illuminate the key issues that will be addressed throughout the current study. This review is divided into five main parts.

1. The English spelling system

The essential linguistic components that build the structure of the English spelling system, and the relevance of the English orthographic structure to research on spelling performance and understanding are described in this section.

2. Intervention studies – moving beyond phonology

A case for using knowledge about phonemes and morphemes together to improve spelling performance and understanding will be built in this section by reviewing the literature that supports teaching about morphology as a central theme and as an essential part of understanding how words work.

3. Teacher knowledge

This section reviews the research that investigates what teachers generally appear to know about the spelling of words, what language knowledge they draw on in order to teach spelling, and the relationship that exists between increased teacher language knowledge and their practice.

4. Models of spelling development

An overview of the dominant contemporary models of spelling development (Ehri, 1998, 1999, 2002; Frith, 1985), and the studies that support and refute their claims are offered in this section.

5. Understanding spelling development: both a cognitive and linguistic perspective

This section develops the rationale for understanding spelling as grounded in both the linguistic and cognitive sciences. Initially, the application of a general cognitive model as a tool for understanding the cognitive dimension of spelling is justified. Then a framework is developed that incorporates children's implicit language knowledge and their increasingly explicit language knowledge in a transitional approach. This transitional approach looks at the finer details of the processes of change between the word level knowledge that children may have but are not necessarily aware of, and the declarative word level knowledge that they can readily access for verbal reporting and reasoning. This section deepens the argument for developing children's reasoning about spelling and for discovering the full impact of explicit word level knowledge on children's spelling performance and understanding.

2.1 The English spelling system

A common view of spelling amongst teachers and the wider community, according to Olson (1994), is the notational view. This view, accepted since the time of Aristotle, holds that spelling is primarily a reflection of sound to letter relationships (Ehri, 1992; Gough & Hillinger, 1980). A similar view held by theorists such as Ehri (1991; 1992; 1998), Frith (1985), Henderson and colleagues (Beers, Beers, & Grant, 1977; Henderson, 1985), and Gentry (1982) holds that the greatest challenge for children learning to spell is learning the sound to letter correspondences. Pollo, Treiman and Kessler (2007) describe a complementary approach to spelling development they call a phonological perspective. The phonological perspective holds that the greatest challenge for children is to learn how to segment the continuous speech stream into discrete units of sound called phonemes. The notational view and the associated phonological perspective are supported by a profusion of literacy research that has primarily focused on phonology and phonemic awareness. These views include understanding that at the heart of children's success in learning to read and write is their profound understanding of the relationship between phonology and English orthography (Tolchinsky, 2003; Goswami & Bryant 1990; Muter & Snowling, 1998; Stanovich, 1994; Wagner & Torgesen, 1987). There are many reviews of research about phonology and literacy learning, including the following small sample: Torgesen, Brooks and Hall, 2006; Ehri, 2005; and Adams, 1990 among many others. Word structure, however, is a much more complex phenomenon than mere strings of letters representing sounds, as has been demonstrated by Nunes and Bryant, 2006, 2009. The importance of learning about the complexity, and depth, of the English spelling system, a motif that continues throughout the current study, will be explained in this section.

The English spelling system serves the dual purpose of representing both the sounds and meaningful forms of English (Mackay, 1987). In other words, English spelling represents a plural system that can be described as both phonological and morphemic, or morpho-phonemic, in nature (Chomsky & Halle, 1968/1991; Mackay, 1987). The morpho-phonemic principle in spelling tends to favour the preservation of meaningful forms over pronunciation (Mackay, 1987). The words *bomb* and *bombard,* for example, are derived from the same morpheme (see Venezky, 1970), yet, notwithstanding the meaningful connection between the two words, there is a shift in pronunciation from *bomb* to *bombard,* with the second 'b' silent in *bomb* but given back its sound in *bombard*. Similarly, despite the change in pronunciation, the word *sign* is related to the word *signal* through sharing the same morpheme, or meaningful form. To maintain a consistent representation of meaning between *sign* and *signal,* the base morpheme is preserved and serves as a visual clue to the meaningful connection between these words. The morpho-phonemic principle is at times imperfectly applied (for example the relationship between *speak* and *speech* is not reflected in the spelling), the words *author* and *authority* are morphologically related but semantically remote (Schiff, Raveh & Fighel, 2012), and the relationship between *ear* and *hear* turns out to be entirely accidental (Taylor, 2002). However, the morpho-phonemic principle does serve to describe many of the regularities that do exist between sounds and meaningful forms in spelling (Mackay, 1987) and is a key to the decoding of essential parts of words and hence to their spelling. There are other sources of linguistic knowledge that contribute to spelling that include orthographic knowledge (spelling rules and permissible letter patterns), etymological knowledge (word origin or history) and vocabulary knowledge (semantic features) these are all important aspects of learning about spelling. However, the current study narrows the scope and

focuses on the under researched area of teaching and learning about the *relationship* between phonemes and morphemes in the English orthographic system.

English, like all languages, is rich with morphemes, where *every* word creates morphological representations. It follows that learning about morphemes is more than learning about prefixes and suffixes, it is learning about a central linguistic system that is interwoven with sounds (phonology) to create our English spelling system. A morpheme is the smallest unit of meaning within a word. So, a word like *frog* has one morpheme, but the word *frogs* has two morphemes, *frog* and the plural suffix -*s*. The relationship between morphemes, phonemes and spelling, though not often obvious at first, is easily demonstrated (Nunes & Bryant, 2009). For example, words and word parts, that sound the same but are irregular in spelling, like the endings of the words magic***ia***n and vacat***ion***, can be seen as regular if the morphemic structure of these words is understood. The word magic***ian*** has two morphemes, *magic* + -*ian*. The suffix -*ian* has the function of changing the noun *magic* to a different kind of noun, a person noun, *magician*. The -*ian* spelling contributes to the meaning of the word *magician,* such that the spelling indicates a person who does *magic.* In contrast, in the word vacat***ion***, also made up of two morphemes, *vacate* + ***-ion,*** the suffix ***–ion*** changes the form of the verb *vacate* and contributes to the meaning of the abstract noun, *vacation*. In summary, even though the endings of the two words *magician* and *vacation* sound the same (phonology), the difference in meaning is reflected in the different *spelling* of the suffixes, the meaningful forms (morphology). In other words, the regularity of English spelling is based not only on phonology, or sounds within words, but also on the "visual identity of meaningful parts" (Venezky, 1999), that is, morphology (Bryant & Nunes, 2009).

Grasping the fundamentals of the morpho-phonemic principle is a vital key to learning to read and write (Venezky, 1970, 1999; Frith, 1980; Liberman, Liberman, Mattingly & Shankweiler, 1980; Henderson, 1982; Mackay, 1987). Despite this, research into literacy development in general, and spelling in particular, has primarily focused on phonological studies (National Inquiry into Teaching Literacy, 2005; USA National Reading Panel, 2000; UK Select Committee on the Teaching of Reading, 2005), which in turn has translated into a dominating focus on phonology in teaching practice. In Australia the National Curriculum in English (2009) states that students learning to spell need to, 'develop an understanding that spoken sounds can be represented with letters and use their knowledge of letters and combination of letters to make written words' (p.11). This position reflects a number of existing syllabus documents that focus on the importance of sound to letter relationships, giving subordinate attention to, or omitting, the importance of morphemic knowledge in understanding the English spelling system. In a fascinating review of the literature around learning morphology, Carlisle (2003) posits that a common, but mistaken view among researchers and teachers is that learning about morphemes (particularly derivational morphology) is too difficult for young children to learn. Others such as Nunes and Bryant (2009), Hurry et al., (2005) and others suggest that teachers are less familiar with the concepts of morphology than phonology and are therefore less likely to teach it.

While the importance of morphemic knowledge and its impact on literacy learning has attracted the attention of some literacy researchers (Elbro & Arnbak, 1996; Arnbak & Elbro, 2000; Carlisle, 1995, 2000, 2003; Nunes, Bindman & Bryant, 1997; Nunes, Bryant & Olsson, 2003; Nunes & Bryant, 2006), there continues to be

incomplete understanding of the relationship between morpho-phonological knowledge and spelling performance and understanding with the result that little sustained attention is given to explicit morphemic instruction in the classrooms (Henry, 2003; Carlisle, 2010; Nunes & Bryant, 2006). And thus a crucial aspect of the linguistic resource available to teachers is left out of practice.

Having made a case for understanding the morpho-phonemic structure of English orthography it is important to acknowledge here that the existing research does show that a key first step in learning about words is to acquire the necessary phonological and phonemic awareness, or the idea that words can be broken up into parts of words that represent sounds (Adams, 1990). This difficult skill requires time and practice. It necessarily involves the explicit understanding that letters of the alphabet can represent abstract and discrete sounds (phonemes) extracted from a continuous speech stream (Fraser, 2006).

Acquiring phonemic awareness is also difficult because phonemes (smallest unit of sound in a spoken word) are a context free, abstract construct that attempts to represent the sounds we *think* we hear in words (Fraser, 2006; Ravid, 2012). In the real world however, we hear and produce variations of similar sounds, called allophones, depending very much on the context in which they are used and the individuals who use them (Fraser, 2006; Ravid, 2012).

Adults often tend to believe that each word has a particular pronunciation as described in a dictionary. In fact, every word has many pronunciations depending on the speaker and the context (Fraser, 2010). For example, there are many variations between

speakers of the articulation of the word *butter* (e.g. /ʙʌɗə/ or perhaps /ʙʌɗɾ/), but speakers (that includes teachers of literacy) are influenced by their knowledge of the spelling of words, and consequently, speakers think they say the word as it is spelled. Fraser (2010) describes this phenomenon as the 'literacy bias'.

The literacy bias manifests early in literacy learning as the way children think about the sounds of words is transformed by their developing knowledge about written words. An example of this can be found in the way children and adults often drop sounds from words in the continuous speech stream, quite unconsciously, and also when reconstructing sounds from reading words, but knowing how words are spelled predicts that speakers will often count letters as sounds, for example, in the word *watch* adults will often count the *t* as a sound in this word (McClelland et al., 2010).

The literacy bias contributes to the difficulties children experience learning about how sounds correspond to letters in words (Fraser, 2010). Children must learn to segment the sounds of words, which may or may not be represented in the written word (for example the *g* in the word *sign* does not represent a sound, it is silent), into distinct phonemes. This makes learning to segment phonemes a difficult task for many children because it requires thinking about distinct sounds that do not exist explicitly in the child's mind before they begin their literacy learning (Hannam, Fraser & Byrne, 2006).

However, it is widely agreed that children who do not develop phonological and phonemic awareness are at risk of becoming less able readers and/or spellers (Wagner & Torgeson, 1987; Muter & Snowling, 1998; Goswami & Bryant 1990; Stanovich,

1994, among many others. There are many reviews on this research, including the following small sample: Bradley & Bryant, 1983; Adams, 1990; Wagner, Torgesen & Rashotte, 1994; Ehri, 2005; Torgesen, Brooks & Hall, 2006). Teachers need to understand their own literacy bias when they assist their young literacy learners in the essential acquisition of phonemic and phonological awareness. That is, teachers are literate adults and their knowledge of the sounds in words is often highly influenced by their knowledge of a word's spelling. For example, Moats (1994) revealed that only a small number of teachers in her study could identify the three sounds in the word *ox.* This is because the teachers had a literacy bias: their knowledge of the spelling of *ox* influenced how many sounds they thought they heard in the word. In this case the overwhelming majority of teachers reported there were only two sounds in the word *ox.* Teachers must have sufficient phonemic and phonological awareness in order to effectively teach the decoding of words into discrete sounds. Nevertheless, even though the conceptualization of spelling as a representation of speech sounds is crucial, it is *not* the whole story.

To know the whole story of the English spelling system is, as Templeton and Morris (1999) point out, to understand how words work. It is important to understand that the English spelling system was not intended to be a direct representation of speech at the level of individual sounds. In fact there are many examples in English orthography where meaning is expressed, but the linguistic unit expressing the meaning does not find expression in speech. For example, all three of the following statements *sound* the same.

The boy's party!

The boys' party!

The boys party late! (the word *party* is used here as a verb)

In all these examples the possessive apostrophe that precedes or follows the final *s* is a linguistic unit of meaning used to avoid ambiguity in writing, yet, in speech this ambiguity is only avoided by further clarification in the continued spoken context. The above examples highlight how the morphological word structure is quite distinct from, and often overrides, spoken word structure.

The challenge for young literacy learners is to discover the plural system in written words, which include discovering the significance of morphological structures and how these structures relate to both meaning and sound. This thesis argues that the relationship that exists between phonemes and morphemes is essential *content* knowledge for children, and that the key to effective spelling instruction lies in making this relationship transparent. The intervention central to the present study was designed with this relational perspective to spelling instruction at its core. Further details of the pedagogical features of the relational approach are found in Chapter 3.2.3.1.

2.2. Intervention Studies – Moving beyond phonology

Given the morpho-phonological nature of our spelling system as discussed above, an intriguing feature of spelling instruction in classrooms is the predominant focus on phonological and phonemic instruction and the general lack of attention given to morphological and morphemic instruction (Hurry et al., 2005). While significant associations between children's morphemic knowledge, their ability to treat as significant the smaller meaningful parts of words and to manipulate those smaller meaningful parts and their spelling ability, have emerged in the research literature

(e.g. Carlisle, 1988, 2002; Henry, 2003; Mann & Singson, 2003; Nunes, Bryant & Olsson, 2003), there is little evidence that spelling programs include morphology study as a *central* aspect of learning about words (Carlisle, 2010; Nunes & Bryant, 2006). Therefore, it is important to review those intervention studies that have attempted to connect research into the association between morphemic knowledge and spelling ability with classroom practice.

Spelling intervention studies that have attempted to fill the gap between research into the association between morphemic knowledge and spelling ability and classroom practice are reviewed here. Of particular interest are those studies that investigated the causal links between teaching children explicitly about morphemes and improved spelling performance in the classroom. These studies support the rationale of the current study that learning about morphemes is a central, and necessary, aspect of learning to spell. This review will draw mainly on the findings of the meta-analysis by Bowers, Kirby and Deacon (2010). Their comprehensive work has provided a number of relevant findings.

It is important to note that the Bowers, Kirby and Deacon (2010) meta-analysis was able to locate only a small number (n=12) of instructional studies that investigated the effects of morphological instruction on spelling outcomes. So while the research in this area is growing, it is still relatively small and it is this gap that the current study aims to address. The Bowers et al. (2010) meta-analysis, however, is most pertinent to the current study, because it comprehensively examines and distils evidence from the available morphological interventions and sheds light on the impact morphemic instruction has on the different aspects of literacy at different points in childhood

development. Furthermore, it highlights the difficulties and complexities involved in translating this type of research into classroom practice. For this reason, the findings from the Bowers et al. (2010) meta-analysis will be reviewed below in some detail.

The meta-analysis by Bowers et al. (2010) revealed that morphological instruction had a consistently moderate positive effect on the intervention groups when compared to the alternative treatment groups (including phonological intervention groups and regular classroom instruction groups). The average morphological instructional effect for spelling outcomes was approximately the same. The morphological instruction groups versus the alternative treatment effect were close to 0 (Bowers, Kirby & Deacon, 2010). These results show positive indications that teaching morphological principles, not simply as an ancillary strategy but as core content knowledge, can have a positive impact on children's spelling performance. However, more research needs to be done to grasp the finer details about what type of morphological instruction works most effectively and efficiently throughout children's spelling development.

Less able participants also show stronger effects according to the Bowers meta-analysis. This finding perhaps suggests that younger children may also benefit from explicit morphological instruction. Less able spellers were also used in the work of Berninger et al. (2008). Berninger and her colleagues explored the effects of morphological spelling instruction on students with dyslexia, and found that even though this population had profound difficulties with reading and spelling they appeared to maintain their gains when spelling both pseudo words and real words. Berninger et al. (2008) showed that phonological, morphological and orthographic

linguistic knowledge about words was relevant to word spelling at *all* stages of literacy development.

Explicit morphological instruction realized its greatest effects at the sub-lexical level where children were taught about bound morphemes, for example the abstract noun endings *–ion* and the agentive endings *–ian*. The Bowers et al. (2010) meta-analysis established that explicit instruction in the sub-lexical morphological features of words brought about measurable literacy benefits compared to the control groups. They argued that morphological instruction facilitates the enhancement of children's lexical knowledge, including increases in children's vocabulary, word meaning knowledge and comprehension (Bowers, Kirby & Deacon, 2010; Carlisle, 2003; Henry, 1988; 2003). Bowers and his colleagues argued that these results may be understood by conceptualizing the acquisition of sub-lexical morphological knowledge, for example learning about prefixes and suffixes, derivational morphemes and inflectional morphemes, as a means of strengthening not only children's sub-lexical knowledge and awareness but also children's lexical knowledge (Carlisle & Katz, 2006; Carlisle & Stone, 2005).

The important work of Nunes, Bryant and Olsson (2003) is also included in the Bowers meta-analysis. Nunes and her colleagues compared the spelling achievements of a phonological intervention group with a morphological intervention group. The results indicated an improvement in the use of morphological knowledge in spelling and this improvement was confined to the groups trained in morphology. Nunes et al. (2003) also showed, for the first time that even if explicit instruction about

morphemes was limited in content and short in duration children could improve spelling performance (Bowers et al., 2010).

Significantly, the spelling test results in the Nunes et al. (2003) study also revealed that the children were, nonetheless, able to transfer their learned morphological knowledge to pseudo word spelling problems. The Nunes, et al. (2003) pseudo words contained known morphemes and phonemes but were; nonetheless, made-up words like *slupless* and *reblod*. The findings confirm the hypothesis that learning about morphemes can have a positive transfer effect from the sub-lexical to the lexical levels (Reed, 2008). For example children who had developed knowledge about the meaning and sound of the suffix -*less* were able to use this knowledge to construct the pseudo word *slupless.* Children who did not develop specific knowledge for this morpheme often wrote letter strings that represented perceived sounds rather than meaningful parts. The evidence in these studies provided much of the groundwork that supports the research undertaken here. However, the current research will go further by investigating the nature of the transferred knowledge and the process by which it is achieved.

The recent work of Kirk and Gillon (2009) supports and builds on the above findings by focusing on the usefulness of teaching children to coordinate morphological knowledge with other types of linguistic knowledge, such as orthography and phonology, to improve their overall literacy performances. Although Kirk and Gillon (2009) used a small population (n =16) of struggling spellers, and the content of the intervention was limited to two types of orthographic patterns that included simple words where vowel length determined the spelling of the final letters (e.g. *cute, cut*)

and complex words that involved modification to spelling the base by adding a suffix (e.g. *funny* to *funniest*), results showed, as did Nunes et al. (2003), that their participants were able to generalize or transfer their new knowledge to words not learned in the intervention. It was not clear, however, whether the intervention teachers in this study made the morpho-phonological relationship transparent and central to their teaching.

Despite the aims of the Kirk and Gillon (2009) study to *integrate* children's linguistic knowledge for spelling, the intervention appeared to focus on spelling rules for adding prefixes and suffixes (e.g. changing *y* to *i* before adding *ing*) without including the meanings or functions of morphemes and how they related to sounds in words. The term *integrated* is often used to describe the way some aspect of spelling knowledge is taught alongside another. For example the *–ed* regular past tense is often taught with a focus on the meaning of past tense and the spelling rule for attaching this suffix, but little attention is given to the phonological aspects of this suffix. This highlights a significant gap that could be addressed by teaching children about the relationship between the meaning of the *–ed* suffix and the different sounds that this suffix can make. In this way the linguistic aspects of the *–ed* suffix, phonemes and morphemes, could be taught in a relational manner.

It is not surprising that research and educational policy documents often refer to an integrated approach to learning about spelling (e.g. *Teaching spelling K-6,* New South Wales, Department of Education & Training, 1998, *Spelling: from beginnings to proficiency,* South Australia, Department of Education and Children's Services, 2011) that refers to the integration of spelling knowledge within the larger literacy

programme; however, they fall short of adequately describing the details of what *integrated* spelling instruction might look like, how to deliver integrated spelling knowledge, or the significant impact teaching a wholly integrated approach to spelling has on learning. These issues will be addressed further in the next sections.

As morphological research grows, there is increasing interest in how to bring together morphemic knowledge and literacy learning and where this learning fits within spelling development (e.g. Berninger et al., 2008; Devonshire & Fluck, 2010). The Bowers et al. (2010) meta-analysis of recent intervention studies found that learning about morphemes produces stronger effects for those studies that *integrated* morphological instruction with other literacy instruction, such as vocabulary or reading instruction. The term integrated is used in Bowers et al. (2010) meta-analysis to refer to an instructional method that teaches morphological instruction "within the context of other literacy instruction" (p.8). This general sense of integrating morphological knowledge, rather than teaching it in an isolated fashion, has shown to be an effective instructional method for improving spelling performance (e.g. Abbott & Berninger, 1999; Baumann et al., 2002, 2003; Berninger et al., 2003; Kirk & Gillon, 2009). The relational approach proposed in the current study develops the integrated approach more deeply, and more extensively, by explicitly teaching children *how* morphological knowledge relates to phonological knowledge through knitting together these two concepts in the teaching of spelling, such that children are able to draw on both aspects of word knowledge explicitly to produce meaningful spelling. A relational approach would encourage young learners to use their knowledge about sounds and meanings together to produce a word like *opened*, but of course, the nature of this challenge needs to be understood first.

2.2.1 Challenges for teachers: Transforming research into practice

Strong evidence for teaching morphological principles explicitly in order to improve children's spelling is supported by the work of Hurry et al. (2005). Significantly, their study found that while increasing teachers' explicit understanding of morphology was not difficult, changing the teachers' classroom practice was tremendously challenging. Hurry et al. (2005) found that the professional development delivered by their team of researchers could effect the intended changes to the targeted classroom spelling instruction, but in practice the teachers found what they had learned hard to sustain. It was found that despite the teachers' enthusiasm for implementing new techniques to improve student performance, teachers needed the support of policy reinforcement requiring them to consistently apply morphology teaching as a prominent and permanent part of teaching spelling.

The surveys conducted by Hurry et al. (2005) prior to their intervention study also revealed that teachers did not normally spend much time teaching spelling; however, during the intervention the teachers commented that they had devoted more time to teaching spelling in their classrooms. After the intervention had finished, the follow-up teacher interviews and student testing had found that increasing time on spelling instruction did not entirely explain the improvement in the students' spelling performance outcomes. Hurry et al. (2005) argue that teachers who had consistently and systematically applied the knowledge they had about morphemes to teaching spelling explicitly, and had increased the time dedicated to spelling, did improve their students' spelling performance.

The Hurry et al. (2005) study draws particular attention to the difficulties inherent in the process of translating research into teacher practice, and the complexity of variables that exist in the classroom that are governed by a variety of curricula, policies and educational management systems, and argues for the need for well-informed interventions in the classroom. The Hurry et al. (2005) work also convincingly argues that explicit knowledge about morphological concepts is a powerful tool for teaching and learning about spelling.

The relatively few morphological intervention studies that exist indicate the significant educational importance of teaching and learning about morphemes as a central and foundational aspect of spelling. A synthesis of the results show that even limited explicit morphological instruction can have positive effects on children with various spelling abilities. The Hurry et al. (2005) study, conducted in the UK, raises important concerns about the practical difficulties inherent in transforming spelling research into effective classroom practice. There is a still a significant gap, however, in Australian research in this area, a gap that is worthy of attention. The next section will review the Australian studies that have explored teachers' language knowledge, what they know, and what they need to know, to deliver effective and efficient spelling instruction.

2.3 Teacher knowledge and practice

2.3.1 Theoretical context influencing teacher practice

In a comprehensive review of literacy instruction in Australia, de Lemos (2002) reported that teacher practice is dominated by 'whole-language' approaches (Mahar & Richdale, 2008). The 'Whole Language' approach to spelling, that is, the incidental

learning of spelling, in the same way that reading is learned in this approach without explicit instruction has dominated literacy teaching practices in Australian schools (Westwood, 1999, 2004). This discovery was reported in the Australian National Inquiry into the Teaching of Literacy (2005) [hereafter NITL] and echoed in the United States of America (USA National Reading Panel 2000) and in the United Kingdom (UK Select Committee on the Teaching of Reading 2005). All these studies share the concern about how poorly their country's students are performing on literacy measures and they have reached the same conclusion: that explicit, systematic instruction is an essential component of learning to read and spell, and that incidental learning with minimal instruction is not in the best interest of children who struggle with reading or spelling (Anderson et al., 2004; Byrne, 1998; Coltheart 2005a-c; Coltheart & Prior, 2007; de Lemos, 2002, 2004a; Louden et al. 2005a; Moats 2000; Rohl & Greaves 2004; Sweet, 1996; Westwood, 1999, 2004).

Australian state policy and curriculum documents have also been dominated by whole language approaches (Mahar & Richdale, 2008). For example, Mahar and Richdale (2008) reported that the Consistency Project (Department of Education, Victoria, 2001) examined the links between the English curriculum frameworks in Victoria, South Australia and Queensland and found literacy strategies in all states were vague, and there was a continued emphasis on a 'whole language' approach to literacy instruction in schools. It was expected, however, that following the recommendations of the NITL (2005) teachers and Australian policy and curriculum documents there would be a shift towards a systematic and explicit approach to literacy instruction. Certainly policy and curriculums have reflected a move in this direction. More recently, the National Curriculum Board (2009) stated as a goal that, "Students

develop an understanding that spoken sounds can be represented with letters and use their knowledge of letters and combinations of letters to make written words" (p.11). This position reflects a number of existing syllabus documents that have shifted toward a focus on the importance of sound to letter relationships, but there still exists inadequate attention to, or even the omission of any reference to, the importance of morphemic knowledge in understanding the structure of the English spelling system. This was also reflected in the K-6 English syllabus for New South Wales (2007) evident in the glossary of terms where phonemic and phonological awareness are defined, but the term 'morphemic awareness' or 'morphology' is notably absent.

The Australian National Curriculum (2009) also reflects the position of the NSW Literacy K-12 Policy (2007) and the NSW Department of Education and Communities Literacy Support Directive (2011) that the explicit and systematic teaching of the structure of words focuses on the teaching of phonemic awareness and phonics. The new English syllabus developed by the NSW Board of Studies in 20111/2012 outlines the need for children to learn about morphemes as part of a spelling programme, but it is limited. The syllabus focuses on the learning of the meanings of prefixes and suffixes and the way they can change the meaning of word, which is necessary, but fails to address the need for children to know about the relationship between phonemes and morphemes. This view may have emerged from an incomplete conceptualization of the structure of the English spelling system. This may in part be due to the dearth of morphological research and the conflation of terms and concepts found in other teaching support documents for spelling, perpetuating poor or inaccurate definitions and misleading information. These inconsistencies can be confusing for teachers and render instruction less effective (Afflerbach et al., 2008;

Stainthorpe, 2004; Yule, 2005). Even system endorsed spelling resources perpetuate the problem. In the *NSW Focus Individual Spelling Assessment* (2002) (written by J. Hall) produced by the NSW Department of Education and Training, and designed to be used by teachers, it was stated on page 16, "Difficulties with morphemic knowledge may indicate a general lacking in understanding the function of the vowels." This statement is misleading and inaccurate because it confuses morphology with phonology, two distinct but related systems, and it distorts the relationship between these two systems. On reading this document teachers would be unlikely to understand that morphemic knowledge indicates an understanding that word forms are related to its meaning. The practical implications for teachers and their students are significant.

In a recent exploration of NAPLAN testing, spelling was defined by Willett and Gardiner (2009) as 'knowledge of orthography, which is the system of symbols and rules used to represent spoken language in writing…The testing of spelling should therefore be focused on knowledge of the orthographic system." (p.4) Morphemic knowledge is only mentioned briefly later in the document in relation to vocabulary development. Given its essential role in our spelling system, morphemic knowledge does not get the focus or attention it demands.

Australian spelling directives such as *Focus on Literacy: Spelling* (NSW Department of Education and Training, 1998) and *Spelling: From Beginnings to Proficiency* (SA Department of Education and Children's Services, 2011) often include instruction about prefixes and suffixes, such as *–ing*, with an emphasis on the spelling rules and omitting or marginalizing the central and essential meaning and function of

morphemic structures. Morphology is most often introduced in these documents as a supporting strategy, or an additive strategy, recommended for children in the upper primary school years (Bear & Templeton, 1998; Ehri, 2002; Henderson et al, 1985). Indeed it will be reported later in the current study that teachers included *–ing* and *-ed* in their instruction prior to the intervention; however, teachers also disclosed that their spelling instruction did not reveal the consistent meaningful structure of the English spelling system. In fact, teacher resources, such as those mentioned above, often present prefixes and suffixes as a set of spelling rules that focus on how to add a suffix to a root, like dropping the final '*e*' before adding the *-ing* suffix. Teachers in the current study, and teachers in other studies reported by Bowers et al. (2006), admitted that they never made the relationship between phonemes and morphemes transparent to learners and neglected to build a coherent understanding of the underlying principles of the spelling system that goes beyond knowing the spelling rules (Bowers et al., 2006). This pedagogic 'gap' emerges from a linguistic knowledge gap that is insufficiently remedied by spelling resources designed for teachers.

Empowering children with the ability to produce meaningful spelling and improve their overall literacy outcomes requires expert teaching and well-founded understandings of the structure and the organization of the English spelling system. Current curriculum support directives, such as *Focus on Literacy: Spelling* (NSW Department of Education and Training, 1998) significantly state that spelling must be taught in an "explicit and systematic way" (p.18) and teachers must know "how the spelling system works" (p.19). However, as reported by Buckland and Fraser (2008), the challenge is to provide teachers with the necessary deep language knowledge and

the meta-linguistic knowledge they need to teach literacy effectively. As stated in the previous section, recent research suggests that teaching children explicitly about the phonemes (sounds) within words (Byrne, 1998; Coltheart & Prior, 2007) and the morphological (meaningful forms) structure of words will improve children's spelling (Hurry et al., 2005: Nunes et al., 2003; Nunes & Bryant, 2006; Bowers & Kirby, 2010). So, it is essential that teachers' language knowledge be up to the task.

2.3.2 Research findings on teachers' knowledge of language and their preparedness to teach spelling

The NITL (2005) recommended that, "teachers be equipped with teaching strategies based on findings from rigorous evidence-based research that has shown to be effective in enhancing the literacy development of all children." (p.38). According to Coltheart and Prior (2007), however, very little action has followed the NITL (2005) review and recommendations.

The Nelson Report (2004a-d/ 2005) noted that Australian teacher training in the science of reading and spelling accounts for less than two per cent of the total credit points required for the Bachelor of Education degree (Coltheart & Prior, 2007). Observations reported by the NITL (2005) suggest that new teachers are insufficiently prepared to teach reading or spelling in the classrooms (Mahar & Richdale, 2008). Teacher training has also been found to be highly variable and many Australian university education courses have yet to adopt the evidence-based approaches recommended for teacher training by the NITL (2005) (Mahar & Richdale, 2008).

In light of the limited literacy training that pre service teachers receive, a review of the following studies and surveys will bring further clarification to the extent of teacher language knowledge and how they employ this knowledge to assist their students' developing understanding of spelling. This is important, because teachers' concepts about language, the way they think about language, will inevitably have a significant impact on their teaching behaviour, and it is their teaching that is at the centre of efforts to improve students' learning (e.g. Buckland & Fraser, 2008; Clark & Peterson, 1986; Fisher et al., 1996; Grossman, 1990; Shulman, 1987; Zancanella, 1991; Hurry et al., 2005).

To teach spelling, teachers are required, not only to understand how the English orthographic system works, but they also need a meta-language to teach children about that language. It is vital that teachers have a well-developed meta-linguistic awareness. Meta-linguistic awareness is defined and used here to include the teachers' ability to shift their attention from whole-context meaning to identifying and treating as significant the linguistic forms within words such as, phonemes, syllables, rhymes and the morphological aspects of words (Edwards & Kirkpatrick, 1999). It is also critical that teachers are able to use this meta-linguistic awareness to explicitly teach these concepts in a way that will accelerate the development of children's reading and spelling ability (Fielding-Barsnley & Purdie, 2005; Tunmer & Chapman, 1999, 2003). Extensive research has supported these assertions (Adams, 1990; Snow, Burns & Griffin 1998; Moats, 1994; Shaywitz, 2003; Torgeson, 2004), but very little research has been done outside the United States and the United Kingdom.

A valuable Australian study by Fielding-Barnsley and Purdie (2005) found in their *Survey of Linguistic Knowledge,* that despite their population of pre-service, generalist and specialist teachers indicating positive attitudes to code-based (phonics) instruction, all groups revealed poor meta-linguistic knowledge of all kinds. The study also showed high variability in the types of knowledge teachers had about language. Low overall scores (24%) on items that required participants to count sounds in words indicated that their participants had an inability to consciously dissociate sounds from word spellings (Fielding-Barnsley & Purdie, 2005). For example, in a particular instance in the Fielding-Barnsley & Purdie study, teachers had exhibited great difficulty distinguishing the number of sounds in the word *box.* Teachers were highly influenced by their knowledge of the number of letters in the word *box*, and thus incorrectly identified only three sounds instead of four. As stated earlier, it is important that teachers understand their literacy bias and are able to distinguish between sounds and letters, and how these relate to meaning. If a teacher has the competency to anticipate and explain a child's misspelling of the word 'boks' (*box*) by helping the child *understand* the error rather than simply correcting the error, then the teacher will need to have a well-developed meta-linguistic knowledge. The teacher's deeper understanding of the spelling of the word *box* is important because the ending of the word *socks* and *box* sound the same, and the teacher needs to be able to explain how the spelling of these words is determined by their morphemic structure. Without this well-developed meta-linguistic knowledge, teachers may be at risk of using the fall-back position of teaching memorization strategies in spite of convincing evidence that the memorization of word lists provides limited generalisation and transfer effects to later writing tasks (Beckham-Hungler & Williams, 2003).

Even though the aim of the Fielding-Barnsley and Purdie (2005) study was to examine teachers' attitudes and knowledge of meta-linguistic awareness, there were no morphological items in their *Survey of Linguistic Knowledge*. The research gap that exists in the understanding of Australian teachers' meta-linguistic awareness, a gap that includes teachers' morphological knowledge, has not yet been filled.

Pre service teachers' beliefs, as well as the language knowledge they used to support the delivery of their reading and spelling instruction, were investigated by Meehan and Hammond (2006) using a survey. Responses to the survey indicated that participants indicated they were aware of the importance of learning about phonics or code-based instruction, but 37 per cent of the sample indicated they believed that all children could learn to read using literature-based text. Meehan and Hammond (2006) found it worrying that many teachers believed that learning to read using context cues was more important than children learning phoneme to grapheme correspondences. A worrying number of teachers also indicated that children should not be corrected if they misread a word. These findings support the observations of Mahar and Richdale (2008), that whole language approaches to literacy education are still prevalent in Australian schools. Significantly, teachers in this survey were not required to indicate their beliefs or knowledge about the importance of morphology in reading or spelling instruction. As Ellis and Briggs (2010) and others have noted, values and beliefs about learning, about learners of literacy, and in particular, about spelling, are significant factors in the development of effective teaching.

Meehan and Hammond's (2006) inquiry into teachers' language knowledge reveals findings that are consistent with the previous research of Fielding-Barnsley and

Purdie (2005), namely that teachers have poor meta-linguistic awareness, and yet, the research strongly indicates that to be effective teachers of reading and spelling need to be "provided with a solid foundation regarding the theoretical and scientific underpinnings for understanding literacy development" (Orton Dyslexia Society, 1997, cited in Meehan and Hammond, 2006, p. 20). These findings have important implications for teacher education in Australia, but again like the Fielding-Barnsley and Purdie study mentioned above, the investigation of teachers' morphological knowledge is still clearly absent.

The influential work of Moats (1994) marked the growing interest in the relationship between teachers' meta-linguistic knowledge and children's literacy development. Moats found that the meta-linguistic knowledge of a population of teachers from the United States was not found to have adequate meta-linguistic knowledge to teach literacy effectively. Research following up this study supported these findings (Bos et al., 2001; Cunningham et al., 2004; Spear-Swerling et al., 2004). Moats' work has provided significant insights into teacher language knowledge that is pertinent to this review.

Moats (1994) used an Informal *Survey of Linguistic Knowledge* to assess 89 in-service teachers. This survey included items related to knowledge about spoken and written language. Two out of fifteen items on the survey required the teachers to respond using their morphemic knowledge. Moats found that 27 per cent of participants were able to identify the transparent morphemes in words. Crucially, Moats notes that many teachers had previously (prior to the survey) not been asked to analyze words at the morphemic level. Moats also observed that, "ignorance was the norm" (Moats,

1994, p.93) and this resulted in many misconceptions. For example, many teachers believed that the digraph *th* represented a fusing of two consonant sounds *t* and *h*, rather than the teachers understanding that the digraph represented a unique phoneme /θ/. This is a significant finding because it shows that while these teachers may have, at best, a superficial or shallow understanding of the sub-lexical aspects of the English orthography (i.e. that sounds are represented by letters of the alphabet), they lack the deeper understanding of word structure and how written forms relate to sounds and meaning in speech. These teachers used their limited language knowledge with a strong literacy bias. That is, they thought about words in the written form and were strongly influenced by their knowledge of a word's spelling. Moats (1994) found they paid little, or no attention, to the word's speech sound structure unless they were trained to do so. Further to this, teachers gave even less attention to the meaningful forms within the word and how these meaningful forms related to the sounds in speech. Moats suggests the reason teachers have insufficient meta-linguistic knowledge is because the subject matter is difficult, it takes time and practice to learn, and there are inadequate teacher training opportunities in this area for pre and in-service teachers. However, teachers' insufficient meta-linguistic knowledge is only part of the problem.

Teachers are often unaware they lack the necessary meta-linguistic knowledge required for effective literacy instruction (Moats, 1994). In the work of Cunningham et al. (2004) teachers were required to calibrate their perceptions of their own meta-linguistic knowledge, including knowledge about phonemes and phonics. These researchers found their participants significantly overrated their explicit word level knowledge including the ability to identify phonemes in words correctly. This is a

significant finding, because overestimation has the potential to limit, not only teachers' ability to explain how words work to their students, but importantly, it is most likely to restrain teacher's receptiveness to learning new information. In contrast, teachers with an accurate awareness of the limitations of their word-level knowledge are presumably poised to acquire new information and experiences (Cunningham, 2004). Spear-Swerling et al. (2005) found similar results. Teachers' accurate perceptions of their own meta-linguistic knowledge and its limits is necessary to ensure that teachers are receptive to and can make appropriate use of any new information offered through professional development (Cunningham et al., 2004).

Teachers' meta-linguistic knowledge and their perceptions about that knowledge was also explored by Nunes and Bryant (2006). They interviewed and surveyed fifty teachers from London and explored the perceptions and knowledge they had about teaching morphemes as an integral part of the teachers' spelling instruction. Their study provides a number of valuable examples of teacher's responses to questions about what they knew about morphemes and the way they taught spelling. Not surprisingly, Nunes and her colleagues found that, prior to their intervention, these teachers used phonology as their dominant strategy for teaching about the spelling of words, and significantly, the word "morpheme" was not mentioned once by any of the teachers in the interviews regarding their teaching of spelling. It was clear that the teachers in this study had varied word-level language knowledge and employed a number of different strategies to help children solve spelling problems, however these strategies were predominantly phonological or visual strategies (e.g. *Look, Cover, Write, Check,* letter string, letter patterns, using mnemonics, sounding out,

memorizing whole words). Teachers in this study did report teaching prefixes and suffixes but in a way that highlighted the spelling rules and the letter strings without making a connection to meaning. For example one teacher responded to the question about how she would teach the spelling of the word "richness" to her students by saying, " I simply pulled out a whole heap of words ending in like, we had *-ness* and *-less* and what sorts of patterns could they see? And they went 'Hey, they all end in *–ness* or they all end in *-less'*." (In Nunes & Bryant, 2006, p.139)

Nunes and her colleagues affirm the Moats (1994) findings that teachers' meta-linguistic knowledge is limited and teachers lack the confidence and preparedness needed to teach effective and efficient spelling. These studies do not suggest, and it is not suggested here, that teachers are illiterate, but that they may be deficient in the relevant technical language, or meta-language, that is needed to teach children explicitly about how words work for reading and writing. These studies also suggest that with specific training teachers are able to learn about the way words work and are able to draw on explicit word-level knowledge to explain spelling concepts and to improve their students' spelling performance and understanding.

2.4 Stage models of spelling development

What do we know currently about the development of spelling and the contribution of word and sub-word understandings to children's spelling performance? The approach to spelling development that dominates contemporary theory and practice proposes a stage model where children gradually develop more sophisticated spellings as they pass through a linear sequence of stages, or step like progressions, defined by distinct types of spelling knowledge (Adams, 1990; Ehri, 1992, 1995, 1998, 2005; Frith,

1980, 1985; Ganske, 1999; Gentry, 1982; Henderson & Beers, 1980; Nunes, Bindman & Bryant, 1997; Treiman, 1993). The stage model sequence begins with learning about letter names and letter-to-sound correspondences then it proposes that children progress through to a higher order orthographic stage where morphological spelling instruction is introduced and mastered. The *late* stage models of Frith (1985), Seymour (1997) and Ehri (1998, 2005) all propose that children only make use of morphemes at advanced reading levels (Quemart, Casalis & Duncan, 2012). However, *early* stage model studies using comprehension and production tasks reflecting morphological knowledge show that morphological knowledge is acquired early (perhaps children as young as 6 years old) and develops throughout the primary school years (Anglin, 1993; Carlisle, 2000; Carlisle & Nomanbhoy, 1993; Casalis & Louis-Alexandre, 2000; Mann & Singson, 2003).

It is generally agreed, however, that stage models are only a guide to understanding spelling development and that children can be slow to develop correct spellings and may do so at different stages of development (Bryant & Nunes, 2004). The stage model approach to spelling development offers a general way of understanding what children can *do* at different ages and the various strategies they might use at different stages of spelling development, but offers little insight into the process of cognitive change (Rittle-Johnson & Siegler, 1999). Accounting for the remarkable changes that occur in the way children *think* about language for writing at the level of the word is a central goal of this thesis.

The stage model also predicts that children will be slow to learn the correct spellings of words that have complex morphological structures, but it is generally agreed

amongst researchers and teachers alike that they will learn them eventually (Bryant & Nunes, 2004; Varnhagen, McCallum & Burstow, 1997) Others have argued that the developmental sequence offered by the stage models may simply reflect teaching practices rather than the natural sequence of spelling development in children (Devonshire & Fluck, 2010). This is supported by the findings of Treiman and Cassar (1997), which suggest children use phonological and morphological knowledge early in literacy learning (Steffler, 2001). These findings support the proposition that perhaps teaching children explicitly about morphemes and phonemes together, at a younger age than the stage models indicate, may be helpful. This suggests that it is teaching rather than maturation that is crucial.

The stage model (Flavell, 1971) has two main features: a qualitative description of a fixed progression from stage to stage and a correspondence between each stage and particular spelling skills. These properties were subjected to critical analysis by Varnhagen et al. (1997): firstly, to determine whether there was a qualitative progression from stage to stage and, secondly, whether the correspondence between particular spelling skills and stages was consistent (Varnhagen et al. 1997). Varnhagen et al. (1997) found that children's spelling did not follow a strong developmental progression through qualitatively distinct stages. They found children's correct spelling progression directly related to the spelling curriculum. For example they found that children's spelling of regular past tense *ed* was directly related to explicit teaching. Before children were taught past tense spelling they relied exclusively on sounding out strategies. The researchers concluded that the developmental stages did not adequately characterize children's spelling development, and they suggested that the stage model was too broad and did not

adequately account for the depth of children's understanding of spelling, making it an ineffective instructional spelling model.

As stated earlier, there are many researchers and educational theorists who argue that the stages of spelling are adequately described by children's spelling errors and their spelling strategies, at different points in time, but spelling development cannot be completely understood by investigating and analyzing spelling test performance alone. We also need to understand *how* children think about spelling and *how* they deploy aspects of their knowledge as they develop, as well as the process of change that occurs in children's thinking in order to appreciate fully the dynamic system of spelling development (Critten et al., 2007; Steffler, 2001).

If the initial propositions of this thesis can be accepted, that teaching and learning about the spellings of words necessarily involves understanding how the written word represents our thoughts about sounds and meaningful forms simultaneously, then it must be reasoned that our meta-language and the way we think about spelling are inextricably bound together. The development of spelling must be viewed as an interactive process where young learners intentionally bring together spelling concepts like phonemes and morphemes to produce meaningful forms in their writing.

In summary, the challenge the findings reviewed above pose to the validity of stage models suggests that teaching the spelling of words fundamentally rests on understanding the interactive nature of spelling concepts, rather than simply looking at how children master distinct aspects, such as phonology and morphology, one after another. This view is supported by the recent work of Critten (2007) who describes

instances of children's phonological and morphological errors occurring simultaneously. It must be concluded that the study of children's spelling development is a study of a process that is grounded in both linguistic and cognitive study. The current study offers an alternative to the stage models by adapting an alternative existing general cognitive theory to account for the observations the stage models handle inadequately. The next section explores this main theme.

2.5 Understanding spelling development: both a cognitive and linguistic perspective

One of the assumptions underpinning this thesis is that the spelling of words is a key aspect of the written mode of communication; moreover, the language of spelling is an artificially constructed system that facilitates the communication of *meaning* through every written word. This conceptualization is an important one, because it serves to highlight the important role spelling plays in our writing system. But spelling is more than the artifact that conveys meaning in writing at word level. Spelling also involves a process of thinking about words and actively encoding meaning and sound into written form. This distinction is important, because spelling is more than just producing and recognizing correct letter-strings it involves thinking about, or developing concepts about, the delicacies and complexities of word forms, thinking about patterns that include the consistencies and inconsistencies of spelling and choosing the best representational fit in written form for the intended meaning.

The conceptualization of spelling as a process of developing concepts, or ways of thinking about words, leads to the discussion of the foundational theoretical stance on which the current study is built: a view of spelling that combines both a cognitive and a linguistic perspective. The study of spelling from this perspective is committed to

not only describing and accounting for the linguistic structures and functions that underpin English spelling, but also to the study of conceptualizations of spelling, or how we think about spelling for the purpose of writing (Evans & Green, 2006). This is a useful and important distinction to make in light of spelling development and learning, because learning to spell is not just about producing correct letter strings but also about learning to think about and process abstract information about written words, and learning to create effective and efficient concepts, or ways of thinking about, how words work.

In addition, it is crucial to learn the meta-language for talking about how words work. Spelling is a system that uses abstract symbols, letters combining them in ways that point toward meaning. To talk and write about this system, it is useful for learners to build a meta-language for the purpose. It follows that our concepts or ways of thinking about spelling, and the meta-language we develop to talk about it, are an integral part of our spelling knowledge and are likely to drive our spelling behaviour. That is, our linguistic knowledge about spelling, or knowledge about how the spelling system works is well supported by effective and efficient ways of thinking about and talking about spelling, in a way, it can be predicted that would drive spelling success. The following subsections develop further the cognitive and linguistic perspectives for understanding spelling, with support from the literature.

2.5.1 Implicit to explicit spelling knowledge: A transitional approach

It has long been established that children begin their schooling with complex implicit knowledge about the structure of their first spoken language (Ellis, 2008), yet at this early stage they cannot necessarily describe or talk about this knowledge because it is

unconscious knowledge. Berko (1958) showed that preschool children had implicit knowledge about morphemes where they could apply morphological rules to pseudo words in their spoken language, such as producing *wugs* as the plural of a *wug* (Bowers, 2006). As children become literate they learn how to use language to talk about language (Ellis, 2008; Painter, 1996). Literacy learning allows children to notice, and treat as significant, aspects of words that were completely unnoticed before. Children then develop explicit knowledge that includes learning to talk about, and theorize about, written words.

Developing concepts about spelling requires information, experience and time. However, it is not probable that spelling development is determined by explicit teaching about the structure of words alone. It is probable that children do develop some spelling knowledge that is implicit. That is, we are able to develop some knowledge about written words that we are not necessarily aware of (Steffler, 2001) and this implicit knowledge is not consciously available for verbal explanation (van Lier, 1995). The research in this area is active and has established that implicit and explicit learning are different processes and that different educational experiences generate these different types of knowledge (Ellis, 2008; Steffler, 2001), but little is known about what children *do* with different types of spelling knowledge and *how* they use their spelling knowledge once they become aware of it.

The value of applying an, 'implicit to explicit' *transitional approach* to an investigation of spelling development is explored in the current study. This investigation has two benefits of immediate value to those seeking to improve the teaching of spelling in schools. Firstly, a transitional approach, rather than a

restrictive dichotomous one, may serve to foreground the *process* of conceptual change rather than simply identifying and describing implicit or explicit spelling knowledge as discrete phenomena. As stated earlier, children's spelling knowledge is expected to accumulate with time and practice through the process of literacy education, and intuitively it may be expected that spelling concepts, or ways of thinking about words will also change over time, without explicit instruction. But the process of transition between implicit spelling knowledge, that children may not be aware of, and explicit spelling knowledge that children can consciously draw on to reason with, talk about and solve other spelling problems, has yet to be tested in real classrooms. The current study will use an, 'implicit to explicit' transitional approach that will allow fine-grained observations and descriptions of how spelling concepts interact, develop and change. An 'implicit to explicit' transitional approach opens the way for conceptualizing the complexities of spelling knowledge and how spelling knowledge drives children's spelling success.

Secondly, the 'implicit to explicit' transitional approach enables an analysis of the *gap,* which often exists between what children can *do* when spelling and what children can explain verbally about their understanding of words. This is important, because children may achieve consistently correct spellings, but correct spelling does *not* necessarily indicate they have an explicit understanding of the word structure (Cheung & Wong, 2011). The correct spelling of a word may have developed through implicit learning where a child remembers the spelling simply due to the frequent occurrence of that word. Correspondingly, a misspelling does not necessarily indicate the absence of explicit understanding (Cheung & Wong, 2011). A child may misspell a word and be quite capable of providing evidence of explicit understanding through

verbal reporting. A child may misspell the word *opend* (*opened*), for example, and yet be quite capable of giving a correct verbal understanding of regular past tense. The child may not be ignorant of the correct form of a word, but children are often fallible at retrieving the correct form (Pinker, 1999). Teachers and researchers may be quite familiar with these paradoxes but they are not well accounted for in non-cognitive theories, and teachers need to be able to know how to build on misspellings, that approximate the correct spelling, in teaching. An 'implicit to explicit' transitional approach makes it possible to tease out and observe the changes that occur as children progress from 'implicit to explicit' spelling knowledge, as well as the changes in the meta-language children use to support their verbal explanations. Further, a transitional approach highlights the finer movements and interactions of implicit and explicit spelling knowledge, as well as how this process relates to spelling performance.

Support for developing a transitional approach to understanding spelling development builds on the work of Cheung and Wong (2011). Their study strongly supported a case for understanding concept formation by using an, 'implicit to explicit' dimension. Even though their study examined fine-grained conceptual changes in children performing balance block tasks, their work describes a change process analogous to the process of spelling concept formation in children, and, thus, it provides a model that can be used to assist with understanding and accounting for the changes that occur during spelling development. Their analysis of the relationship that exists between the performance of a correct explanation and behavioural success (i.e. correctly performing a balance beam task) suggests that a correct explanation was not necessarily a precondition of behavioural success in block balancing. They did find however, that implicit knowledge about block balancing was acquired before explicit

knowledge. Importantly, it was noted that the *gap* that existed between the respective mastery of implicit and explicit knowledge was not necessarily age-specific. Most importantly, Cheung and Wong suggest from their findings that behavioural performance and verbal explanation should not be viewed as two sides of the one coin. This is because they found behavioural performance and verbal explanation did *not* necessarily appear at the same points in development.

These significant findings relate well to spelling research and design, because if a test relies on either spelling performance or verbal report alone, the implication is that children's spelling knowledge will likely be underestimated. Similarly, if a test is entirely dependent on correct spelling and correct verbal explanation as an indication of spelling mastery, then we risk overestimating a child's knowledge. We need to observe the process of change between what children can do and what they understand. The 'implicit to explicit' dimension proposed by Cheung and Wong (2011) is the base on which the transitional approach is built. A transitional approach will capture greater clarity and detail in an individual's developing conceptual knowledge and may provide the much needed insight to understand the way spelling knowledge develops and changes over time.

2.5.2 Karmiloff-Smith's (1992) Representational Redescription model

Now that an understanding of spelling conceptual development using an 'implicit to explicit' transitional approach has been justified, an explanatory model is needed to operate as a comprehensive framework, codifying the implicit to increasingly explicit spelling knowledge identified in children's talk about spelling. Cheung and Wong (2011) found Karmiloff-Smith's (1992) Representational Redescription model was

useful for conceptualizing explicitness as a dimensional process in the study of general cognitive development. The first application of the general cognitive model proposed by Karmiloff-Smith (1992) to the study of spelling specifically was by Critten, Pine and Steffler (2007). The Critten et al. (2007) study will be reviewed in some detail in section 2.5.2, but first the Representational Redescription model will be considered in its own right.

Karmiloff-Smith's (1992) Representational Redescription model has at its core the notion of conceptual, or representational change (Steffler, 2001). This general cognitive model offers important insights into the development of knowledge, and it follows a long tradition of understanding the power of conceptual change (e.g. Piaget, 1978).

According to Karmiloff-Smith, as a result of external influences from the environment, representations or concepts may be changed or redescribed by the learning process. For example, children may develop ways of thinking about words that are incorrect or incomplete and teachers provide the external influences to redescribe, or change, those concepts through their teaching. Karmiloff-Smith theorizes that the way in which representations change over time can be understood as a process of increasing explicit knowledge that becomes increasingly accessible for verbal report. That is, the learning process can redescribe or reconstruct implicit representations (transform knowledge that is not accessible to verbal report) to establish more flexible explicit knowledge that is accessible to verbal report. This model comprises a series of distinct levels for reflecting on this process and on the range and type of knowledge stored in the cognitive system. According to Karmiloff-

Smith (1992, p.21), "The redescriptions are abstractions in higher level language." The model does not suggest, however, that lower levels of representation are replaced with more explicit levels, but instead shows how different levels of representation (including both implicit and explicit knowledge) coexist and become available to meet different task demands (Cheung & Wong, 2011).

At this point in the review, *levels of representation*, as proposed by Karmiloff-Smith (1992) can be usefully described. Entry-level knowledge is coded at the Implicit Level. Implicit Level knowledge can be described as procedural knowledge, or knowledge acquired through the environment in a procedural format, knowledge that remains unavailable to the conscious mind. Implicit knowledge "cannot be used outside the special-purpose processes in which it is embedded" (Karmiloff-Smith, 1992, p. 356). For example, children's first awareness of the sound properties of speech is described as implicit knowledge (Ellis, 1994). Similarly, initial processes involved in children's spelling recognition and production particularly regarding their names can also be understood as implicit knowledge. Characteristics of this level may include task success or behavioural mastery, but significantly, what marks this level is an absence of conscious access to knowledge and an inability to talk about, or analyze, what is known in terms of its component parts. Implicit knowledge has been described as "chunks of unarticulated wholes, and not transportable to other cognitive operations" (Browne, 1997, p.353). In contrast, increasingly explicit knowledge is the development of declarative knowledge, knowledge that can be reported consciously and which is versatile, flexible and transportable across different fields. Declarative knowledge can be articulated into its component parts allowing for the application of the knowledge to different tasks (Browne, 1997).

Karmiloff-Smith proposes that there are three levels of increasingly explicit knowledge. The first level of explicit knowledge (E1) (E= explicit) consists of abstractions from the initial implicit representations. Children who have developed explicit levels of knowledge are able to begin talking about what they know about the spelling of words. For example they may begin by talking predominantly about the phonological aspects and then move on to include deeper knowledge, which includes talking about and reasoning about morphological structures. The first explicit level is different from the first implicit level, because it marks the departure from the point where a child needs to depend entirely on external influence to create representations. Children at this level begin the process of building connections between old and new information, although, reorganizing their knowledge at this level often results in overgeneralization errors.

The phenomenon of overgeneralization errors is well known in language acquisition. For example, children typically over generalize the regular past tense *ed* rule when learning to talk, and they often produce constructions like "I seed him yesterday," or "we holded the baby rabbit" (Pinker, 1994). It is often observed, as a result of overgeneralizations, that children appear to perform worse before they get better (Pinker, 1999). This behaviour is counterintuitive, because we naturally anticipate that as children learn more and get older they will improve; however, overgeneralizations that cause a temporary regression in performance are a common feature of language development (Strauss, 1982; Pinker, 1999).

As a result of overgeneralization, a decrement in performance can be illustrated by a U-shaped developmental curve as performance temporarily drops, even though

understanding has increased (Critten et al. 2007). Overgeneralization errors confirm that an integral part of a child's language learning is the ability to capture an aspect of language structure, like the regular past tense, and unconsciously activate a special rule-forming mechanism within their minds that may temporarily be applied to words more broadly than the rule allows (Chomsky, 1959; Halliday, 2009; Lennenberg, 1964; Pinker, 1999). The specific issue of overgeneralization errors in spelling has been addressed by Critten, Pine and Steffler (2007). Their contribution will be reviewed in more detail in Section 2.5.3.

The second explicit level (E2) denotes a phase of increasing integration between the initial implicit representations and the external input from explicit learning. At this level conscious knowledge may be accessed without children necessarily being able to talk about it, although verbal reporting at this level is developing (Cheung & Wong, 2011). The consequence of this integration at this level is reflected in improved performance. Significantly, this improved performance is accompanied by explicit understanding with the representations developed increasingly accessible to verbal report. For this reason, implicit knowledge no longer dominates entirely.

The final level of Karmiloff-Smith's (1992) model is the third explicit level (E3). Characteristics of this level include the development of fully explicit knowledge representations that can be consciously accessed and verbalized to others. This level also includes the development of flexibility and creativity in the use of this knowledge and the ability to transfer this knowledge to other tasks.

Of particular interest to the current thesis is Karmiloff-Smith's attempt to account for development *beyond* task success or behavioural mastery. Karmiloff-Smith suggests that successfully repeating the performance of a task is *not* the end goal. Moving *beyond* task success means developing explicit knowledge about the successful behaviour to assist in the transferability of this knowledge to reasoning and solving other problems. Thus, explicit knowledge about spelling becomes a portal not just to spelling mastery, but also to further learning.

The insight that spelling knowledge becomes a portal to further learning is critical, and relevant to understanding the transition of spelling knowledge from implicit to explicit. This is because a pivotal aim of most spelling instruction is the development of children's automatic recall of the spelling of words to assist efficient and effective writing. For example, weekly spelling lists and memorization strategies like *Look Cover Say Write Check* (or variations on this theme) are designed for this purpose. Karmiloff-Smith's cognitive framework may assist in understanding how the nature of implicit spelling knowledge that supports isolated spelling word success, constrains the transferability of spelling knowledge to solve spelling problems encountered beyond spelling lists. Karmiloff-Smith proposes that development *beyond* task success, that is, the development of explicit knowledge about the successfully completed task, will facilitate knowledge that is transferable. However, little attention is given to understanding the role of implicit knowledge and the importance of developing explicit knowledge *beyond* task success in spelling development models. Understanding the nature of spelling concepts and the complexities that promote conceptual change in spelling development is essential.

The current study investigates whether the three levels of explicit spelling knowledge are useful concepts for understanding the progression of spelling knowledge as it transitions from implicit to increasingly explicit knowledge and how this transition aids spelling performance. The value of developing explicit knowledge about spelling that includes the ability to make use of verbal reasoning and justifications will be extensively investigated here. These levels may also serve to highlight how representations at lower levels can be used to generate representations at a higher level, how different types of knowledge can coexist and how knowledge can become more accessible to facilitate the learning process (Steffler, 2001).

In summary, the current study will investigate the validity of using Karmiloff-Smith's (1992) Representational Redescription model to (*a*) observe the range of children's spelling knowledge, (*b*) observe children's transition from implicit spelling knowledge before the intervention to increasingly explicit spelling knowledge after the intervention and (*c*) discern whether children's ability to learn about spelling, and about morphemes in particular, is related to the child's ability to talk about that knowledge. These observations will be measured by spelling performance tests and children's talk about spelling.

Although Critten, Pine and Steffler (2007) were the first researchers to apply Karmiloff-Smith's (1992) cognitive model directly to the investigation of spelling processes they did not develop an intervention study. Nevertheless, the current study builds on their significant findings, but goes further by using Karmiloff-Smith's framework to understand children's cognitive changes (as these can be accessed through verbal reasoning and justifications) as a result of a spelling intervention. It is,

therefore, pertinent that the work of Critten, Pine and Steffler (2007) is described in some detail in the following section.

2.5.3 Critten, Pine and Steffler (2007)

In their quest to gain further insight into the mechanisms underlying spelling development, Critten at al. (2007) found that Karmiloff-Smith's (1992) Representational Redescription model was useful for conceptualizing how children's spelling knowledge develops and changes. By enabling researchers to analyse children's verbal reasoning and justifications of spelling choices, this model enabled Critten and her colleagues to gain insight into not only *how* changes in spelling behaviour occur, but also *why* they occur.

Initially, children's spelling performance on production and recognition tasks gave Critten et al. (2007) a clear picture of what they could do. To find out what cognitive mechanisms were underlying performance, or what the children were thinking about while they were spelling, the authors asked their participants to reflect on their choices and to give verbal responses. For example, the researcher asked, "Why is *left* correct?" The participant replied, "It sounds l-e-f-t". The authors found this child was clearly able to abstract phonological knowledge to spell this word, but in another example the researcher asked another child, "Why is *laughed* correct?" and this child replied, "I don't know, I just know how to spell it." This child was unable to abstract explicit word level knowledge about this word despite being able to identify the correct spelling. These verbal responses revealed the type of representations or ideas children in this study had about spelling. The coding of these verbal explanations as implicit or increasingly explicit allowed children's representational development in

spelling to be followed for the first time, by concentrating not just on children's performance but also on what they could understand and communicate (Critten et al., 2007).

The analysis of the verbal reports was the most powerful aspect of the Critten et al. (2007) study and contributes to our understanding of how spelling representations are organized in the cognitive system of children. The Critten et al. (2007) study supports the levels described in Karmiloff-Smith's (1992) model. They in turn support Karmiloff-Smith's (1992) proposition that while the acquisition of knowledge is cumulative, that is, children learn progressively complex knowledge, children's understanding does not necessarily follow a sequential path, and that performance and understanding do not necessarily develop at the same time. Karmiloff-Smith's general cognitive model is well suited to understanding how children's spelling knowledge develops with explicit teaching and experience, over time. In addition to this, Critten et al. (2007) also found that, rather than demonstrating a neat sequential spelling development, their evidence supports the particularly interesting notion of multiple representations.

According to Critten et al. (2007) multiple representations occurred when children developed different types of information about a word and these different types of knowledge representations are able to coexist. Multiple representations are stored and used to meet different task requirements. For example, when children were faced with a difficult spelling problem, performing under the stress of spelling tests or with words they were less familiar with they often used a fallback strategy onto earlier simpler representations, such as sounding out. In contrast, a progressive, or reach

forward strategy might see children abstracting different types of word level knowledge, for example, more complex phonological and morphological knowledge to solve spelling problems. The coexistence of multiple representations is under researched, yet fundamentally important to the understanding of how children use different types of spelling knowledge to assist their spelling of words.

In addition, the Representational Redescription model also helped to account for the type of overgeneralization errors children make in spelling. While the phenomenon of overgeneralizations is well known in other linguistic domains, for example, language acquisition and phonology, it has yet to be fully accounted for in spelling development. The simplicity of overgeneralization errors in spelling is quite deceptive. It is not well explained in the spelling models why children start marking overgeneralization errors, and even less is understood about why they stop (Pinker, 1999).

According to Karmiloff-Smith's (1992) model, overgeneralization errors are characteristic of Level E1 (first explicit level) where evidence of an overriding theory dominates and is over-applied inappropriately, as children look for productive patterns in language. In the Critten et al. (2007) study the researcher found evidence that children at this E1 level over-generalized their knowledge of the regular past tense *–ed* suffix to irregular verbs and non-verbs (e.g. *solded, sleeped* and *colded*). It was particularly significant that many children in this study had spelled these words correctly before they made the overgeneralization errors. That is, these children became worse at spelling these words before they became better. This type of

overgeneralization is exactly parallel to what happens in other domains in language acquisition, for example, phonological development (Berko, 1958).

The work of Critten and her colleagues and their application of Karmiloff-Smith's (1992) Representational Redescription model, highlight the complexities of developing spelling knowledge. They raised some important questions, for example,

> Why is it that they [children] can attempt to read and spell unfamiliar words, make overgeneralizations and recognition errors, and develop the ability to communicate their spelling and reading knowledge (Critten et al, 2007, p.190).

By using the Representational Redescription model, demonstrating the process of building increasingly explicit knowledge, their evidence suggests that children progress beyond implicit knowledge by becoming *active* in the construction and interpretation of theories and ideas about spelling (Chomsky & Halle, 1968/1991; Critten et al., 2007). Conceptualizing spelling development through an 'implicit to explicit' continuum, or dimension, that shifts the focus from spelling accuracy to examining the different types of spelling knowledge children have, and includes what they understand through verbal explanation, will reveal, Critten et al. (2007) argue, what it is that drives children's spelling behaviour.

In the exploration of verbal reasoning, this project will extend the work of Critten and her colleagues by applying the Karmiloff-Smith's general cognitive model to children's verbal responses to spelling problems collected before and after a spelling intervention. Understanding the way children's spelling concepts change in the context of real classroom teaching and learning is crucial to understanding the development of spelling knowledge and is essential to determining what works.

2.6 Research questions

Concluding this chapter is an outline of the rationale for the research questions that have arisen as a result of this literature review. The research questions are listed below, each one followed by a rationale.

2.6.1 What do teachers know about spelling?

Teaching children explicitly about the relationship between phonemes and morphemes in written words requires that teachers have the necessary linguistic knowledge and appropriate concepts about spelling to implement effective instruction. There is a significant gap in the Australian literature about what teachers know about morphemes and if, and how, they explicitly teach morphology in their classrooms. The discovery of teachers' word level language knowledge is necessary because the practical implications for their students are profound.

2.6.2 Does teaching children about the relationship between sounds and meanings in words contribute to spelling achievements in spelling tests?

The evidence from the recent research suggests that teaching children about morphemes is of significant educational importance, but there is little evidence that spelling programs include morphology as a central aspect of learning to spell. This gap between research into the importance of teaching children about morphemes and teaching practice is pronounced (Carlisle, 2010). The need for further research in this area has been the driving force behind the current study, which explores the significance of teaching children about the morpho-phonological structure of words as content knowledge, not simply as an ancillary strategy, to improve children's spelling performance and understanding.

The current study differs from other studies, for example, Arnbak and Elbro (2000), Nunes, Bryant and Olsson (2003) and Bowers (2006) by not focusing on a narrow range of suffixes, or limiting the teaching intervention to a morphemic analysis of words in isolation. Rather, an attempt is made to inspire and support the teachers prior to the spelling lessons by providing them with the understandings necessary to make the relationship between phonemes and morphemes transparent in practice. As stated earlier, this thesis proposes a relational approach to teaching spelling that takes the integrated approach to learning about morphemes and phonemes deeper. The relational approach aims to knit together a set of concepts about phonemes and morphemes and provide the necessary word level knowledge children need to produce meaningful spelling. To my knowledge, the approach applied to spelling instruction in the current study is unique.

Naturally, practical concerns arise when designing and implementing a study of this kind. It is essential to know, not just *what* to teach to improve children's spelling performance, but *how* to teach it. How do teachers merge this necessary morphemic and phonemic knowledge together? Preliminary investigations suggest that children should be taught about morphemes explicitly along with other word level knowledge, and that this is more effective than teaching about morphemes in isolation (Devonshire & Fluck, 2010). These are, however, only preliminary indications and further intervention studies are needed to address these issues. These questions can only be answered by developing an intervention study, such as the one reported in the current study. To date, research has provided a dearth of intervention studies in this area, and it is essential that further research be connected to classroom practice.

Lastly, students' and teachers' motivational and affective responses to the relational approach to spelling instruction need to be investigated more systematically. The issues of practicality, and how difficult morphemes are to teach have not yet been adequately addressed, but they constitute a central concern of the current thesis.

2.6.3 What knowledge do children use when reasoning and solving spelling problems?

This literature review has shown that analyzing children's spelling performance, or what children can *do* in spelling tests, is not sufficient for a complete explanation of spelling development. It has also been proposed that how we think about spelling is inextricably bound to our spelling behaviour. For this reason, it is crucial to understand *how* children think about spelling, as well as the process of change in children's thinking to wholly appreciate the dynamic system of spelling development. Accounting for the shifts in conceptual change is a key aspect of the current study.

The 'implicit to explicit' transitional approach provides a unique way of identifying and conceptualizing these shifts and the interactions that occur between different types of spelling knowledge. This is essential to understanding *how* children use spelling knowledge once they become aware of it, and importantly, how explicitly teaching the relational approach to spelling can affect not only children's spelling performance but also their understanding. Further to this, this investigation explores whether explicit knowledge about the relationship between phonemes and morphemes in words assist children's learning.

Karmiloff-Smith's (1992) model will be used to classify and evaluate verbal reporting data collected from an intervention study, thereby extending the work of Critten et al. (2007) significantly. This will be the first time Karmiloff-Smith's Representational Redescription model is used as part of a classroom intervention. Central to the current study will also be the investigation of multiple representations, or different types of word level knowledge co-existing, used to facilitate the learning process. The Representational Redescription model will be assessed for its appropriateness in describing the fine-grained process of representational change in children's understanding of spelling concepts, an assessment that includes investigating overgeneralizations in spelling errors and the importance beyond spelling success of developing explicit knowledge.

2.7 Summary

The intention of the current study is to establish empirically, through an intervention study, that children's spelling performance is affected by the way children *think* about words. The way children think about words is greatly modified and facilitated by their experiences in the classroom, so it follows that the way teachers think about words and communicate, or transmit those concepts for children to grasp and assimilate, is also of particular interest here. The relational approach to teaching spelling accounts for the need to facilitate spelling development by delivering crucial linguistic content knowledge about word structure alongside ways for children to think about and talk about this knowledge for writing. In this area there is a dearth of research conducted in typical classroom settings, yet such research is of particular importance to educators. The current intervention aims to provide the necessary insight into dynamic classroom contexts, where both students and teachers are the principal subjects of

study as a means of determining the best conditions for enhancing spelling performance and identifying the understanding that might underpin this enhancement. The theoretical understandings that have emerged from the literature review now need to be shaped into a method that will answer the research questions posed above. This will be the task of the next chapter.

Chapter 3

Methodology

"A theory is a tool which we test by applying it, and which we judge as to its fitness by the results of its applications."

Karl Popper

3 Introduction

This study responds to the contextual complexity and multifaceted nature of teaching and learning spelling by resisting simplistic and reductive causal explanations obtained from quantitative data alone. This type of data often provides only a snap shot of ability at any given point in time. In contrast, qualitative research methods like interviews and observations yield 'thick descriptions' (Geertz, 1973) of the phenomena under investigation and contextually specific accounts of the lived experience of research participants, as well as providing pathways to the generalization of theories about the key determinants of phenomena. Quantitative research methods like surveys or pre and post-tests enable us to generalize findings in statistically verifiable ways – thus, providing robust accounts of phenomena. Such methods are commonly used to test theories generated via case studies or other quantitative methods of research. And it is possible, of course, to draw on the strengths of both approaches in a mixed-method study. This research has employed the strengths of both quantitative and qualitative methods to discover a breadth and

depth of understanding about the issues that need to be addressed here (Boardman & Klinger, 2011).

The application of a mixed method approach is well suited to this elaborate empirical investigation, which has at its core an intervention. The intervention was delivered in real classrooms by teachers, making it possible for the researcher to observe, describe and theorize the complex causal relationships between the explicit teaching of word structure knowledge (i.e. phonemes and morphemes taught simultaneously) and the processes by which children understand how spelling works. Further to this, applying a mixed method approach has allowed for the precise measurement of the impact of this new understanding on the children's spelling performance. The complexities inherent in these relationships need to be addressed, first by acknowledging that these relationships depend on the complexity of classroom contexts, and, second, by demanding the juxtaposition of multiple perspectives to allow a finer, more comprehensive interpretation. In doing so, the gap that is often created between research, and teaching practice, can be minimized.

There are a number of mixed method research designs to be considered, but this study has chosen a Triangulation Design (Creswell, Plano-Clark et al., 2003). This design gives the researcher the opportunity to compare and contrast quantitative and qualitative data with equal weight, simultaneously. For example, information from surveys and observations can be contrasted with test results from the same time frame. The compatibility was found in the triangulation design's purpose "to obtain different but complementary data on the same topic" (Morse, 1991, p. 122). In addition, this design framework facilitates bringing together the strengths of quantitative methods

(large sample sizes, trends and generalizations) with the strengths of qualitative methods (detail and depth in small sample sizes) (Creswell, 2003; Patton, 1990) to support one interpretation. A triangulation design provides the framework for inter-relating data and findings in a complementary way and thus strengthening the empirical bases of the study.

The literature supports this design as being particularly suited to teasing out complex educational phenomena (Greene et al., 1989; Plano Clark, 2007). Teaching and learning is indeed complex, and integrated methodologies are needed here to provide alternative interpretations and conceptual insights into what might work to improve children's spelling (Freebody, 2007).

The procedure of this particular variation of triangulation design has involved a concurrent, but separate, collection of qualitative and quantitative data that is then integrated into a holistic interpretation (Creswell, 2003). As an example, Anderson, Newell and Kilcoyne (1999) used this variation of triangular design to converge their quantitative survey data with their qualitative findings to form a well-validated conclusion about the single problem of understanding the motivations of plasma donors (Creswell, 2003).

In order to achieve a convergent triangular design, qualitative and quantitative data are juxtaposed and directly compared and contrasted to support valid conclusions. This design makes intuitive sense, because it offers an efficient framework for collecting different data from the classrooms at the same time, while having the flexibility to analyze the data separately and independently. Ultimately, the strength

of this framework offers a way of integrating different perspectives to gain insight into this complex educational problem (Creswell, 2003).

The challenges inherent in this design include the generation of large quantities of data that would best be managed by a research team, rather than an individual researcher. The collection of both qualitative and quantitative data also requires a great deal of effort and expertise in both areas. These challenges were faced by the author and overcome by rigorous preparation, meticulous attention to detail and many months of invested time and effort.

The data collection fell into three main categories: the baseline data required before the intervention began; the impact data that measured the effect of the intervention on children's spelling performance and the equally important qualitative data, which included interviews and observations that provided the interpretative and contextual information. The quantitative data were collected for baseline and impact information, and included: teacher language knowledge surveys, children's standardized spelling tests, a specifically designed morphological spelling test and a morphological production task. The qualitative data were collected in the same time frame and included: teacher interviews and reflections, spelling lesson observations in the classrooms and verbal justification of spelling choices from individual students. What follows is a detailed account of the methods and techniques used to investigate the issues at hand.

3.1 Sampling procedures

The procedure for sample selection was randomized at the level of the group, rather than the individual, to the extent that circumstances would allow (Donneer &Klar, 2000; Murray, 1998; Myhill et al., 2012). Schools were randomly selected from a large rural area that included the Southern Highlands and Goulburn, Mulwaree District of New South Wales. There were a total of twenty public primary schools in these areas. All the public primary school principals were contacted in writing and invited to participate in this study. Of the twenty, only six schools positively responded and were keen to get started. An informal interview between the principal and the researcher was then arranged to reveal more information about the planned research, to answer any questions or concerns, to meet the participating teachers, and build confidence and trust between the researcher and the interested parties. All the participating school principals and teachers were required to complete consent forms and were aware they could withdraw from the project at anytime.

The rationale for inviting only public schools in this rural district to participate was primarily the homogenous nature of the schools: their pedagogic frameworks and expected spelling performance outcomes, the shared rural cultural experiences, and the differential spelling ability of students, as compared to the diverse nature of urban and independent schools. The public schools in these areas also had similar lower to middle socio-economic factors that significantly affected the children's learning and expected outcomes. These public schools were not selective schools and were co-educational. In addition, the teachers in these areas had similar teacher training experiences and were most often raised in the town (or similar small towns) where they now worked. It was also anticipated and confirmed that the majority of children

from these rural areas had English as their first and only language. Only one teacher in the intervention group was found to have a language other than English (Greek) as her first language. All these factors were taken into account when designating the sample area and understanding the impact variables would have on the interpretation of result.

3.1.1 The Sample

In this study, the subjects included approximately equal numbers of boys and girls from Year 3, Year 4 and Year 5 (n=318). This feature was not controlled by the researcher, but was an inherent aspect of the co-educational nature of schools in the study. The participating population was distributed over twelve mainstream classrooms, and their teachers (n=12) participated as an integral part of this investigation. The ten intervention groups included four composite Year 3/4 classes, one composite Year 4/5 class, one Year 3 class and four Year 4 classes. In addition the two comparison classes consisted of one Year 4 class and one composite Year 4/5 class. The comparison classes were randomly chosen from the participating group. There were six public primary schools that took part in this study, all under the control of the NSW state government and guided by the same curriculum and teaching resources.

All the teachers and students that participated in the intervention groups were aware the focus of the research was spelling. As the research progressed, however, a significant limitation was revealed. A halo effect was created because the two comparison groups were recruited from the same schools as the intervention group. Consequently, the comparison groups were very aware of the spelling intervention

and could not be separated entirely from the buzz of enthusiasm and the inevitable talk that was generated in the school by teachers teaching something new. This may have had a significant impact on the comparison group teachers and their students with the result that the comparison group teachers were consciously, or unconsciously teaching spelling differently as an indirect result of an intervention being delivered at their school.

The student sample was aged between 7 years and 11 years. This age range provided a diverse range of spelling abilities and the perfect opportunity to observe and measure the process of learning spelling.

3.1.2 Intervention Groups

The ten intervention group teachers were trained and prepared to deliver the intervention to their classes (Details of the training programme can be found in section 3.2). Each teacher was also trained to deliver the pre and post tests. Practical considerations guided this decision as it allowed for testing to be completed by all classes in the same time frame. It also minimized disruptions to class routines and encouraged teacher participation in the project.

Close communication and good rapport between the researcher and the intervention group teachers were essential throughout the study. Weekly face-to-face meetings to discuss difficulties, concerns and insights were backed up by frequent emails to individuals that became a matter of routine (A sample of emails can be found in Appendix H).

Following is an outline of the pedagogical principles that provided the supporting pedagogical framework guiding the intervention teachers (Finer details of the intervention programme can be found in section 3.2.3.1).

- Revisit, explain and use knowledge about the spelling of words to confirm prior knowledge and explain the purpose of new learning about words.
- Include open discussions in the classroom that encourage children to talk about words, to theorize about the logic of spelling patterns and actively identify meaningful connections indicated through spelling patterns between words.
- Teach, model and define how sounds and meaning work together to form meaningful spelling forms. Offer contrasting examples that make the new knowledge explicit.
- Practice, explore and investigate examples of spelling, with new knowledge, set in the meaningful context of written texts.

3.1.3 Comparison Groups

Two comparison groups were established: a Year 4 comparison group (C1) and a Year 4/5 comparison group (C2). These comparison groups, C1 and C2, were paralleled with the intervention groups as much as possible insofar as they comprised children of the same socio-economic backgrounds, the same educational experiences in the same NSW public school system. They were also administered the same tests, surveys and interviews as the intervention groups. The comparison groups, however, received no pedagogical support from the researcher, no teacher training and no intervention resource materials. Moreover, they were given no instructions from the

researcher to alter their "normal" spelling lessons. The comparison group teachers were encouraged to continue teaching as they had always done, with the assurance that after the research testing was complete they would receive a copy of the intervention resource materials.

3.1.4 Internal validity

Internal validity is measured along a continuum between high and low and is determined by how well researchers are able to eliminate confounding variables before coming to a conclusion (Maxwell, 1992). Importantly, internal validity refers to the validity, in context, of the account given, not the validity of the data or methods (Maxwell, 1992). Threats to internal validity include questions about whether the researcher can confidently claim that the children's spelling performance outcomes are a result of this intervention. Like action research, one of the main threats to internal validity here is the delivery of the intervention by 10 teachers, each with their own teaching style, rather than objectively by the one researcher. The very nature of collaboration between teachers and researcher aiming to change children's spelling behaviour makes the internal validity of this project problematic. It could be argued that the children's progression after the spelling intervention was simply a result of natural maturation, or the result of an effective teaching style, or perhaps the added attention given to spelling during this research period. All these threats to internal validity need to be addressed.

The integrity of the project's internal validity was a major consideration when developing the design of this study. The mixed method approach with a triangulation design was used to reduce these threats as effectively as possible (Maxwell, 1992).

Thus, counter design features that attend to these concerns are summarized in the following points:

- Location threat was minimal. The intervention and comparison classes were from the same social, cultural and geographical locality.
- Two comparison groups and ten intervention groups were included to reduce "single group" threats (Maxwell, 1992).
- To minimize differential selection all the classes had similarly mixed ability, age range and gender ratios. All the teachers were similarly experienced with similar teacher education and teacher training directives and resources.
- To minimize the maturation threat all children were equally affected by maturation over the 10-week intervention. Moreover, the length of the intervention was not long enough to raise serious concerns about the maturation effect during the intervention.
- The increased attention given to spelling because of the research project focus was a concern. While this had the potential to lead to possible 'halo' effects, for example, teachers spending more time on spelling, the concern was unfounded, as the teachers did not spend any more time on spelling instruction than they had done before the intervention. The teachers had already established lesson timetables to which the intervention had to conform.
- All the teachers received the same teacher training prior to the student intervention reducing differential teacher language knowledge.
- All the intervention teachers received the same intervention support from the researcher, thereby reducing differential support between classes.
- Individual classroom spelling programs could threaten internal validity, but this was minimal because all the schools followed the same official teaching

curriculum and the enacted curriculum was very similar. All the teachers had similar approaches to teaching spelling and all the teachers had experienced the same kind of difficulties teaching spelling effectively.

- A main threat that should have been avoided was a social interaction threat between the intervention teachers and the comparison group teachers. To avoid this the comparison groups should have been allocated to schools where there were no intervention groups. This threat is taken into account in the interpretation of the comparison groups' results.
- To avoid the reduced testing threat the same instruments were used to test all groups before and after the intervention. The same questions were also raised in interviews and discussions with teachers and students.
- Qualitative data, which included documentation of teacher interviews and conversations between researcher and teachers throughout the intervention, was a way of verifying inferences made through discussions and classroom observations and thereby reducing threats to internal validity.
- To ensure diverse perspectives were taken into account, interviews with students that included responses to spelling problems and spelling choice justifications were used to support and contribute to the interpretation of the findings from the four different quantitative tests delivered before and after the intervention.

The mixed method approach allowed for various perspectives on the one problem before the determination of cause and effect. This varied perspective is an important aspect of the study's design, because this study is not just looking at improved spelling performance as a result of a spelling intervention but a more differentiated

and fine-tuned investigation into the *processes* involved in changing spelling performance and understanding in children. The methodological design used here uncovers this complexity, while significantly reducing threats to internal validity.

3.1.5 External Validity

Attempts were made to improve external validity in three ways. Firstly, the sample size was maximized as far as practicable for this study. Further to this, there was enough variation in the spelling ability of the children, and the extensive and diversified testing of that ability, to encourage transferability of this research to other classroom populations. Secondly, the qualitative aspects of the method allowed for rich descriptions of the context in which the intervention was delivered. These descriptions were taken as observations from the researcher, and from the point of view of the participating teachers, about what worked and didn't work in the classrooms. The analysis of this type of data complemented the quantitative data and improved the likelihood of the transferability of these research findings to other classrooms. Thirdly, in the final analysis of the data, the mixed method triangulation design reduced threats to external validity and supported the potential abstraction of important concepts that could be applied to other classrooms. For example, the comparative analysis of classroom observations with children's spelling test results and children's talk about spelling revealed not only important insights into the development of spelling knowledge, but also what worked and what didn't work in the classroom.

3.1.6 Attrition and fidelity

Fortunately, the original twelve classes started and finished the research period. Nevertheless, even though the total student sample size was $n = 318$, there was the natural ebb and flow of student absenteeism that is part of classroom life occurring throughout the intervention and testing periods. As a consequence, a small number of children missed some spelling lessons and a small number of children did not have their tests included in the results because they did not complete either the pre or the post-tests.

The natural classroom setting raises potentially problematic issues of fidelity (Myhill et al., 2012). Even though the ten intervention group teachers were given the same intervention training and the same teaching support materials they were not required to follow a rigid lesson plan. They were allowed to adapt the materials to suit their own teaching style and the life of the classroom, but, at the same time, they were encouraged to remain faithful to the teaching content of the intervention. This allowed teachers to determine when they delivered the intervention, how often they delivered the lessons and the length of each teaching session. This flexibility empowered teachers to adapt the intervention to their individual teaching style and the individual needs of their students. This important aspect of the design fostered in the teachers a real sense of being actively involved in the research process, although the differences need careful consideration when interpreting the results.

3.1.7 Ethical Considerations

In the first instance, prior to the commencement of this project, ethics approval was sought through the Human Research Ethics Committee of The University of New

England, Armidale, New South Wales, and through the SERAP (State Education Research Approval Process) from the Department of Education and Training in New South Wales. The original research proposal underwent ethical review from both these institutions and was awarded a Certificate of Approval No. HE11/025 and SERAP No 2011001.

Participation in this project was voluntary and all principals, teachers and students were informed of the procedures, aims, content and the expected outcomes involved in this research. Written consent was obtained from each school principal, all participating teachers in the intervention and the comparison groups, and all the students involved. In addition, the parents of all the students were issued with details about the study, its aims, content and procedures, and were required to sign consent forms before their child could participate. This process was rigorous and necessary before the research could begin.

The principals and staff participating in the study were reassured that the researcher would be mindful of the busy and complex life of each classroom, and that the necessary visits for observations and interviews would be done with the utmost care and sensitivity to the needs of the students, the teachers and the schools. Parents were reassured in their information sheets that no photographs or filming would take place, only written notes and digital voice recordings. All participating schools, staff and students were reassured that no names would be used to identify individual schools, teachers or students in publications that arose from this research.

Schools, teachers and students were all given the opportunity to withdraw at anytime from the study, and all the teachers and parents were given appropriate contacts to make complaints or access further information. No ethical problems arose during or after this research investigation.

3.2 Statistical Measurements

The quantitative data comprised three data sets collected by administering, before and then again after the intervention, the following three assessment instruments: the Teacher Language Knowledge Questionnaire, the student South Australian Spelling Test (Westwood, 2005) and the student Morphological Spelling Test. These data sets, therefore, provided both baseline data collected before the intervention and impact data collected after the intervention. The South Australian Spelling test, a standardized test, was used as an independent measurement of children's spelling ability, a measurement that could be compared to data from the larger population of Australian children the same age. The Morphological Spelling test was not standardized, but was specifically designed by the researcher to extract particular data of interest to this study.

These three quantitative data sets were collected in order to reveal both teachers' knowledge about language, about morphemes in particular, and children's spelling performance. The spelling tests were administered to the ten intervention groups and two comparison groups in the same time frame by the participating teachers. The researcher delivered the Teacher Language Knowledge Questionnaire. The details of these tests follow.

3.2.2 Teacher Language Knowledge Questionnaire

The study assumed that teachers' language knowledge was likely to drive the way they approached the teaching of spelling, and in particular, the teachers' language knowledge would directly impact their ability to deliver the intervention. So, before the intervention began, it was important to have baseline data that reflected a concise account of the teachers' language knowledge in order to avoid accidental bias in the intervention or comparison groups. It was also used to inform the researcher as to the necessary teacher training required before the intervention.

A questionnaire was designed by the researcher to reveal each teacher's working knowledge of language with a particular focus on morphological knowledge (see Appendix C). There were ten concrete multiple-choice questions. Five questions asked about morphological knowledge followed by five questions asking about how spelling works and how the teachers used this knowledge to assist poor spellers in their classrooms. The teachers were also asked to rate the importance of spelling in literacy learning. There were no time constants and teachers were encouraged to attend to this questionnaire in a relaxed manner.

The questionnaire generated unsolicited and robust conversations between the teachers and the researcher as they struggled to find correct answers. These conversations were notated and have since contributed to a contextual understanding of the limitations of teachers' spelling knowledge and the difficulties and frustrations that teachers experience as a result of these limitations. However, it must be noted that inter-rater reliability checks were not done due to the limitations of conducting a large study with a sole researcher.

3.2.3 South Australian Spelling Test (Westwood, 2008)

All participating intervention and comparison group students' were assessed using a standardized measure. A standardized measure of spelling performance ability was important for three leading reasons. Firstly, it reliably situates this population's spelling capabilities within the broader context of children's spelling ability in Australia. This increased the validity of the study by improving the researcher's potential to extrapolate outcomes observed in this particular sample of children to children in the broader population (Nunan, 2005).

Secondly, a standardized measure of spelling ability reliably provided the necessary baseline data against which impact data could be measured. This was necessary to determine the statistical significance of the intervention on children's spelling performance.

Finally, using a standardized measure of spelling ability also provided a way of comparing class performances against other classes in the study to ensure the groups were similarly matched before the intervention began. This again reduced threats to internal validity.

The standardized measure used here was the South Australian Spelling Test (SAST) printed in Peter Westwood's (1999, 2005) *Spelling: Approaches to Teaching and Assessment*, 2nd Edition, ACER Press. This test of seventy increasingly difficult words was developed for the purpose of assessing students' spelling ability from ages 6 to 16 years. An important feature of this standardized spelling test is that the child's raw score generates a corresponding *spelling age*. Even though the SAST does produce

standard scores that reflect a cautious relationship between spelling age and chronological age, standard scores were not used in this study. A raw score that generated a spelling age was particularly useful in this study because it highlighted the extent of spelling ability regardless of age, gender or grade level. A spelling age, rather than chronological age, substantiates the focus of this study on what children can do and what children understand about spelling concepts at different points in time: pre and post intervention. Chronological age is not a dependable marker of spelling ability, as children often develop spelling ability in an idiosyncratic manner (Westwood, 2005). The relationship between chronological age and spelling is beyond the scope of this thesis.

The SAST has two real word spelling lists: Form A and Form B. Teachers would usually deliver Form A (70 words) at the beginning of each academic school year and Form B (different set of 70 words) at the end of the same year. This test is familiar and popular with Australian teachers, because it uses Australian norms. All the teachers in this study had used this test routinely prior to the commencement of this study. The SAST is used in public primary schools to assist teachers in the assessment of the class spread of spelling ability and to compare spelling performances from the beginning and the end of the school year. It also offers a tool for teachers to assess individual students' spelling weaknesses and to direct teaching that attends to students' specific learning needs.

According to the norm tables developed for the SAST (Westwood, 2005), which reflect developmental stages of spelling, the mean of each year group in this study, when the test results were analyzed, fell within the average range of spelling ability. It

must be noted, however, that there were a small number of children in each class that had critically low spelling scores and some that performed above their age group. The SAST was used before and after the 10-week intervention to detect improvements however, it was found, through closer analysis of individual spelling errors, that this test was not particularly sensitive to the short-term gains or the explicit morphological knowledge we were looking for (further discussion in Chapter 5).

Teachers administered the South Australian Spelling Test (SAST) Form A (Westwood, 2008) orally to their class, pre and post intervention. Each student heard the target word followed by the target word in the context of a simple sentence. For example, ***Lost…I lost my keys…Lost.*** Each child was required to give a written response. The tests were not timed, and the teachers moved through the tests at a reasonable pace that allowed most children the time to write down a response. The raw score was out of 70 and each response was marked either correct or incorrect. No extra points were given for a correct response, after a block of 10 words was marked incorrect. This follows the directions set out for scoring in the SAST (Westwood, 2005). Each child's raw score was then allocated a corresponding spelling age.

3.2.4 Morphological Spelling Test

The Morphological Spelling Test (MST), based on the work of Nunes and Bryant (2006), was developed specifically for this study. While the SAST is extensively used throughout Australian schools as an instrument for teachers to evaluate their students' spelling progress, the SAST has limitations. The words presented early in the SAST word list test children's developing phonological awareness and their knowledge of sight words, but morphological knowledge is not tested until much later in the list, at

the point in the test where the words presented are beyond the capability of early literacy learners. For this reason, unfortunately, testing based on the SAST word list reveals little about children's complex spelling knowledge. It does not allow for the detection of developing morphological knowledge at an early learning stage. It was therefore necessary, for the purpose of this study, to devise another test that would specifically highlight children's developing morphological knowledge.

The MST included 14 words (11 real words and 3 pseudo words) that required children to use both their phonological and morphological knowledge, simultaneously, to produce the correct spelling (e.g. *richness, opened, emotion, magician, buy. See table for full list).* The words chosen for the MST were common words, familiar to children who are in this range of spelling ages in this population. Words that required the children to think about, and draw on knowledge about, the sounds and meaningful parts of a word at the same time were expected to reveal the complexities of how children use and store knowledge about words. The words used in the MST are listed in Table 1 below.

Table 1 Morphological Spelling List and Pseudo words

REAL WORDS	
Magician	*On Sunday, we are going to see the magician.*
Statement	*The policeman asked me to make a statement.*
Opened	*I opened my eyes.*
Madness	*It is madness to tease a gorilla.*
Careless	*She made a careless remark and upset the young girl.*
Musician	*My sister wants to be a musician.*
Richness	*The richness of the colours made the paining beautiful.*
Emotion	*He was overwhelmed by emotion and began to cry.*
Buy	*I would like to buy some chips.*
Brother's	*My brother's bag was left in the car.*
Children's	*The children's playground was closed.*
PSEUDO WORDS	
Lagician	*A person who does lagic is a lagician.*
Slupless	*I felt slupless when I had no slup.*
Reblod	*When I reblod my shoe I have to blod it again.*

Teachers delivered the MST to their class directly after they had delivered the SAST. The MST followed the same procedure as the SAST. Each target word was given orally, followed by the target word in the context of a sentence, followed by the isolated target word (e.g. ***buy… I went to buy some chips…buy***). Each child was required to write a response.

As mentioned above, the MST included three pseudo words, *reblod, slupless* and *lagician.* Pseudo words were included in the present study to ascertain whether the children could transfer their morpho-phonological knowledge to problem solve the writing of a word they did not know. The pseudo words were created to reflect a child's ability to use phonological knowledge and morphological knowledge together to solve the spelling problem. In 1980, the use of pseudo word spelling to understand children's spelling knowledge was pioneered by George Marsh and his colleagues (Marsh et al., 1980). They found the spelling of pseudo words a useful way of teasing out children's higher order knowledge of spelling principles (such as form or function) from children's reliance on what a word "looks like". Some researchers argue that pseudo words are not useful because pseudo words do not exist, so pseudo words have no correct spellings (Nunes & Bryant, 2006). This may be true for many pseudo words. With this in mind, the present study has constrained the word *form* possibilities by designing pseudo words with limited grapheme-phoneme possible combinations and constraining the possible spelling of the morphemes by providing the contextual sentence that dictates the *function* or *meaning* of the morpheme and, therefore, constraining the possible spelling of the morpheme in the pseudo words.

In the word *reblod* a common prefix *re-* is used in the context of a sentence that bears the meaning of the prefix out. The base pseudo word *blod* was designed to be phonologically transparent with a short vowel limiting the vowel-to-grapheme possibilities. Similarly, in the pseudo word *slupless,* there is a phonemically transparent pseudo base with the addition of a common meaningful suffix. The last pseudo word, *lagician,* is a little more challenging because the pseudo base *lagic* (given in meaningful sentence context) shifts its pronunciation, like the word *magician,* to become *lagician.* The person noun suffix *-ian* used here is less familiar and is also more challenging. It was hoped that children would use analogy to assist them with these spellings. The use of pseudo words is an important aspect of the test, because it allows the researcher to discover if the children are learning about the principles of word structure to understand spelling, or if they are just learning specific words and relying on memory. A raw score of correct spelling responses was calculated, including a detailed error analysis to capture a fine-grained realization of children's spelling knowledge.

The investigation of children's sub lexical ability, ability to think about words in terms of component morphemes was analyzed in the error analysis of this test. The analysis was based on the work of Nunes and Bryant (2006, 2009) where each correctly spelled morpheme in a word is given one point. Therefore, in the word *magician* there are two morphemes, *magic* and *ian,* so a possible two points could be awarded for this word. If *magic* was spelled correctly, but the ending was not, then only one point would be given. A statistical analysis was then undertaken producing an average mean, standard deviation and effect sizes. The error analysis was done on both the real and pseudo words providing this investigation with valuable information

about the fine changes in children's development of morphological knowledge as a result of the explicit intervention.

3.3 Qualitative data

The qualitative data comprised three data sets: Teacher interviews and reflections, weekly classroom observations and children's verbal responses to spelling problems, and their justifications of spelling choices. This section describes the processes and materials involved in each set. This collection of data enabled the study to respond to the delicacies and complexities of teaching and learning spelling in the classroom. Qualitative data is crucial both to inform and to contribute to the current study's understanding of spelling theory and teaching practice.

3.3.1 Teacher interviews and reflections

During the introductory meetings between researcher and teachers, conducted in the week prior to the start of Term 3, each teacher was presented with a questionnaire sheet and an interview form (see Appendix D) on which they could write down any comments or suggestions. The participants (n =12) all agreed to an audio recording of the meeting.

Each interview consisted of two sections and was designed to reveal both teachers' content language knowledge and their pedagogical practice. Section A required the participating teachers to write, in a small space provided, information related to their qualifications, the number of years teaching experience and the grade they were teaching at present. In this section it was intended to reveal the number of children in each teacher's present class who struggled with spelling, and how much time was

spent teaching spelling per week. This section also required information about their school's current spelling program and whether the participating teachers found that program to be effective. In addition, it included questions, such as: What method of spelling instruction did you think is most appropriate to teach children who struggle with spelling? And lastly, this section investigated spelling strategies teachers favoured in their classrooms. Even though the teachers were required to write their answers in this section, many of these questions inspired later frank and open discussions between the teachers and the researcher. These discussions were noted and tape-recorded for further analysis.

Section B of the questionnaire was designed to discover the attitudes, beliefs and motivations driving these teachers' spelling instruction. There were five questions aimed at provoking a deeper discussion about the importance of spelling to literacy instruction. For example, teachers were asked quite concretely about when they believed spelling was most crucial in literacy development and about what concerns they had about their role in delivering spelling instruction to their students. This section also required the teachers to describe the common spelling mistakes their students made and to explain what strategies they used to help their students resolve these spelling problems. These findings are reported in Section 4.5 and discussed in Section 7.1 and 7.5.1.

3.3.2 Classroom observations

The classroom observations were crucial to understanding how the relational approach worked, or didn't work, in the real world context. These observations were arranged and designed to record and witness the intervention in action. The researcher

visited each classroom once a week for the entire intervention and testing periods. While the teachers and students were aware of the presence of the researcher at the back of the classroom, every effort was made to be as unobtrusive as possible.

The teachers and the students were equally important subjects of these observations. The researcher's notes reflected each lesson's content and the sequence of activities for that unfolded for each lesson. In addition, detailed notes recorded the teacher's interactions with students and the children's responses. The teacher's references to morphological and phonological knowledge to explain spelling phenomena were noted, as well as the questions raised by the students. Of particular interest was the level of active participation and enthusiasm between teachers and students during the intervention. This will be discussed further in Section 7.2.

3.3.3 Children's verbal responses and justifications

For this part of the study two children from each intervention and comparison group were randomly chosen by the teacher to be interviewed by the researcher. All the children in the study had prior consent to take part in the interviews. Practical issues of limited time and resources meant only two children from each class (i.e. 24 student interviews in total) were required to take part in the interview. The two that were chosen for the pretest intervention were the same children interviewed in the post-test.

The children worked with the researcher on a one-to-one basis and each interview lasted about 20 minutes. Each interview was recorded and notated for later analysis. Before each session, the child was put at ease by the researcher and reminded that their participation in the interview sessions was voluntary. Each child was then asked

for consent to tape recording and making notes throughout the interview. Each child was then informed about the sort of questions they would be asked in response to stimulus materials.

The stimulus materials consisted of three parts. The first part of the stimulus was a relational reasoning task developed by Derwing et al. (1995). This task required the children to make judgments about a set of morphemically related and unrelated word pairs, one with a suffix and one without (e.g. *know* and *knowledgeable*). This task required each child to read each isolated word of the10 words in column A, and determine if the word related to, or was connected to, the corresponding word in column B. For example, one of the words in column A was *run,* and the corresponding word in column B was *runner.* The child was then encouraged to talk about the relationship between these words (if they believed there was one) and justify their choice. For example, if the child said these words did relate, or were connected, the researcher asked, " *How do you know these words are connected?"* The child was then required to draw on any explicit word knowledge they may have to answer this question.

The second part of the stimulus provided each child with three groups of four words. Each group was morphologically related except one word (e.g. *useless, used, usage* and *fused*). Each child was asked to choose the word that didn't belong in the group and to justify their choice. Again, this task was included to draw out the child's spelling knowledge through their reasoning as they solve this spelling problem.

The third part of the stimulus required each child to look at a correct spelling alongside two incorrect spellings of the same word. The child was asked to identify the correct spelling and then to talk about the reasoning behind their choice. For example, after choosing the correct spelling *slept* the child was asked, *"Why is that word correct? How do you know that sleeped is wrong?"* The child might answer. *"Cause, it just looks wrong,"* or the child may draw on more detailed spelling knowledge that would be gleaned from a response like, *"It's wrong, because we don't say sleeped…we don't need an 'ed' on the end."* Verbal responses were collected with the intention of comparing and contrasting the pre and post-test responses to determine the impact of the intervention on the children's understanding of spelling concepts. Importantly, the comparison of verbal responses before and after the intervention allowed the researcher to observe the finer processes of cognitive change as the children's spelling concepts were redescribed, or changed, by the intervention.

3.4 Procedure

3.4.1 Design of spelling intervention

This study follows a pre-test, intervention and post-test design. This included a teacher questionnaire to determine what language knowledge teachers used to teach spelling in their classrooms, and teacher interviews to discover their attitudes and views that supported their teaching of spelling. It was critical to understand teachers' working knowledge and practice, as the teachers required specific and individualized training before they delivered the intervention to their classes. Both the intervention and control classes were given standardized spelling tests, as well as spelling tests that focused on morphologically complex words, including pseudo words (e.g. *reblod, lagician* and *slupless*).

Following the written tests, two children from each classroom were chosen by the teacher and interviewed by the researcher, individually, for verbal responses to questions about spelling choices and spelling justifications. The teachers selected the children for the interviews. The teachers gave their assurances that the children were selected randomly, and not because they were good or poor spellers.

The elicitation of verbal responses from the children selected for this aspect of the study required each child to attempt three tasks. In the first task each child was shown written pairs of words like *moth* and *mother, help* and *unhelpfulness, know* and *knowledgeable* and were then asked to say if the pairs related to each other in some way (or not). If the words did relate, or connect to each other, the children were then asked to explain why. In the second task, the children were shown groups of words that were related by a common morpheme, but one word in the group did not belong (e.g. *usage, useful, reuse* and *fused*). Each child was then asked to justify their choice of the word that didn't belong to the group. The third task required each child to look at a word like *opened* alongside two incorrect spellings of the same word (e.g. *opend* and *openned*). Each child was then asked to identify the correct spelling and justify the choice. For example they were asked, "Why is that spelling (*opend*) incorrect?" The child may answer, "Cause it doesn't have an *e* in it." The researcher encouraged the child further by asking, "Why do you need an *e*?*"* The child may respond, "Cause the *ed* tells us it's in the past." These different responses give insight into how children think about words and how they use different written word level knowledge to solve spelling problems. Karmiloff-Smith's (1992) model is well suited to analyzing and coding these verbal responses in an attempt to understand, from the way they talk about the structure of words, and how children's spelling knowledge

changes. The most predominant type of verbal response given by each child allowed the researcher to form an overall impression of the verbal response level. There were no inter-rater reliability checks on the verbal response coding due to the constraints of being a sole researcher. This must be acknowledged as a limitation.

During this initial phase the teachers were prepared by the researcher to deliver the intervention in their classrooms. After the 10-week intervention the children were again tested and interviews were conducted with the same children, using the same materials and questions. The researcher then, as before, scribed and taped the children's spelling choices and justifications. In addition, the teachers were supported as they prepared for and delivered each lesson with teaching materials and resources designed by the researcher to reflect the relational approach to spelling used in the intervention. Each week observations of the intervention lessons were collected from each classroom.

3.4.2 Developing a Spelling Toolkit for Teachers

The teacher training intervention was designed to deliver essential information about word structure, to persuade the teachers that learning about morphemes is central to spelling instruction and to build their enthusiasm for teaching this new approach to spelling. These essential elements worked together to sustain the participating teachers through their training, and into their classrooms, to create the best possible context for this research.

At the beginning of the teacher training sessions each teacher received an information folder that outlined the morphophonemic principles (see Appendix G). This included

how the structure of words represented both sounds and meaningful forms, how to identify morphemes and types of morphemes (affixes, bases and roots), and the meanings and functions of a list of common morphemes found in many words in the readings of primary school children (e.g. *–ion, -ian, -ness, -ous*). All the terminology was defined and made explicit (e.g. *morpheme, phoneme, base, prefix, suffix*) to increase the teachers' morphological awareness and the meta-language they needed to support this approach to spelling instruction.

It is one thing to advocate teaching about phonemes and morphemes together, and another to understand exactly *how* to do so, effectively. The teachers were, therefore, encouraged to teach their students about the sounds and the meaningful parts of words at the same time. They were given detailed information about how to do this and lists of words that would make good examples for learning these principles (see Appendix G). It was suggested that their spelling instruction could include morphemes, for example, the comparative noun forming suffix *-est*, and the person noun forming suffix *–ist.* If taught together, these contrasting suffixes adequately illustrate the morphophonemic principle. These suffixes, for example, at the end of *fattest* and *artist* sound the same, but we write these endings differently to indicate a different *meaning* or *function*. Other teaching examples included base words that change their sound, but preserve the spelling to preserve the meaning (e.g. *heal* to *health, know* to *knowledge, mean* to *meant,* or *sign* to *signal* and *signature*). These examples served to assist the teachers in making the conceptual shift from understanding spelling instruction in terms of teaching about phonemes and morphemes separately, to understanding that written words represent a relationship between sounds and

meaningful forms, and these concepts can be taught simultaneously. In this way, the teachers were introduced to the relational approach to teaching spelling.

Due to time constraints teachers were given an average of two one-hour training sessions. These sessions were conducted individually, or in small groups of two or three. These small groups provided a unique opportunity to discuss concerns and ideas for teaching in a relaxed collegial manner. Further details of these discussions will be uncovered throughout the following sections and subsections. The teachers were given notebooks to write down their suggestions and comments during the intervention period, and they agreed to weekly observations of spelling lessons throughout the term by the researcher.

3.4.3 The Intervention Design

Once the teachers had participated in the initial surveys and interviews, and they had realized the limits of their language knowledge, the teachers became convinced that they needed to learn more about morphemes to support their teaching of spelling. This provided the motivation they needed to take part in the spelling intervention. It would not have been enough to offer a spelling intervention that was either, not endorsed by the official educational framework they used, or was merely more of what the teachers felt they were already doing in their classrooms. Fortunately, morphology is an accepted aspect of the teaching of spelling (albeit a minor one) and the participating teachers became convinced that increasing their morphemic awareness had the potential to improve their teaching of spelling and, crucially, improve their students' spelling.

Ten teachers began the intensive, sustained and comprehensive 10-week classroom intervention with their students. The teachers were free to use the information toolkit they received in the teacher training as they wished, and they were also free to deliver the intervention to their students as often as they felt necessary. This approach promoted individual teacher control over this aspect of the research, allowing for the variations in teaching styles (Hattie, 2009). The teachers were encouraged to view their active participation in this project as an integral part of the research. Their intervention delivery and constant feedback throughout was intended to be an invaluable contribution of qualitative data. This data led to significant insights into understanding how and why the intervention was, or was not, successful.

3.4.3.2 Pedagogical features of teaching a relational approach to spelling

The written word simultaneously represents concepts about meanings and sounds. So, it is important for teachers and learners of spelling to understand that the meanings and sounds within a word are in constant collaboration (Dehaene, 2009). This intervention was developed as a bespoke design drawing on the work of Bowers (2006), Nunes and Bryant (2006) and Ramsden (2001). This design was well suited for the particular needs of the teachers and students in this intervention. The intervention teachers were initially advised to break words down into the letters, or groups of letters, that represent their meaningful parts and sounds, but it was also imperative for the students to see how sounds and meanings within a word related to one another. For children, sounds and meanings are poorly coordinated (Dehaene, 2009), and it is for the teacher not only to show them the significance of the representation of sounds and meanings, but also to assist them in understanding how to bolt these two abstract concepts together in a way that produces meaningful

spelling. Initially, teachers needed to provide their students with detailed information on which graphemes of a word represent particular phonemes. This gave the students a phonemic reference point. Then it was explained why a specific grapheme was most appropriate for a given word. For example, the word's meaning may need to be preserved, by using a consistent letter pattern. An important aspect of the intervention content was to assist children in identifying and learning about the most commonly used morphemes in written words. It would not have been useful, or practical, to overload the instruction time with too many affixes, their meanings and functions (Kirkland & Saunders, 1991). So, the intervention design incorporated only the most commonly used affixes and roots (e.g. *–less, -able, un-, dis-, help, sign,*) which both highlighted the morpho-phonemic principle and had the greatest potential for propelling the children's learning forward in spelling and other reading related activities. Following is an outline of the suggested instructional sequence for each lesson.

- Identify the word: read the word(s) and have an open discussion about the dictionary meaning(s) of the word(s).
- Break it down: Find the individual sounds within the word and syllables
- Problem-solve the correspondences between the sounds and letters including digraphs, tri-graphs, and silent letters through open class discussion.
- Look for the clues that indicate the meaningful parts of words including the bases, root, prefixes and suffixes
- Define, explain and consolidate the use of terminology that assists the talk about written word parts
- Identify the meanings or functions of the morphemic parts of the word(s).
- Identify how the morphemes relate to the sounds in the word(s).

- Identify other written words that are formed by using these morphemic parts. Perhaps illustrate this by creating a word web on the board. At the nexus of the word web is a common morpheme, like *sign,* and the threads connect other words like *signature, signal,* and *assign* that incorporate this morpheme in their structure.

The key aspects of the above activities that are distinctive to the relational approach are (1) the identification of written morphemes (2) learning about the meaning or function of morphemes (3) making an explicit connection between the meaningful forms (morphemes) and the way these forms *sound* (phonemes). This relational approach to spelling instruction was designed to assist the teachers and learners to treat as significant the meaningful parts of words and how they are related to the sounds within that word. Importantly, the relational approach was designed to assist children in understanding the morphophonemic principles that determine the structure of written words. That is, the understanding of how morphemes and phonemes work together in predictable ways, and discovering the interconnections between the spelling of the word, the sounds in the word, and the way the spelling can indicate meaning. The intervention instruction included the identification of homophones, affixes/roots, and the possessive apostrophe, thus, encouraging children to develop multiple ways of thinking about the spelling of a word.

Prior to the intervention, all the participating teachers used too many words (up to 30 words per lesson) as the basis of their spelling program. These lists were either thematic, where words were chosen from a current topic of study, for example, Gold Rush history words, or they used letter patterns lists of words that shared, for

example, the ‘ough’ or ‘ight’ letter patters, but that were otherwise not meaningfully related. Spelling lessons, therefore, were often too broad (thematic lists) and too shallow (letter pattern lists). Emails from the researcher to the teachers provided support and helped to focus their attention on a small number of words using a common morphemic principle. For example, one email focused on the *-ous* Latin suffix that means ‘full of’. The teachers were given examples like *adventurous*, *poisonous* and *famous*, because the meaningful parts of these words are transparent, and the sounds on the ends of these words could be compared to other words with the same sounds but with different spelling patterns that indicate different meanings (e.g. The words ‘lettuce’ and ‘focus’ were suggested by students because they thought these words were had the same final sound as *-ous*).

In summary the intervention was designed to assist teachers and children with learning about the principles of word structure in order to develop the meta-linguistic tools they needed to think about and talk about the structure of the written word. In doing so, the intervention was designed to give each participating teacher the potential to offer effective assistance to each child by explaining and justifying, in depth, the relationship between multiple layers of word level knowledge. This raised the potential of each child to approach each spelling problem with an attitude of problem solving. The next section scrutinizes the possible threats to the validity of making causal inferences between the intervention and its effects on student spelling performance and understanding.

3.5 Data Analyses

3.5.1 Quantitative data analysis procedures

Data were analyzed using Microsoft Excel 2008 and IBM Statistical Package for the Social Sciences (SPSS) statistics software, Version 19. There were two dependent statistical variables: a raw score out of 70 for the South Australian Spelling Test and a raw score out of 14 for the Morphological Spelling Test. The raw scores collected from the South Australian Spelling Test were compared to the published grade equivalent norms for the standardized pre and post-test completed by all the intervention and comparison groups. Means and standard deviations on the raw scores were also calculated and tabled for the Morphological Spelling Test. Means and standard deviations are presented in Chapter 5 showing the comparison between the overall performances of each group, pre and post-test.

The Effect Size based on the work of Hattie (2009) is used here to show growth or improvement associated with this intervention. Hattie's interpretation of Effect Size statistics can be understood by using his benchmarks as a guide. For example Hattie's calculated Effect Size below 0.2 was considered to be due to maturation processes (without a teacher), an average effect size (over a school year) was scored between 0.2 and 0.4, a score between 0.4 and 0.6 is considered above average and Effect Sizes between 0.6 and 0.8 are considered excellent. Effect Sizes above 0.8 represent a substantial improvement of two to three years' growth. It must be remembered that Hattie's Effect Size benchmarks are based on results gathered over a full academic year and the present research only lasted 10 weeks. The implications of a relatively short intervention period on results must yield smaller Effect Sizes according to Hattie's (2009) benchmarks.

The interpretation of the outcomes for these tests using Hattie's (2009) benchmark must also be considered with some caution. Hattie's benchmarks are suggested as a general guide and are subject to judgment. Thompson (2006) and Bowers et al. (2010) concur that small Effect Sizes may have significant potential for practical applications and, conversely, it must be considered that large Effect Sizes may have little practical application. The reliability of interpreting the Effect Size using Hattie's benchmark as a guide is addressed here by giving the calculated Effect Size a context. This is achieved by interpreting Hattie's value in light of the rich qualitative data collected in this study. This underscores the strength of using a mixed method triangulation design in the analysis of these complex, educational phenomena.

3.5.2 Qualitative data analysis procedures

The first of the three qualitative data sets comprised the teacher interviews and the teacher's reflections as they progressed through the intervention period. A profile of each teacher's experience, educational background, attitudes and beliefs about the importance of teaching spelling, was developed. All conversations between the researcher and teachers were transcribed and analyzed and added to each teacher's profile. The twelve teacher profiles provided context that is crucial to a meaningful analysis of what the teachers know about language, and importantly, to the analysis of their teaching practice. These teacher profiles are used as supporting evidence to explain, in real terms, the links between teacher knowledge, pedagogical practice and student outcomes.

The analysis of the descriptive classroom observation data was another vital aspect of the qualitative data corpus. Classroom visits during the 10-week intervention period

totaled 120. Particular features in the data were coded for example (A) data reflected student participation and enthusiasm in the lesson, (B) teacher preparedness and confidence delivering the lesson, (C) difficulties teachers experienced delivering the lesson and (D) student responses and questions in class. Again, this *context* data contributed to the study's fine-grained analysis and nuanced interpretation of the way the intervention was realized in practice.

Verbal data constituted the qualitative dependent variables for this study. The children's verbal responses and justifications were brought to light through a three-part stimulus that was designed to tease out the different types of knowledge children had about words and how they used this knowledge to solve spelling problems. The researcher scribed and taped the children's spelling choices and justifications.

All three parts of the stimulus were coded in the same way to reflect, firstly, the child's correct or incorrect identification of the target word, and secondly the coding of the verbal justification of the child's choice. As the literature review revealed, Karmiloff-Smith's representational redescription model (1992) was used as a framework for coding the children's verbal responses. Karmiloff-Smith's model consists of four levels: Implicit, E1, E2 and E3 as previously described in section 2.5.2. Each child's verbal response was coded according to Karmiloff-Smith's definition of an implicit or increasingly explicit response. So for example, if a child's justification of a spelling choice was, *"I don't know"* or *"I just know it",* it would be coded as an implicit response. An implicit response may reflect correct spelling, but importantly there is an absence of, or an inability to verbalize knowledge about the

word or analyze it in terms of its meaningful parts. An implicit verbal response shows no insight into word structure to justify or solve the presented spelling problem.

If a child was clearly able to abstract phonological word level knowledge to justify a spelling choice, they might respond, for example, *"Cause that's the way the word sounds"* or *"I can sound it out".* In this case, the response would be coded at an E1 level. At this level the child draws on dominating phonological knowledge to justify all spelling choices, resulting in errors and over generalizations. At the E1 level, there maybe evidence of emerging morphological knowledge in their responses, but this knowledge tends to be over applied. For example, the researcher asked a child with a spelling age of 9years, *" You said the word slept was wrong, Why is slept wrong? "* the child responded, *"'cause it needs an ed on it."* This type of response would be coded E1 as it shows emerging morphological knowledge that is over applied.

A response coded at E2 would show phonological and morphological knowledge on the verge of integration. For example, a child may be able to explain why the word *wishd* is spelled incorrectly, "*it needs an e there to show it's in the past",* but unable to explain why the spelling of *wished* is correct, *"'cause it has an sh and ed in it"*. The second justification is not incorrect, but it shows that the child could have drawn on more information. In another example a child may have been able to explain the misspelling of the word *opend* but unable to explain the misspelling of *playd,* even though they could be similarly justified. In summary, the E2 level is characterized by improved spelling performance with understanding, but phonological and morphological knowledge is inconsistently applied.

Responses coded at the E3 level are explicit representations that can be fully accessed and verbalized to others. There is flexibility and creativity in the use of spelling knowledge at this level that includes being able to draw on both phonological and morphological knowledge to solve spelling problems. For example, a child at E3 level might respond, *"The word washed has an ed on it to show that we washed something in the past"* or *"The er on the end of runner tells us someone who runs is a runner."* This type of response would be coded at E3 level.

The morphological aspects of meta-language developed here in this data set indicate significant potential for the teaching and learning of spelling. Each child's set of responses were separately analyzed and coded in this way and averaged to determine the representational level (Implicit, E1, E2, E3) that would most appropriately describe the child's verbal responses at that point, pre and post intervention. Karmiloff-Smith's model provided an efficient way of determining whether the children's responses had become more explicit after the intervention, as they abstracted and verbalized their phonological and morphological knowledge to justify spelling choices and of enabling me to explore spelling development as a reasoning ability (i.e. meta-linguistic). This data was then compared to each child's spelling performance.

3.6 Summary

The design of the current study is based on a multifaceted methodology with a triangulation design that brings together the important aspects of an intervention on teaching and learning. This triangulation design provided the framework for inter-relating the quantitative data of surveys and performance tests with findings from

qualitative questionnaires, observations and interviews in a complementary way that strengthened the empirical bases of the study. The triangulation design has been justified here as an appropriate model for investigating how and why the relational approach to teaching spelling has affected children's spelling performance and understanding throughout the intervention. In addition, it is argued that Karmiloff-Smith's (1992) general cognitive model serves to capture the fine-grained transitional process of children's implicit knowledge developing into explicit spelling knowledge as a result of the intervention. The analysis of children's spelling performance and understanding through spelling tests and verbal reasoning and justifications shifts the focus from spelling accuracy to an examination of the different types of spelling knowledge children may have and hence to the crucial role of meta-linguistic knowledge (specifically, morphological knowledge) in spelling development.

The results are separated and defined by the next three chapters. Chapter 4 begins with the qualitative and quantitative results for the teachers. This includes the discovery of teachers' word level language knowledge through questionnaires and interviews, thus, initiating the first steps in this research toward understanding spelling instruction in the dynamic classroom context.

Chapter 5 describes the impact of the intervention on children's spelling performance. Initially, observations of classroom interactions between teachers and students during the intervention lessons set the context for these results. The reporting of the performance tests, or spelling tests, used complementary investigative approaches: a comparative analysis of correct spelling performances across two statistical measures followed by a detailed analysis of spelling errors. This complementary approach gives

depth and breadth to the analysis necessary in teasing out the complexities of spelling performance and understanding.

Finally, Chapter 6 offers a detailed report on what children 'think' about, or what they understand about the spelling of words. Children's talk, their justifications and reasoning about the spelling of words is described and analyzed here providing valuable insight into what children understand about spelling.

Chapter 4

Results

What do teachers know about spelling?

4 Introduction

It has been argued in the literature review that explicit knowledge about the structure of words is not only a powerful aid to learning spelling, but also to teaching. Shulman argues that, "the knowledge base of teaching lies at the intersection of content and pedagogy" (1987, p.15), and this proposition applies well to the teaching of spelling. Teachers need the necessary foundational content knowledge base about the structure of words, and the ability to refashion this knowledge into forms that makes sense to their students (Shulman, 1987). More recently, Fielding-Barnsley and Purdie (2005) found their participant teachers' phonological knowledge was highly variable and their meta-linguistic knowledge was insufficient. These studies contribute to the growing concern that many Australian teachers may not have the necessary linguistic knowledge to teach spelling effectively (Fielding-Barnsley & Purdie, 2005; Hammond & Macken-Horarik, 2001; Meehan & Hammond, 2006; Mahar & Richdale, 2008; NITL, 2005). It follows that many teachers may have incomplete information about not only *what* to teach, but also *how* to use their language knowledge to improve their students' spelling performance and understanding.

This study must discover what these teachers know about words and how they use their word level knowledge to teach spelling. Therefore, the starting point for the present research must be a Teachers' Language Knowledge Questionnaire. This chapter begins with the question, "What do teachers know about spelling?" with a detailed account of the results of the Teachers' Language Knowledge Questionnaire.

4.1 Teachers' Language Knowledge Questionnaire: A starting point

The survey consisted of a questionnaire and an interview. The aim of the Teachers' Language knowledge Questionnaire was twofold. Firstly, from a practical perspective, the questionnaire was designed to assess the width and depth of teachers' content knowledge about word structure and to investigate the context in which that knowledge has developed (e.g. educational background, experience etc.) before they delivered the student spelling intervention. Recent literature suggests that teachers in Australia have some experience identifying phonemes (Fielding Barnsley & Purdie, 2005; Meehan & Hammond, 2006; Mahar & Richdale, 2008), so this questionnaire focused particularly on teachers' morphemic knowledge, and included an assessment of their ability to identify morphemic units in words and to select the corresponding units of meaning or function.

Secondly, the questionnaire was used to assess teachers' concept knowledge, ideas or ways of thinking about word-level language. In particular, it assessed their ability to identify a child's misspelling and explain how the child's spelling concepts for that word could be modified to support better spelling. These questions were designed to reveal not only what teachers knew about language, but also how they *used* their language knowledge to assist their students with solving spelling problems.

In summary, the starting point of the present study was to investigate teachers' word level knowledge and their beliefs and motivations for teaching spelling through a detailed questionnaire that included a questions and an interview. The Teachers' Language Knowledge questionnaire was designed to reveal comprehensive information about what teachers knew about words and how they used this knowledge to support their teaching of spelling. The teacher interview, which was conducted simultaneously, was designed to discover the teachers' beliefs and motivations that supported spelling instruction. This information established the foundation on which to build the necessary professional development required prior to the teachers delivering the student interventions.

4.2 Method Overview

As described in some detail in the previous chapter, this study used a mixed method triangulation design to gather complementary quantitative and qualitative data. These two sets of data were collected in the same time frame and given equal weight. The purpose of collecting these two types of data was to bring together the different strengths of each. The quantitative data (the questionnaire) provided the necessary structured questions about what teachers knew about the morphological aspects of language, and the qualitative data (the interviews) provided the informal discussions that gave the '*how* and *why* they knew' context to '*what* they knew'. These complementary sets of data were merged into one overall interpretation in the discussion. This mixed method triangulation design, supported by the published work of Creswell and Plano Clark (2007), is followed throughout the current study.

4.3 Teachers' Language Knowledge Questionnaire

4.3.1 Design overview

The teachers' language knowledge questionnaire had ten multiple-choice questions (see below). Five questions required morphological knowledge that included defining terms, and identifying morphemes and their corresponding function or meaning. These were followed by questions about how spelling works and how teachers use word level knowledge to assist their students. Lastly, the teachers were asked to identify, from a multiple-choice answer, what dominant factors they considered contributed to developing good spellers. This questionnaire was based on the work of Moats (1994) and adapted to reveal teachers' word level content that focused particularly on teachers' morphemic knowledge and their conceptual language knowledge about how words work in the world of writing and how they assist children who struggle with spelling in the classroom.

Teachers' Language Knowledge Questionnaire

1. What is a morpheme?
   (a) the smallest unit of sound
   (b) a pronounceable group of letters containing a vowel
   (c) the smallest unit of meaning *(Correct answer)*
   (d) a sliding vowel
   (e) I don't know

2. Which of the following is an inflected verb? (Pick one)
   (a) Scarecrow
   (b) Nameless
   (c) Impeached *(Correct answer)*
   (d) Unbelievable
   (e) I don't know

3. Which of the following is a bound root? (Pick one)
   (a) Once
   (b) Tables
   (c) Phonograph *(Correct answer)*
   (d) Weakly
   (e) I don't know

4. Which of the following words has a prefix? (Pick two)

(a) Missile
(b) Unhappy *(Correct answer)*
(c) Commit *(Correct answer)*
(d) Interest
(e) I don't know

5. Which of the following words has an adjective suffix? (Pick one)
(a) Natural *(Correct answer)*
(b) Apartment
(c) Encircle
(d) Emptiness
(e) I don't know

6. If a student spelled the word "electricity" as "elektrisuty" which of the following is most likely true?
(a) The student does not know sound-symbol correspondence.
(b) The student has a poor ear for the symbols in our language.
(c) The student has a poor visual memory.
(d) The student does not know the base word and suffix from which the word 'electricity' was constructed. *(Correct answer)*
(e) All of the above
(f) I don't know

7. A student writes: 'I have finely finished my book.' Her misspelling of the word 'finally' most likely indicates that she:
(a) is not attentive to the sounds in words
(b) does not know basic letter-sound relations
(c) has not matched spelling to the meaningful parts of the word *(Correct answer)*
(d) has a limited vocabulary
(e) has a limited knowledge of sight words

8. Choose the sentence that is punctuated correctly.
(a) The children's shoes were in the ladies toilets.
(b) The childrens' shoes were in the ladies' toilets.
(c) The childrens shoes' were in the ladies toilets'.
(d) The children's shoes were in the ladies' toilets. *(Correct answer)*
(e) I don't know.

9. The spelling system of the English language primarily represents:
(a) speech sounds
(b) spelling rules
(c) orthographic patterns
(d) meaning
(e) I don't know

10. To be a good speller you need to:
(a) have a good visual memory
(b) have a gift for it
(c) have phonemic awareness
(d) have morphemic awareness
(e) have phonemic and morphemic awareness
(f) I don't know.

After all the teachers completed the Teachers' Language Knowledge Questionnaires the correct responses were totaled and the percentage of correct responses was calculated for the entire group. The data were analyzed in terms of the percentage of correct scores, and in terms of the sort of errors teachers made on the questionnaire. The next section describes the language knowledge teachers used to complete this questionnaire, and the comments teachers made while completing this challenging task.

4.4 Results

4.4.1 Teachers' Language Knowledge Questionnaire Results

Initial analysis of the questionnaire revealed that even though all the teachers attested to knowing what morphological knowledge was and had claimed they had used it regularly as a support strategy in their spelling lessons, none of these teachers could correctly identify the correct definition of a morpheme (the first multiple choice question). It was also clear that these teachers had some morphemic knowledge that was confined to common prefix and suffix patterns, such as the *un* in *unhappy* and the *-ness* in *emptiness,* but only one teacher could identify the prefix *com-* and the bound root *mit* in *commit*. Crucially, the teachers could not confidently identify affix meanings, or their functions. For example, only four out of the twelve participating teachers could identify the inflected verb *impeached,* and only two teachers were able to identify the adjectival suffix *–al* used to transform the noun *nature* into *natural.* Only four out of the twelve could correctly use the possessive apostrophe. Two teachers admitted to *never* having learnt to use the possessive apostrophe morpheme and confessed, 'We have no idea about possessive apostrophes, could you please explain it at the end of the questionnaire?'

Ten out of the twelve teachers admitted to guessing most of the questionnaire answers and they often conferred with each other to produce the best answer from their pooled knowledge. They all confessed that they had never had to answer questions about morphemes before, and this fact contributed to their acute lack of confidence in their ability to identify the morphological aspects of words.

Table 2 Summary of Questionnaire Results

Questions	***% of correct responses***
1. What is a morpheme? *C: The smallest unit of meaning*	0%
2. Which of the following is an inflected verb? *C: Impeached*	30%
3. Which one of the following has a bound root? *C: Phonograph*	8%
4. Which two of the following has a prefix? *B: Unhappy C: Commit*	50%
5. Which of the following has an adjectival suffix? *A: Natural*	16%
6. If a student spells the word *electricity* as "elektrisuty" which of the following is most likely true? *D: The student does not know the base and suffix from which the word 'electricity' was constructed.*	50%
7. A student writes "I have *finely* finished my book." Her misspelling of the word 'finally' most likely indicates that she: *C: Has not matched spelling to the meaningful parts of the word.*	33%
8. Choose the sentence that is punctuated correctly. (possessive apostrophe use) *D: The children's shoes were in the ladies' toilets.*	33%
9. The spelling system of the English language primarily represents: *D: Meaning*	16%
10. To be a good speller you need to: *E: Have phonemic and morphemic awareness*	66%

This group of teachers also revealed through the questionnaire that their primary strategy for identifying and correcting students' spelling errors was to draw attention to the *look* of the whole word, and its dictionary meaning, rather than focusing on the smaller parts inside words that give clues to *both* meaning (morphemes) and sounds (phonemes). For example, when teachers were asked to identify the best strategy to help a student with the misspelling of *finally* in the writing, *"I have finely finished the book",* four out of twelve teachers said they would discuss what the word means, three teachers said they would draw attention to the sounds within the word, and all the teachers said they would then have made this word a *sight* word for the child to practise by using the *Look, Cover, Say, Write, Check* strategy.

The last two questions in the questionnaire asked the teachers what they thought the English spelling system primarily represented and what type of spelling instruction they thought made good spellers. The teachers were very unsure how to answer these questions, but the questions inspired lengthy discussions after the questionnaire was completed that demonstrated the teachers' lack of confidence in their deeper spelling knowledge. For example, the majority of responses incorrectly identified spelling rules or speech sounds as the primary drive behind the creation of the English spelling system. It was clear that these teachers viewed spelling as a necessary, but a somewhat troublesome and an exasperating skill to teach and learn. These discussions revealed the teachers' gaps in spelling content knowledge and their misconceptions that promoted the belief that spelling is a chaotic system, rather than a highly predictable written language system that communicates meaning.

Even though in the last question eight teachers correctly identified phonemic and morphemic awareness as the strongest predictor of good spellers, they acknowledged that they deduced this answer would be correct due to the focus on morphemes throughout the questionnaire. The most common discussion prompted by the last question was the teachers' reflections on their own experiences as young learners. Many talked about how they couldn't remember any spelling rules from school and they just remembered how words were spelled by the *look* of words. These teachers talked about how good spellers really just remember how words look. In the questionnaire, eight out of the twelve teachers indicated good spellers needed phonemic and morphemic awareness, but talked about the good spellers in their classrooms as either already having good visual memories, or possessing a combination of good visual memory and phonemic awareness which they believe is largely determined by innate spelling ability. This suggests a discrepancy between what the teachers know and what they practise, and perhaps what teachers perceive about their own language knowledge. This finding supports the earlier findings of Bos et al. (2001); Cunningham et al. (2004); Fielding-Barnsley and Purdie (2005); Moats (1994) and Spear-Swerling et al. (2005) who also found a discrepancy between what teachers know about language and what they think they know about language.

The responses to this questionnaire have shown that this group of teachers were either unaware of the importance of learning about morphemes when learning to spell, or at the very least, were unsure about *how* to use morphemic knowledge in the teaching of spelling.

4.5 Teacher Interviews

4.5.1 Design overview

The aim of the interviews that followed the questionnaire was to discover teachers' attitudes or belief systems about teaching spelling. Were the teachers confident and prepared to deliver effective spelling instruction? Did the teachers believe they had adequate language knowledge to teach spelling? What research questions did teachers want answered about spelling instruction and what are teachers' main concerns about spelling instruction? These were open-ended questions that required detailed answers that could only be thoroughly considered in an interview with each teacher.

Teacher interview questions
School
Grade you are teaching at present?
Teaching qualifications and year obtained (e.g. Bachelor of Education, 1984)
How many years of teaching experience do you have?
How many children are in your class?
How many children in your class struggle with spelling?
What is your school's current spelling program?
Whole language based
Phonics based
Other

What method of spelling instruction do you think is most appropriate for teaching poor spellers?
What spelling strategy do you favour teaching in the classroom?
Do you think spelling is important?
What role do you think spelling plays in literacy development?
What concerns regarding literacy teaching/learning would you like researchers to address?
What are the difficulties that your students have with spelling and how would you address them?
What are the common mistakes your students make with the word 'opened', and how would you help them address their difficulty spelling this word?
Look for a similar response to these words:

Slept	Combination
Prepare	Uncovered
Beginning	Happiness

The interviews were tape recorded and transcribed later for further analysis. The responses were analyzed and compared in terms of the teachers' experience, education, attitudes and beliefs about spelling instruction. The interviews were then compared to the Teachers' Language Knowledge Questionnaires to determine how the teachers' beliefs and attitudes about spelling impact their knowledge about spelling and their teaching of spelling. The next section reports on the teachers' verbal responses to questions given by the researcher in the interviews.

4.6 Teacher Interview Results

The interviews revealed the participating teachers were very experienced primary school teachers; two had ten years experience, and ten had at least thirty years' teaching experience. They were all dedicated to their professions, and they often provided mentoring to younger teachers in their schools. All the teachers believed that spelling was important to literacy learning, and all the teachers had experienced pressure from parents, after standardised national literacy testing (NAPLAN), to improve their students' spelling performance. All the teachers had the challenge of teaching to a variety of spelling abilities within their classroom populations, and they reported using either a phonics-based program, or a combination of phonics and whole language approaches. This included the incorporation of the four types of spelling knowledge (i.e. visual, phonological, morphological and etymological) recommended by Australian education policy documents.

The amount of time devoted to spelling instruction in each of these teachers' classrooms varied significantly. Some teachers spent a minimum of twenty minutes every morning committed to teaching the week's spelling words. Others spent much

longer using the whole morning session before recess for word study activities. One teacher used just one hour every two weeks to teach the spelling rules and extend vocabulary. Some teachers gave their students up to twenty-five words to learn a week that were a combination of appropriate curriculum content words and common letter pattern words (e.g. *ight* words like *bright, fight, might).* All the teachers said they did their best to tailor the word lists to meet the needs of individual students.

Teachers were asked questions about the type of spelling strategy they favoured in their classrooms, most teachers said, 'spelling patterns and spelling rules.' Other responses included visual cues, sight words, and 'does the word *look* right?' strategy. The *Look Say Cover Write Check* strategy was the most common way their students learned their weekly spelling lists, and it was used as a daily mantra in all the classes. So even though every teacher said they used morphological knowledge to teach spelling, *none* of the teachers mentioned it as a favoured strategy, or a strategy they would use to help struggling spellers.

These teachers shared many concerns, but the most common concern voiced at every available opportunity throughout the research project was, "Why don't children use their spelling knowledge in their writing? Why is it that they can get all their spelling words correct in the Friday test and not retain any of that knowledge in their writing on Monday?" This concern is crucial and goes to the heart of understanding the need for portable knowledge about language that goes beyond passing spelling tests. This includes teachers knowing how to develop children's deeper knowledge about language at the word level beyond the memorization of spelling lists.

Other shared frustrations included the high proportion of struggling spellers they had in each class despite increased time devoted to spelling instruction. Some teachers reported up to 75% of their class had tremendous difficulties with spelling that flowed on to affect the children's confidence in their writings. These teachers also mentioned that many of their students who could sound out their words had become "stuck" using sounding-out strategies to spell all words. This strategy had caused these students to make many unnecessary errors. None of the teachers, however, knew *how* to move these students on from a reliance on sounding-out, other than to give these children word lists to memorize or practise. Teachers also reported that the *Look Cover Say Write Check* strategy was *not* effective for most of their students beyond the weekly spelling tests, however, this entrenched strategy has as yet, no alternative. All the teachers reported they were unsure about *how* to help children who struggle with spelling. They also reported a great need for better training and spelling resources.

4.7 The Relationship between Teachers' Language Knowledge Questionnaire and the Interview Findings

The informal discussions generated in the interviews revealed the extent of the teachers' spelling instruction practises and their beliefs about the importance of spelling and their motivations for teaching it. All the teachers who participated in this study valued spelling instruction as an essential aspect of literacy learning, and they were highly motivated to help their students improve spelling performance in all aspects of writing. The teachers' prevailing concern, however, was *how* to effectively and efficiently improve their students' spelling performance and understanding.

Teachers were hungry for good spelling resources and the necessary continued professional development training to assist them in this pursuit.

Further to this, the results from both the questionnaire and the interviews indicated that these teachers did not have enough explicit word level knowledge to teach spelling effectively, and all the teachers acknowledged this. So while the teachers were highly motivated to teach spelling well and to improve their students' spelling outcomes, the teachers clearly lacked confidence in their own content knowledge about words and were very unsure about *how* to use the knowledge they did have to help their students with spelling. All the teachers bemoaned the lack of good spelling resources and professional development in this area. Teachers' lack of solid foundational knowledge about the structure of words significantly impacted these teachers' ability to deliver effective spelling instruction.

4.8 Summary

The questionnaires and interviews initiated the first steps in this research toward understanding the factors at play for spelling instruction in the dynamic classroom context. Interestingly, it appeared that regardless of the teachers' experience teaching spelling, the time devoted to spelling instruction, or the use of phonics or whole language programs, *all* the teachers were at a loss as to *how* to improve their students' spelling performance. This perhaps suggests that improving spelling performance must begin with increasing teachers' spelling knowledge and changing spelling instruction.

The relational approach to teaching spelling developed for the intervention in this study requires detailed explicit knowledge about how phonemes and morphemes work together to produce meaningful spelling forms. The teachers' responses to the Language Questionnaire and in the interviews confirmed a shared lack of confidence in the specific word level knowledge needed to deliver this new spelling instructional approach. From here, the next step was to develop a teacher-training intervention that met the needs of these teachers before the scheduled commencement of the student intervention. The teacher training was designed to fill in these conceptual and content knowledge gaps identified in the survey.

The data gathered from the survey, from both questionnaire and the interviews, attempted to answer the question posed at the beginning of this chapter, do teachers have sufficient word level knowledge to deliver effective spelling instruction? The findings of the questionnaire spotlighted some important gaps in these teachers' spelling content knowledge and the teachers' spelling concepts. These gaps shaped the way teachers thought about spelling words. For example the Teachers' Language Knowledge Questionnaire highlighted the biggest gap between teachers' actual language knowledge and perceived language knowledge was related to knowledge about morphemes. Prior to undertaking the questionnaire, all the teachers had said prior to the questionnaire that they were familiar with teaching about morphology as it was indeed a requisite aspect of spelling instruction outlined by their school curriculum. Because they found the questionnaire so challenging, however, all the teachers realized they did not know as much about morphemes and the way spelling works as they had previously thought.

Insufficient spelling content knowledge and incomplete spelling concepts are likely to have a direct and profound impact on the effectiveness of their spelling instruction, and it follows that this is likely to have a profound impact on their students' spelling performance and understanding. It is hypothesized that this significant finding impacts on the potential quality of children's spelling performance, and on the depth of children's understanding demonstrated in their verbal reasoning and justifications. The spelling performance and depth of understanding of the children participating in the current study will be described in the next two chapters.

Chapter 5

Results

Can teaching children about the relationship between meaningful forms and sounds in words contribute to improving spelling performance?

5 Introduction

This chapter reports on the quantitative results collected from children's spelling performance on two spelling tests. Improvements in spelling performance are interpreted in this study by using complementary investigative approaches: a comparative analysis of correct spelling performances across two statistical measures followed by a more dynamic detailed analysis of approximations to correct spelling based on morphological knowledge. This distinction is an important one because correct spelling scores alone only tell part of the story. A detailed investigation of spelling errors highlights the subtle details of what change in spelling performance might look like before correct spelling is achieved. This chapter begins by setting the context for these findings by reporting on the classroom observations of the intervention in action, and importantly, some of the feedback from teachers as the intervention progressed.

5.1 The intervention in classrooms

Ten teachers began the spelling interventions (and two comparison group classes continued their usual spelling instruction) in their classrooms with enthusiasm, but within the first week all the intervention teachers experienced some degree of anxiety and uncertainty about their ability to deliver the intervention. When I visited each classroom to observe the lessons the teacher would often get me aside to convey their worries and concerns about their ability to deliver the intervention. Most teachers requested detailed clarification of terminology such as, "Could you tell me again how to explain morphemes?" or when teachers found a word that was difficult to talk about they asked questions like, "How do you justify the spelling of *grateful*...what does the root *grate* mean?" There were many questions like these that reflected teachers' concerns and insecurities about their own word level knowledge.

These discussions also revealed that the teachers found the teaching materials of high quality, stimulating and engaging, but many teachers lacked the confidence to deliver it. A common anxiety was revealed in the details of *how* to teach explicitly about the way morphemes and phonemes work together to form written words. It became apparent throughout the intervention that the teachers needed continued high support from the researcher in the form of scripted lessons delivered by email each week, that included word lists. This highlights the limitations of the teachers' specific linguistic knowledge needed to support the teaching of spelling. Clearly teachers also need the necessary professional support required to teach spelling effectively, not just knowledge about language but ways of applying this in day-to-day teaching. It also highlights the limitations of the materials in the current study's toolkit that were designed to assist the teachers in the rather short teacher-training period.

All the teachers needed to know more about not only *what* to teach but *how* to teach it. Assisted by the researcher, all the teachers learned *how* to teach spelling through the weekly emails that included, more specifically, *what* to teach. The teachers and their students were learning together and discovering together in a way that illustrates not only the students', but also the teachers' developing explicit morpho-phonemic awareness.

The intervention teachers each received the same detailed lesson plan on a weekly basis and they were free to interpret and deliver the material as they wished. For example, four teachers used the materials to create independent writing tasks for their students reinforcing the teacher's belief that spelling was essentially a writing activity. This activity required the children write-out a list of words with common suffixes or prefixes and then have the children write them in the context of a sentence. This type of activity kept the classroom quietly busy, and the teacher encouraged very little active discussion about the words.

Six teachers used the email information to create classroom discussions around word knowledge. For example, one teacher put the word *remember* on the board and announced to the class that they were going to have a conversation (led by the teacher) about this word. Initially, students talked about the dictionary meaning, then some students identified the sounds within the word like the /re/ sound at the beginning or the /er/ sound on the end. The teacher guided them to look at the possible smaller meaningful parts within this word. Following this, the teacher then directed the class to look at the letters *mem* in the middle of the word and explained that this combination of letters often indicates a Latin root, meaning to 'think'.

Attention was drawn to the *re-* prefix (meaning 'to do again') and finally the *-er* suffix (meaning 'someone who does'). After this, the class was able to identify the meaningful parts and sounds of this word. The children were then directed to offer other words that might be connected by the same meaningful root. The students quickly put forward words like *memory*, *memories*, *memo*, *memoir* and *memorial*. Soon a web of words was created on the board that was copied into the students' notebooks. The students participated enthusiastically in these discussions, as they were encouraged to develop hypotheses about meaningful parts, sounds and the possible connections to other words. This lesson took only twenty minutes, but other similar lessons by other teachers were often much longer.

Prior to the intervention, many teachers revealed they used up to thirty words each week as the foundation for spelling lessons. Their weekly spelling words were rarely chosen to reflect common morphemic forms, but rather selected from a current unit of study (e.g. *colony, settlement, aborigines*) or for a common orthographic pattern (e.g. *fight, bright, sight*). Spelling lessons, therefore, were often very shallow and this was evident in a comment made by one of the teachers before the intervention, "The more words they (*the children in her class*) can memorize, the better". To this end, teachers tended to flood their students' minds with as many words as possible and encouraged them to look at the whole word, practice writing the word repeatedly, and learn its dictionary meaning. Consequently, each word was to be learned as a unique item, which offered little if any transferrable knowledge to the learning of other spelling words. Consequently, scant attention was given to the smaller parts of words, like phonemes and morphemes; the linguistic patterns that could be used to predict connections between words. For example the bound base *rupt* that indicates the

meaning ‘to break’ could be identified in many words like *rupture, corrupt, eruption,* and *interrupt*. So, instead of memorizing each of these words as a separate item the relational approach encouraged teachers to identify the relationship between morphemes and phonemes in words.

The researcher’s emails helped to focus the teachers’ attention on a small number of words (perhaps 6-10) using a common morpho-phonemic principle. For example one email lesson focused on the -*ous* Latin suffix that means ‘full of’. Morphologically transparent teaching examples were suggested like *adventurous*, *poisonous, famous* and *gracious*. The morphemes in each of these words could be identified and contrasted with other words that had the same final sounds but different spellings. For example, some children volunteered the words ‘lettuce’ and ‘focus’ as examples of -*ous* words, because they had recognized the same final sounds. However, their teacher was observed to dismiss the children’s suggestions out-of-hand and missed the unique opportunity to confirm the children’s observation that these words *did indeed* have the same final sound as the *–ous* suffix, but the sound was not represented by the *–ous* morpheme. This is a crucial point in the learning of this concept. A particular sound, or string of sounds can, in the writing of a word, realize *different meanings* (Katamba & Stonham, 2006).

It became apparent that the intervention teachers were becoming increasingly morphemically aware as the spelling intervention progressed. The teachers were learning how words were connected by common morphemic patterns and they were learning how the identification of morphemes could give clues to the meanings of

words. Teachers were noticing how morphemic awareness changed the way they looked at words. For example, one teacher announced to her class one morning:

> "Class! I have something very exciting to teach you today. In fact it is something I only just learned last night. After reading my spelling email, I realized that I had never looked at the word "unhelpfulness" in this new way before. (*Students were on the edge of their seats!*) I was so excited about this new lesson, that I sat my husband down and gave him the lesson last night and my husband was excited too, because he had never looked at the word 'unhelpfulness' this new way before either. So I'm going to teach you about this word today."

The teacher put the word *unhelpfulness* on the board and expertly guided her class to discover the four morphemes *un help ful* and *ness.* A conversation, led by the teacher, facilitated the children's understanding of the meaning, function, look and sound of each part and how it all came together to create the word, *unhelpfulness*. The teacher had had an epiphany, and declared to the researcher after the lesson that it was an important moment for her when she was able to see how this word was made up of smaller parts of meaning. This teacher had never looked at words this way before, even though she had said before the intervention that she had taught morphology for many years as part of her spelling programme. Her spelling lessons would now be changed by this insight. Importantly, she enabled her students to identify the meaningful parts of words, to talk about the relationship between meaningful forms and the way they sound, and see that meaningful forms (morphemes) can predict the spellings of other related words. This supports the findings of the Nunes and Bryant

(2006) study that training teachers explicitly about morphemes increases teachers' morphemic awareness, and this can have a significant effect on their students' understanding of how words work.

In summary this section has described some teachers' reflections on the intervention as it progressed and some of the significant observations of *how* the intervention worked in the classroom. It naturally follows that it is important to look at the quantitative data that tells us what children were able to *do* in spelling tests. The next section reports on the impact of this spelling intervention on children's spelling performance through correct spelling scores.

5.2 Quantitative Results

5.2.1 Comparative Correct Spelling, Mean Scores

The results are revealed here through the overall average effects on correct spelling performance for each year group followed by a detailed error analysis. The statistical analysis reveals the results of two spelling tests. The first test to be delivered, pre and post intervention, was the South Australian Spelling Test (Westwood, 2005). This test determined children's ability to produce the correct spellings of target words in isolation. The second test, the Morphological Spelling Test, was a bespoke test to determine children's ability to spell morphologically complex words. The comparative means were calculated on correct spelling scores for the pre and post-tests. The intervention groups' test results are compared with the results of the comparison groups. The results reveal the significant improvements the intervention children made in spelling performances compared to the comparison group.

Table 3 sets out the comparative mean scores for the South Australian Spelling Test (SAST), pre and post intervention. The effect size is calculated for the Year 4 and Year 5 intervention groups where results were compared to the matched comparison group. Although it was not possible to generate an effect size for the Year 3 intervention groups (no matched comparison group), their results contribute significantly to the understanding and interpreting statistical data of the older children.

Values of N, Pre-mean, Pre-SD (standard deviation), Post-mean, Post-SD and *p* are taken directly from the Statistical Package for the Social Sciences (SPSS) output. Gain was calculated by subtracting Pre-mean from Post-mean. The comparison group's negative gain value means this group did not improve at all. The *p* value is a statistical measure of the difference between the two groups. For the difference between two sets of results (e.g. pre-mean and post-mean) to be statistically significant, the p-value has to be less than 0.05. If the SPSS output shows *p* as 0.000 it is always reported as <0.001. It is important to note that the *p*-values included in these tables represent the probability, or likelihood, that there is no difference between mean scores for pre-intervention and post-intervention results. If this value is less than 0.05 this difference is usually considered statistically significant. This means that there is a less than 5% probability that the result was obtained by chance. If the *p*-value is more than 0.05 the two means may still be importantly different, however, there is an increased possibility that chance factors influenced the result. The results of this first spelling test (SAST) clearly indicate that the children in the intervention groups made significantly more progress than the comparison or control groups.

The effect size is calculated as Cohen's *d* value and used here to show growth or improvement associated with this teaching intervention. In general, effect size statistics can be understood based on the work of researchers like Hattie (2009) such that:

- Effect sizes below 0.2 are considered poor, with an appropriate range of growth over an academic year for a student cohort established as within the range of 0.2 to 0.4;
- Effect size scores of 0.4 to 0.6 are considered strong;
- Effect sizes between 0.6 and 0.8 are considered very strong; and
- Effect size scores above 0.8 represent substantial improvement of the order of approximately two-three years' growth.

According to Hattie's (2009) benchmark the effect sizes calculated here indicate the impact of the intervention on children's spelling performance can be construed as poor, but it must be remembered that Hattie's effect sizes are calculated over an academic year and the present intervention was delivered in only one academic term. This is important to note and it may be reasonably inferred that had the intervention been delivered over a full academic year the effect size would have been considered strong.

Another confound that may have contributed to the weak effect size for this spelling test was the comparison groups' proximity to the intervention groups. The comparison groups were recruited from the same schools as the participating intervention groups. Therefore, a significant halo effect may have been generated by the buzz and enthusiasm for spelling that spread as a result of the initiation of the research. The comparison group data is not as clean and clear as would be expected.

It is important to note the comparison group performed significantly better in the pretest compared to the intervention group (see Table 3). The comparison group

means score was lifted by a higher proportion of good spellers in that group. The compared starting point has not been treated here as significant but the comparative movement from that starting point is the focus. It may be argued that the intervention group was simply catching up to where they should be through a maturation effect. However, I counter argue that the relatively short intervention period has produced better than expected gains for the SAST and the MST (Real and Pseudo words).

Table 3 South Australian Spelling Test (SAST)

Group	**N**	**Pre-Mean**	**Pre-SD**	**Post-Mean**	**Post-SD**	**Gain**	***p***	**Effect size**
Intervention group	222	36.10	6.229	37.86	6.172	1.76	<0.001	0.284
Comparison group	50	37.88	4.538	37.60	5.911	-0.28	0.520	n/o

Table 4 and 5 present the comparative means on the correct spelling scores for the second spelling test, the Morphological Spelling Test. The Morphological Spelling Test was designed to reveal children's morphological knowledge. This test required children to spell morphologically complex real words and they were also required to use their morphological knowledge to resolve the spelling of pseudo words. Separate results are tabled for the real words (Table 4) and the pseudo words (Table 5). Paired samples T-Tests were conducted using IBM SPSS Statistics software, Version 19. For simplicity, the individual class scores are condensed into performance scores for intervention groups and comparison groups.

Table 4 Morphological Spelling Test (MST): REAL WORDS

Group	**N**	**Pre-Mean**	**Pre-SD**	**Post-Mean**	**Post-SD**	**Gain**	***p***	**Effect size**
Intervention group	223	12.05	4.877	13.96	4.791	1.91	<0.001	0.395
Comparison group	48	13.77	4.577	15.04	4.672	1.27	<0.001	0.274

Table 5 Morphological Spelling Test (MST): PSEUDO WORDS

Group	**N**	**Pre-Mean**	**Pre-SD**	**Post-Mean**	**Post-SD**	**Gain**	***p***	**Effect size**
Intervention group	223	3.21	1.451	3.71	1.497	0.50	<0.001	0.339
Comparison group	48	3.67	1.260	3.60	1.349	-0.07	0.777	n/o

5.2.2 Summary of Results (T-Tests) for the Morphological Spelling Test

The above tables show that for the intervention group there was a statistically significant difference between the pre-intervention and post-intervention results for both the South Australian Spelling Test and the Real word and Pseudo Words in the Morphological Spelling Test ($p<0.05$). For the comparison group, there was a statistically significant difference between pre and post only for Real Words. For the other two operations there was no statistically significant difference between pre and post for the comparison group. This is, of course, expected given that the comparison group children in this study showed no improvement.

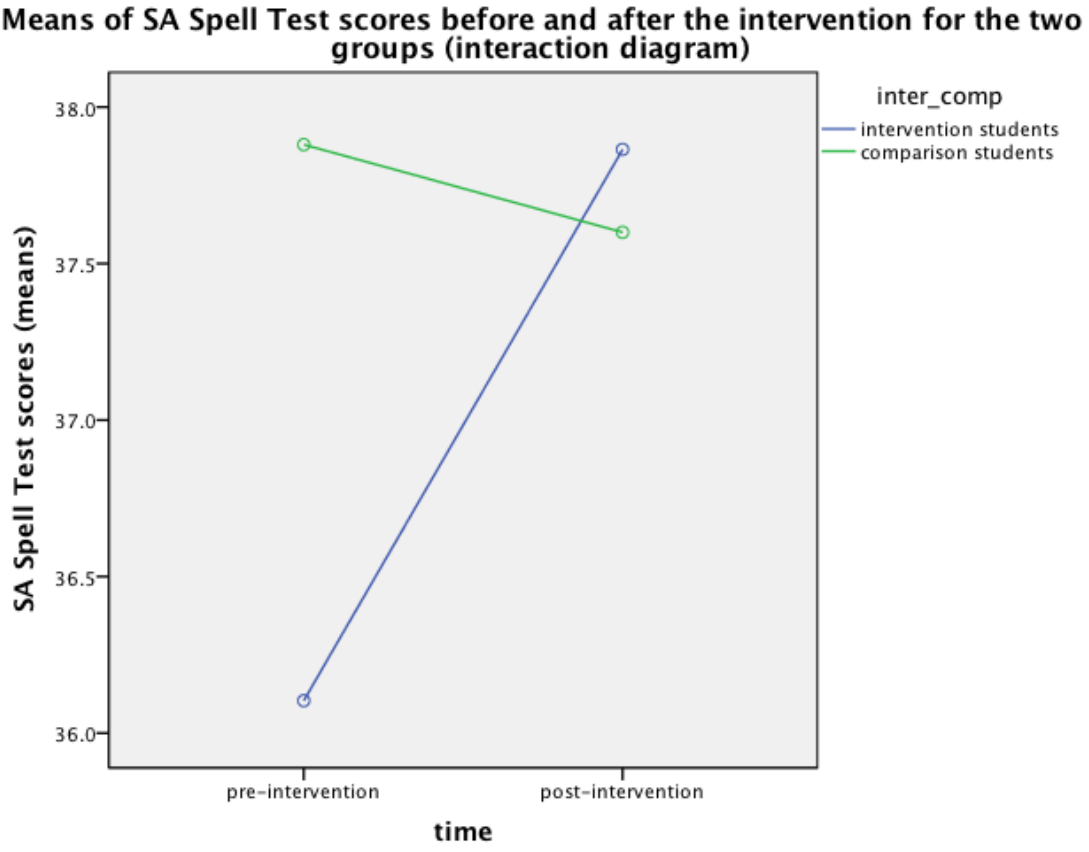
5.2.3 Summary of Results (ANOVA) for the South Australian Spelling Test (Test 1)

A two-way repeated measures analysis of variance was conducted examining correct spelling scores for the Intervention and Comparison groups as the dependent variable measured at two points in time – before the intervention and after the intervention. The difference in Real Words scores before and after the intervention was significant ($p = 0.005$, Partial Eta Squared = 0.029) (Cohen's $d = 0.345$). The difference in correct words scores between Intervention and Comparison groups was not significant ($p = 0.407$, Partial Eta Squared = 0.003) (Cohen's $d = 0.109$). The interaction between 'time' and 'group' was significant ($p<0.001$, Partial Eta Squared = 0.054) (Cohen's *d*

= 0.477). This interaction indicates that the test group (Intervention students) improved significantly more than the control group (Comparison students). The Cohen's *d* values reported above have been calculated from the Partial Eta Squared statistic provided by the SPSS ANOVA procedure using the formulas suggested by Cohen (1988).

In Figure 1 below is the interaction diagram produced in SPSS for this test. Blue is Intervention students, green is Comparison students. On the horizontal axis of Figure 1, '1' is 'pre' and '2' is 'post'. On the vertical axis we have mean values.

Figure 1

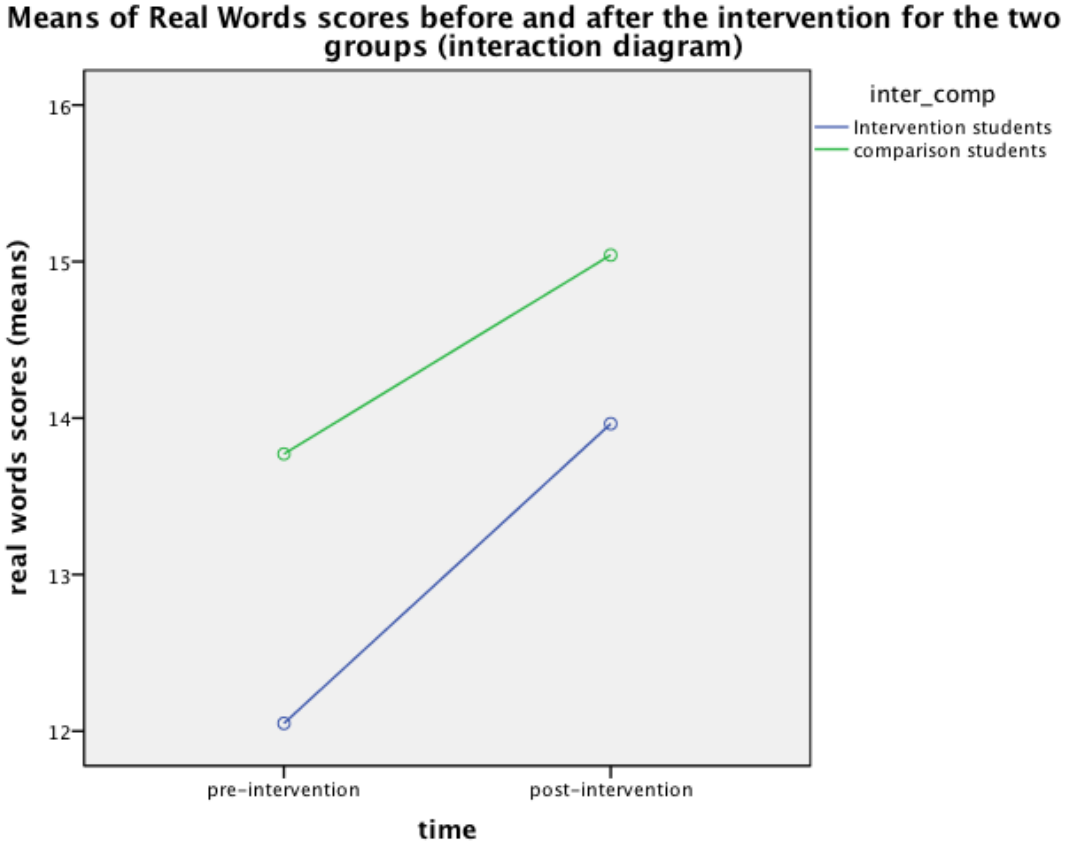


5.2.4 Summary of Results (ANOVA): Morphological Spelling Test (Test 2)

A two-way repeated measures analysis of variance was conducted examining Real Words scores for Intervention and Comparison groups as the dependent variable measured at two points in time – before the intervention and after the intervention. The difference in Real Words scores before and after the intervention was significant ($p<0.001$, Partial Eta Squared = 0.175) (Cohen's $d = 0.921$). The difference in Real Words scores between Intervention and Comparison groups was almost significant ($p = 0.058$, Partial Eta Squared = 0.013) (Cohen's $d = 0.229$). The interaction between 'time' and 'group' was not significant ($p=0.128$, Partial Eta Squared = 0.009) (Cohen's $d = 0.766$). This interaction indicates that the test group (Intervention students) did not improve significantly more than the control group (Comparison students) in the second spelling test.

In Figure 2 below is the interaction diagram produced in SPSS for this test. Blue is Intervention students, green is Comparison students. On the horizontal axis of Figure 2, '1' is 'pre' and '2' is 'post'. On the vertical axis we have mean values.

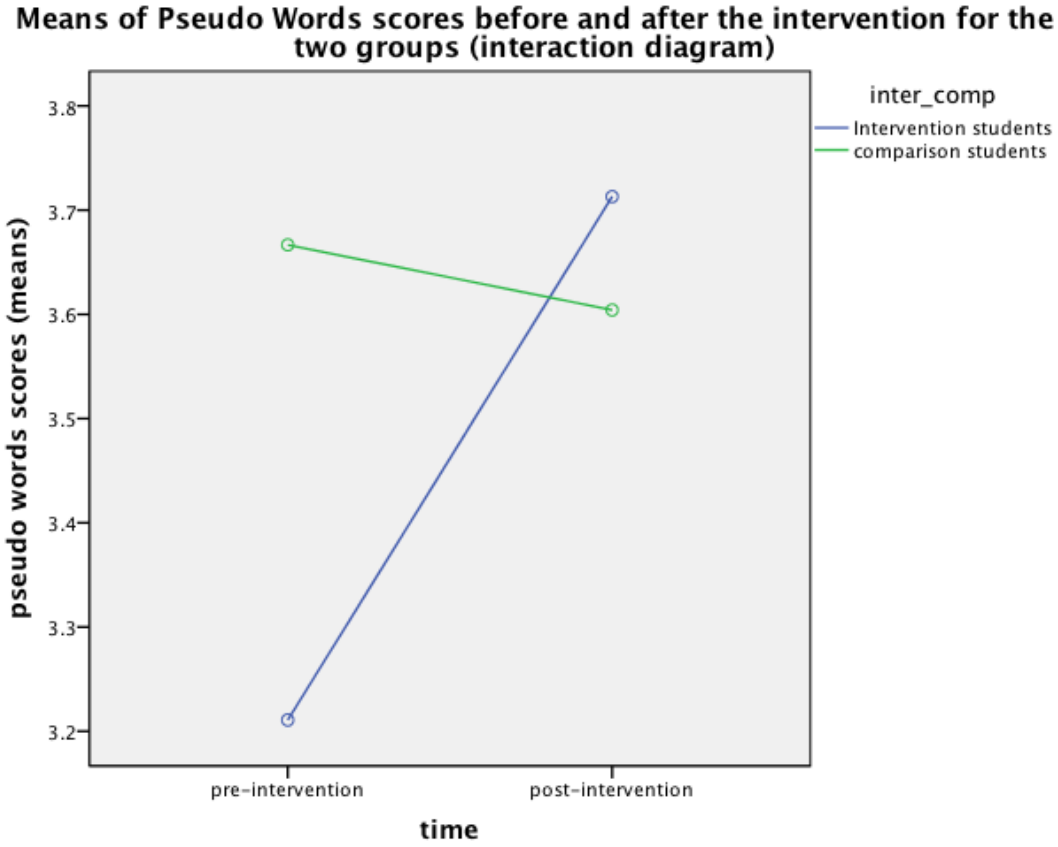
Figure 2



A two-way repeated measure analysis of variance was also conducted by examining Pseudo Words scores for Intervention and Comparison groups as the dependent variable measured at two points in time – before the intervention and after the intervention. The difference in Pseudo Words scores before and after the intervention was significant (p = 0.047, Partial Eta Squared = 0.015) (Cohen's *d* = 0.247). The difference in Pseudo Words scores between Intervention and Comparison groups was not significant (p = 0.391, Partial Eta Squared = 0.003) (Cohen's *d* = 0.109). The interaction between 'time' and 'group' was significant (p=0.011, Partial Eta Squared = 0.024) (Cohen's *d* = 0.313). This interaction indicates that the test group (Intervention students) improved significantly more than the control group (Comparison students) for Pseudo Word scores.

In Figure 3 below is the interaction diagram produced in SPSS for this test. Blue is Intervention students, green is Comparison students. On the horizontal axis of Figure 3, '1' is 'pre' and '2' is 'post'. On the vertical axis we have mean values.

Figure 3



It can be safely concluded from these results that children improved spelling performance in two spelling tests completed before and after a short intervention as compared to the comparison group. These results however only reflect the *correct score data,* and though important, provides a limited interpretation of the spelling intervention's effect. To understand the full impact of the intervention requires a detailed analysis of the nature of children's spelling errors made in these tests. The following subsections reveal some startling results.

5.3 Rationale for Spelling Error Analysis of words in MST (Test 2)

Even though correct spelling is the target for efficient and meaningful writing, correct spelling performance tells us nothing about *how* the task was accomplished, or what the finer changes in performance might look like before the target performance is reached. Spelling errors provide a unique opportunity to observe the written evidence of what children might think about to produce the spelling of a word. Importantly, the analysis of spelling errors can show how children's concepts or ways of thinking about spelling, as a result of time and teaching, changes. To develop a comprehensive understanding of the processes involved in children's development of spelling we need a detailed quantitative and qualitative analysis of spelling errors.

Spelling error analyses in the literature typically focuses on the ability or inability of children to make sound to letter correspondences (Henry, 2003; Nolan, 2007; Moats, 19995a). For example, errors are often categorized into groups, such as, Phonetic Errors, Semi-phonetic Errors and Dysphonetic Errors (letters used in a word that do not correspond to any of the sounds in that word). In addition to this, visual letter-confusion (transposing letters) and the use of irregular spelling rules are often identified, as well as the identification of legal or illegal letter patterns (Treiman & Bourassa, 2000). These types of error analyses follow the framework of the stage models of spelling development and most often highlight, in isolation, either children's orthographic knowledge or children's ability to perform appropriate phoneme-grapheme mappings (Bahr, Silliman & Berninger, 2009).

Spelling error analyses that investigate children's fine-grained development of written morphological knowledge is rarely addressed or made the focal point. The present

study builds on the seminal work of Nunes and Bryant (2006, 2009) by not only identifying children's correct spelling of morphemes, but also analyzing a wide range of children's morphological spelling errors that would otherwise be overlooked. This type of error analysis uncovers what the fine changes in children's morphological knowledge might look like.

Building on the important work of Nunes and Bryant (2006), the words of the Morphological Spelling Test (MST) were specifically chosen for their morphological complexity and designed to reveal something about children's morpho-phonogical knowledge. There were two parts to this error analysis. In the first, each correct morpheme was counted. So for example, if a word had two morphemes, as in the word *musician (music +ian),* a possible two points were allocated. As the MST had real words and pseudo words it was theoretically possible to receive a score of 21 points for all correctly spelled real word morphemes, and an additional 6 points were allocated for all correctly spelled pseudo word morphemes. By shifting the focus of analysis to the production of correct *morphemes* in spelling, it was possible to ascertain the delicate details of children's developing spelling knowledge in their performance that forms the basis for the think aloud data that followed.

The second part of the error analysis focused on the linguistic nature of the spelling errors and the qualitative differences that existed between each spelling error, pre to post-test. This analysis identified as significant children's attempts to use their phonological and morphological knowledge to spell words even if their spelling attempts were incorrect. So, in this part of the error analysis, the researcher is not looking for correct spellings of phonemes and morphemes, but looking for a

qualitative shift between the linguistic nature of the spelling approximations in the pre-test and the corresponding spelling in the post-test. Therefore it was expected that this type of analysis would reveal a movement as a result of the intervention from phonologically based spelling approximations to morphologically based spelling approximations in the post-test. This type of analysis is complex, but it has significant potential to inform diagnostic and instructional practices. The implications are discussed at some length in the conclusions.

5.3.1 Qualitative spelling approximation analysis

The rather static comparative mean scores described in the previous subsection are a condensed summary of the data, which necessarily, presents a narrow view of what children as a group can *do* at a particular point in time. In order to avoid a reductionist view, where inferences and conclusions are made based only on averaged and condensed data, this thesis also investigated the qualitative differences in children's spelling approximations by looking at individual examples of spelling pre and post-test. Table 6 reveals some samples of Year 3 spelling approximations in the MST. Each row in Table 6 and Table 7 refers to a different student.

Table 6 Samples of Year 3 errors in Morphological Spelling Test

Yr.3	***PRE TEST***	***POST TEST***	***Target***
1. a	mast	magitien	***magician***
b	ontf	orplted	***opened***
c	mesand	muitian	***musician***
2.a	samt	stadment	***statement***
b	otme	oped	***opened***
c	chilters	childen's	***children's***
3.a	broutheres	brother's	***brother's***
b	childrenes	children's	***children's***

4a.	magicition	magician	***magician***
b	musicition	musician	***musician***
5.a	emotchen	emosion	***emotion***
6.a	braths	brothers	***brother's***
b	chelgens	childrens	***children's***
7a.	stantment	statement	***statement***
b	mandnees	madness	***madness***
c	musn	musicen	***musician***
8a.	magition	magician	***magician***
b	musition	musician	***musician***
9.a	mudish	mudishen	***magician***
b	opnl	opent	***opened***
c	manss	madnes	***madness***
d	chrinss	childrns	***children's***
e	brufs	bruthes	***brother's***
10.a	mussishion	musicion	***musician***
b	emossion	emotion	***emotion***
11.a	chedens	chigrend's	***children's***
12.a	keles	careless	***careless***
13.a	stment	statement	***statement***
14.a	***rissness***	***richness***	***richness***

Tables 6 and 7 present a representative selection of the most common spelling approximations children made in the MST, before and after the intervention. This includes examples of spelling from some of the poorest spellers in the study. Table 6 gives examples of the types of spelling approximations children made who were in Year3. Table 7 gives examples of Year 4 students' spelling approximations in the same test. These spelling approximations provide valuable insights into the way children use spelling knowledge and what might be going wrong. A detailed analysis and discussion of these spelling approximations follow.

Table 7 Samples of Year 4 errors in Morphological Spelling Test

Yr.4	***PRETEST***	***POST TEST***	***Target***
15.a	rignest	richness	***richness***
16.a	satment	statement	***statement***
b	richnce	richnes	***richness***
c	bruthers	bruther's	***brother's***
d	coldrens	choldren's	***children's***
17.a	meighslion	magicain	***magician***
b	emoision	emotion	***emotion***
18.a	mewshison	musision	***musician***
19.a	mginr	murchishin	***magician***
b	opind	opened	***opened***
c	madnes	madness	***madness***
d	cerles	cerless	***careless***
e	richnes	richness	***richness***
f	chilchrins	chilchren's	***children's***
20.a	magicion	magician	***magician***
21.a	chrennes	chilldren's	***children's***
22.a	magson	meghion	***magician***
b	opend	opened	***opened***
c	madnes	maddness	***madness***
d	carles	carelless	***careless***
e	bothers	brouther's	***brother's***
23.a	seatment	statement	***statement***
b	mugen	maugican	***magician***
c	brothers	brothere's	***brother's***

In the Morphological Spelling pretests the poorest spellers often struggled to make accurate sound to letter correspondences In Table 6 there are a number of examples of this: 1a, 1b, 1c, 2a, 2b, 6a, 6b, 9a-e. Children produced spelling approximations in the pretest like, *mast* (target word: *musician*) and *samt* (target word: *statement).* These examples highlight these children's limited ability to make connections between letters, sounds and their meaningful parts. Interestingly, after the intervention these

children were able to produce spelling approximations like, *magitien* (target: *magician*) and *stadment* (target: *statement).* Even though the target word was not achieved, it is important to evaluate the considerable development of their spelling knowledge through these spelling examples. The child who spelled the word *samt* in the pretest*,* and then was able to produce *stadment* in the post-test has made extraordinary progress. These errors reveal the simultaneous development of morphological and phonemic knowledge, as the child applies the correct suffix and produces a closer phonemic representational fit between sounds and letters in the base word. It may be inferred that as this child becomes increasingly morphologically aware, as he has also become increasingly phonemically aware. This suggests a parallel growth, or flow on, into the phonemic of the morpho-phonological development.

Parallel growth in phonemic and morphological development can be supported by many spelling approximation examples in the data that were analyzed and compared between pre and post-test, but one particular sample from the Morphological Spelling Test is most striking. Table 6, *1b* displays the spelling approximation *ontf* for the target word *opened* in the pretest. This spelling approximation suggests this child (Year 3) struggles profoundly with the spelling of words. This pretest sample also reveals that this child has extremely limited phonological and morphological knowledge. This is evident in the inaccurate sound to letter representations in *ontf,* and the creation of a spelling approximation that only represents one morpheme, where the target word *opened* represents two morphemes. After the 10-week intervention the same child was able to produce the spelling approximation *orplted* for the target word *opened.* This shows a significant improvement in sound to letter

correspondences suggesting phonemic development, the /o/, the /p/ and the /d/ ending sound are represented by appropriate letters, and importantly, this spelling approximation represents two clear morphemes *orplt (open) +ed (past tense)* revealing morphemic development. This pre and post-test sample suggests this child has made a dramatic shift in spelling performance and understanding by learning and incorporated new information about the sounds and the meaningful forms of words, simultaneously, despite the child's significant spelling disability.

There is further evidence that children use their phonological and morphological knowledge, simultaneously, to solve spelling problems. In Table 6 and 7 there are a number of examples where children have attempted to write the words *children's* and *brother's*. In *11a* (Table 6) and *21a* (Table 7), for example, the children wrote *chedens* and *chrennes,* respectively, for the target word *children's* in the pretest. Even though the target word was delivered in the context of a sentence by their teachers, the students ignored the *'s* unit of meaning, and wrote down the letters that represented the most salient sounds. After the intervention, the students were able to write *chigren's* and *chilldren's.* These spelling approximations are further evidence that even though the students had not produced the correct spelling of *children's* in the post-test these students had progressed significantly, in two ways. Firstly, these children had used a better representational fit between phonemes and graphemes. Secondly, the post-test spelling approximations, *chigren's* and *chilldren's,* demonstrate both the students' developing complex morphological knowledge by using a base morpheme followed by a possessive apostrophe before the *s*. These post-test examples clearly indicate that the students are not just writing to transcribe sounds, they are also writing to transcribe meaning. A reminder that teaching spelling

must go beyond the teaching of sounds. What is remarkable about these misspellings, and cannot be overlooked, is the fact that after the intervention these struggling spellers are paying more attention to both phonemes and morphemes, simultaneously, as they write words.

5.3.2 Error analysis of pseudo words

The error analysis of the pseudo words *slupless, reblod* and *lagician* involved the qualitative appraisal of children's attempts to spell these words, pre and post-test. This was done in order to discern if the children had incorporated new transferrable knowledge about the structure of words. The inclusion of pseudo words for error analysis has the potential to open up a unique perspective on the finer details of change in children's spelling performance. Children's spelling approximations of pseudo words aids this thorough investigation into not just what children can spell, but what children can do with phonemic and morphemic knowledge to solve spelling problems.

5.3.3 Evidence of Phonological knowledge

Not surprisingly, the pretest analysis of children's spelling approximations of the pseudo words *slupless, lagician* and *reblod* revealed that children often relied on a phonological strategy, such as sounding out, to transcribe the most salient sounds they thought they could hear in these pseudo words. Table 7 below gives a number of examples of this type of spelling that reflects a dominant phonological solution to the given spelling problem. For example the spelling approximations *sluples (target: slupless), largishen (target: lagician)* and *riblod (target: reblod)* are clearly letter strings that reflect perceived sounds. These spellings fail to treat the meaning, or

function, of the required affixes as significant. It may be inferred here that these examples reflect a dominant phonological approach to the spelling of these words. It is also important to note that it was rare to find illegal combinations of letters and most words looked as if they could indeed be English words. This would suggest that even though children were transcribing sounds they thought they heard in the pseudo words, they were simultaneously creating one-morpheme word forms that reflected their English orthographic knowledge. Table 8 gives some samples of pseudo word spelling in the MST.

Table 8 Samples of Pseudo word errors in Morphological Spelling Test

Pseudo		***Target***
Phonological		
sluples		***Slupless***
slubles		
sloples		
slaples		
Morpho/phono	*Morpho/phono*	
suluds	slupness	***Slupless***
slups	shipness	
slugless	sluplest	
slopless	slubless	
slapless	slopeless	
slutless	slumpless	
soupless	slumblest	
slumless	sleepless	
slagless		
sluckless		
sloopless		
lapness		
slucklest		
Phonological		
lugish		***Lagician***
lugishen		
largishan		
lerjishon		
ladgishin		
lageshin		
laghin		
Morpho/phono	*Morpho/phono*	
lagicshion	lamagiction	***Lagician***
lugition	lagichin	

largishion	logiction	
ladishion	lagitian	
lagiction	lungician	
lagicsion	lagicdishion	
Phonological		
riblod		***Reblod***
reeblod		
reablod		
reiblod		
wreablod		
reblode		
Morpho/phono	***Morpho/phono***	
reblood	rebloped	***Reblod***
rebold	reablood	
rebled	rebowled	
reblond	rebloded	
reploped	replayd	
reblog	reblow	
reblot	realbled	

The analysis of the pseudo word, *reblod,* provided some excellent examples of the way children use sounding out, while simultaneously drawing on their extensive orthographic knowledge. Common phonemic responses of this type included *reeblod,* and *reablod.* Again, these letter strings clearly indicate a dominating phonemic strategy where children have transcribed the sounds they thought they heard using legal letter combination to create a one-morpheme word with no prefixes or suffixes. Some less common, but more complex sound to letter solutions included words like *wreablod, rieblod* and *reybold.* These examples show how children use less common letter combinations, but quite sophisticated letter patterns to transcribe sounds and create plausible English words.

Incidences of these types of spelling approximations were found in every classroom, across every age group before and after the intervention, and across the comparison groups. Of particular interest was the use of sounding out strategies, not just by

younger or weaker spellers, but also by the highest performing spellers on the SAST (Westwood, 2005).

Interestingly, children often used phonological information from the pseudo base word to create a real word in its place, creating words like *slapless, slagless, slutless,* and *slugless.* The phonemes represented in these real word bases are very close to the phonemes of the pseudo word base, *slupless,* and it may be that children have simply slipped automatically into creating a real word in place of the unfamiliar, made-up word, or perhaps the sounds in the real words are just what they thought they heard. However, as the error analysis progressed it became strikingly apparent that many children were creating some unique and complex morpheme combinations that go beyond simple explanations.

5.3.4 Evidence of Morphological Knowledge

Regardless of age or spelling ability, many children were creating complex morpheme combinations in response to the spelling of the pseudo words *slupless, reblod* and *lagician.* Some children had written for example, *soupless, shipness* and *sleepless* for the target word *slupless.* These spelling approximations are sophisticated spellings. To write the base words *soup, ship* or *sleep* instead of *slup* suggests that morphological knowledge was dominating the spelling performances of these children, at this time. Or perhaps, it is a demonstration of the way the drive to make meaning tends to override other aspects of language use for competent language users. If so, this would support the use of meaning-based spelling tuition.

Further interesting examples of this occurrence are found in the writing responses to the pseudo word, *lagician.* It was anticipated that *lagician* would be the most difficult pseudo word for the children to spell, because of the pronunciation shift between the base word *lagic* and the target word, *lagician.* It was hoped that many children would use the analogy between *lagician* and *magician* to assist their spelling. If this analogy was not apparent, it was expected that many children would use a sounding out strategy to spell this word. Encouragingly, the post-test revealed many children were able to transcribe the meaningful *–ian* person noun suffix and spell this word correctly. However, it was the spelling approximations of *lagician* in the pre and post-tests that revealed the most interesting results.

The spelling approximations analyses for the pseudo word *lagician* revealed significant insights into the way children were developing and attempting to integrate complex spelling knowledge. The analysis of spelling approximations *lungician, lagicdishion, lamagiction* and *lagition*, in particular, revealed that children were using both their phonemic and morphemic knowledge at the same time. In the first example, *lungician,* the child has transcribed the perceived sounds of the base word and then attached an appropriately spelled suffix *–ian.* A sounding out strategy would not have assisted this child to solve the problem of how to spell the *–ian* suffix. This is important to notice, because the child has made a shift between phonemic and morphemic strategies in the middle of writing the word *lungician*. If the child was using only sounding-out, the ending would most likely show a common *sh* to indicate that sound. The child has clearly used a sounding out strategy for the base word and then used complex morphemic knowledge to determine the suffix.

Similarly, the second example *lagicdishion* reveals the complexity of children's developing spelling knowledge. This example shows a correctly transcribed base word *lagic*, then extra letters to represent perceived sounds in the word, *dish,* followed by a suffix -*ion*. The suffix is incorrect, but nevertheless a very close resemblance. This example suggests the child is using both phonemic and morphemic knowledge together to create this meaningful form.

The third example, *lamagiction* is evidence that this child is using analogy to solve this spelling problem. The analogous word *magic* is embedded within the child's created word despite there being no /*m*/ sound in the target word *lagician*. The analogous use of the word *magic* has dominated the middle of the spelling approximation, followed by a morpheme *tion* on the end. This example again shows how children use phonemic and morphemic knowledge together. The child has created a base word *lamagic* and attached a suffix –*tion.* Again, the suffix does not reflect the target meaning delivered in the grammar of the chosen sentence, but it does show the child is using morphemic and phonemic knowledge. In fact, this example suggests that the child's morphemic knowledge is dominating the performance of this word.

The fourth example, *lagition,* was a very common spelling approximation, particularly in the post-test and significantly less prolific in the comparison group spelling (see Table 9). This spelling approximation*,* as reported in the examples above, gives research a unique opportunity to reflect on the complexity of children's developing spelling knowledge. This sophisticated spelling approximation economically reflects the perceived sounds in the target word (*lagician*), while clearly

creating a letter string that represents two morphemes (like the target word). The – *ion* suffix is not the target morpheme for this pseudo word, but it was commonly used by children in their spelling approximations for this word. Perhaps children were more likely to use the *–ion* morpheme because *-ion* is a more common suffix than the target suffix *–ian.*

Table 9 Frequency of Pseudo word misspelling

Pseudo target word: LAGICIAN Incidence of error production: LAGITION Intervention Groups				
	Pre Test		***Post Test***	
	Raw Score	%	*Raw Score*	%
Year 3	9	8.46	14	13.16
Year 4	10	16.4	32	52.48
Year 5	6	2.75	11	4.95
Comparison Groups				
	Raw Scores	%	*Raw Scores*	%
Year 4	1	1.5	1	1.5
Year 5	6	1.92	4	1.28

Even though writing the word *lagition* (target word *lagician*) would not qualify for any points to be awarded for correct spelling (even at the morpheme level) it is crucial to recognize that the production of this spelling approximation marks a dramatic shift in the intervention children's spelling ability. Table 10 gives a representative sample of the intervention children's spellings pre and post-test, with their spelling ages determined on the SAST (Westwood, 2005). In the pre test column it is evident that children have written down the most salient sounds to assist in the creation of a word form to represent the pseudo word, *lagician.* The corresponding performance for each child, for that word in the post-test, reveals a profound change. After the intervention period these children no longer used a dominant sounding out strategy, but used phonemic and morphemic knowledge together, relating these two linguistic concepts to solve this spelling problem.

It is also significant that behind these spelling approximations is a broad range of spelling abilities. Pretest spelling approximations, for example, *lugsh* (9) and *lugsint* (10) in Table 10 are evidence of children making poor sound to letter representations, and yet these children are able to produce *lagition* in the post-test. Again, this may suggest that even younger children, or children with poor phonemic awareness could benefit from explicit instruction about morphemes.

Table 10 Samples of common misspelling for Pseudo word: LAGICIAN

Target Pseudo Word: Lagician		
Pre Test	***Post Test***	***Spelling Age***
1 ladishen	lagition	11.2 years
2 lergion	lagition	9.6 years
3 lagishan	lagition	11.5 years
4laginsihn	lagition	10.8 years
5 lagison	lagition	10.8 years
6 laresen	lamagiction	10.5 years
7 ligishon	lagition	12.2 years
8 ligican	ligition	11.2 years
9 lugsh	lagition	9.4 years
10 lugsint	lagition	8.10 years
11largishion	lagiction	9.11 years
12ludgeishin	lagiction	10.8 years

Lastly, and perhaps most interesting were children's unique written responses to the pseudo word, *reblod.* Many interesting examples were found, such as *reblond, reblot, respot and replod.* These examples may simply be reflections of individual perceptual interpretations of the sounds children thought they heard. However, what cannot be overlooked are the more complex morphological manifestations, for example in *reblood, reblooded, rebowled, replayd, readblood* and *realbled.*

The production of *reblood* was particularly interesting because it was written by 26 children over a range of spelling ages and classrooms in the pretest, and 28 incidences

were found in the post-test. The range of spelling ability for children writing *reblood* in the pretest started from a spelling age of 8years 4months to a spelling age of 11years and 2 months (spelling age determined by SAST Westwood, 2005). In the post-test, however, the writing of *reblood* began to appear later in children with a spelling age of 9years 1 month through to children with a spelling age of 13 years. This shift suggests that between the pre and post-tests children were increasingly writing for meaning, rather than relying on sounding out alone.

In the first analysis, children's frequent writing of the word *reblood* was puzzling. Why would children use two *o*'s to represent the short vowel sound heard in *reblod,* when two *o*'s never represent this short vowel sound in English orthography. It is unlikely that children have relied exclusively on their phonemic knowledge to produce the word *reblood.* It is more likely that children's morphemic knowledge is dominating the performance of this word. The common word *blood* is readily accessed, despite the different sounds in the word *reblod.* Similarly, in the spelling approximation *replayd,* it may be that familiar morphemic knowledge has dominated the performance of this word. However, in the spelling approximations *reblooded* and *rebowled* children have gone even further by adding the *ed* suffix to indicate past tense despite the grammar of the context sentence not requiring it. Children's writing of *readblood* and *realbled* reveal children's creative writing at the word level as they compound real words to make meaningful forms. Children in the current study have written words that *look* meaningful and have treated the markers of sound in the target word as less significant.

5.4 Summary

These findings suggest it is possible to improve the performance of children's spelling by teaching children explicitly about the relationship between phonemes and morphemes, together. Prior to this intervention, all the teachers had taught spelling strategies in isolation, one after another, and had primarily focused on phonics and letter patterns that omitted, or marginalized, essential information about morphemes. All the teachers in this intervention acknowledged a new way of *seeing* the structure of words and how this structure determined spelling patterns that represented both sounds and meanings. The teachers' insights were the driving force behind a successful, but short intervention period. These teachers improved children's ability to treat as significant the smaller meaningful parts of words and initiate the process of integrating morphemic knowledge with children's established phonemic knowledge.

The power of the intervention is found in the qualitative analysis of children's spelling approximations, even though the quantitative data revealed the intervention had a weak overall effect on *correct* spelling scores. The evidence born from a thorough analysis of spelling approximations of real and pseudo words discovers that children were using both phonemic and morphemic knowledge, simultaneously. The post intervention results show that with specific instruction that develops children's awareness of morpho-phonological relationships in written words, children will spell, even unfamiliar words, primarily for meaning.

Chapter 6

Results

What knowledge do children use when reasoning about spelling?

6 Introduction

While the focus of the present study has been to explore the value of morphological knowledge in the development of children's spelling ability, an important aspect of the study has been to analyze the links between spelling performance and the way children think about and understand spelling, in other words, to analyze how children apply what knowledge they have, both phonological and morphological, to the spelling process. Such an analysis will play an important role in answering Research Questions 2 *(Does teaching children about the relationship between sounds and meanings in words contribute to spelling achievements in spelling tests?)* and Question 3 *(What knowledge do children use when reasoning about solving spelling problems?)*, which both relate to the link between children's knowledge and understanding and the development of their spelling performance.

This chapter builds on the work of Nunes and Bryant (2006) and Critten, Pine and Steffler (2007) by extensively reporting on what children 'think' about, or what they understand about spelling through the analysis of their reasoning and justification of spelling choices. As these researchers found, the meta-language and meta-cognition

that children develop for the special purpose of thinking and talking about spelling is crucial to understanding children's development of spelling knowledge.

The insights into children's understanding about spelling reported in this chapter have been gained first, by documenting what children are able to tell us explicitly about word structure and then, by describing and analyzing this verbal data.

As argued in the literature review, Chapter 2, it is crucial to discover children's spelling concepts, or what they think about to spell words, because our spelling concepts are an integral part of our spelling knowledge and are likely to drive our spelling behaviour (Fraser, 2006). However, when children write down a word, we can only *infer* the knowledge they have used to spell the word. A correctly written word, for example, does not reveal whether the child used specific knowledge or understanding. Children may simply have automatic recall for some words. That is, children may just be able to spell some words implicitly without consciously understanding why words are spelled that way. By collecting children's verbal responses to set tasks that require their deeper thinking to justify and reason about spelling, then we begin the process of teasing out the implicit (*just know it's spelled that way*) from the explicit (*knowing the how and why it's spelled that way*) and examine the way children use both implicit and explicit spelling knowledge to assist spelling performance.

Karmiloff-Smith's (1992) general cognitive model was adapted here for the special purpose of identifying implicit spelling knowledge from explicit spelling knowledge and coding them for analysis. Karmiloff-Smith's (1992) model comprises a series of

distinct levels from an initial implicit level through to increasingly explicit (E1, E2 and E3) levels that reflect the process of developing knowledge and the range and type of knowledge children store in their cognitive systems. This framework also reveals the *fine-grained* transitional process as children's spelling knowledge changes and becomes increasingly explicit. In other words, this framework is particularly suited to analyzing the subtle changes of children's developing spelling knowledge as it shifts from unconscious, reflexive, implicit knowledge to increasingly conscious, considered, explicit knowledge expressed through children's talk about spelling.

There has been some debate about the validity of using verbal response data (e.g. Ericsson and Simon, 1993); however, Coyne (2008) concluded from extensive testing that verbal responses are an effective, reliable and valid method (Devonshire & Fluck, 2010) for examining children's thought processes. The present research addresses the need to explore children's reflections on morphology, and to understand approximation (growth) in spelling awareness even if the lack of accurate spelling is in evidence. There is a real need to explore spelling development on a continuum of increasing explicitness rather than as an either/or achievement.

Two children from each classroom (total $n = 24$) were randomly chosen by their teacher, following the written tests described in Chapter 5. After formal consent was received from each child and their parents the next phase of the study could begin. Each child was interviewed individually and required to complete three tasks under the direction of the researcher. These tasks were designed to extract verbal responses that had the potential to reveal the extent of each child's spelling knowledge before and following the spelling intervention. This aspect of the study follows closely the

work of Nunes and Bryant (2006).

The first undertaking involved a relational reasoning task that required each child to read isolated words in two columns that were positioned side-by-side (see Appendix E). Each child was asked to read each word, and then consider the relatedness of the word pairs formed across the two columns. The researcher then asked the participant to talk about their reasoning. These pairs of words were created to find out if the children could identify and reason as to why these words were related to each other, or not, and if so, why. Some paired examples were *moth* and *mother, help* and *unhelpfulness, know* and *knowledgeable*. The goal of this task was to discover, through the children's verbal responses, the extent of each child's meta-cognitive understanding about word structure, and the meta-language they used to express that understanding. When the child indicated that either the words did, or did not relate or connect to each other in some way, the child was then asked to explain why. The follow-up question of *why* or *how* words were related to each other or not, was important in discovering if the child noticed morphemes and phonemes as a significant pattern connecting words, or whether they just saw each word as unrelated letter strings.

In the second task all the participants were given three groups of four words before being asked to identify which word did not belong in each word group, and then talk about *why* they chose that word. For example Group 3 contained the words, *fused, used, useless* and *usage.* The word *fused* does not belong in this group, because it does not contain the morpheme *use*. The goal of this task was investigate the type of knowledge children exploit when solving spelling problems. In particular, this task

investigated whether children used their morphemic knowledge implicitly or explicitly to solve spelling problems. A child using their implicit morphemic knowledge may identify *fused* as the word that does not belong in the group, but be unable to explain or justify their choice. A child using explicit morphemic knowledge could also identify *fused,* but go on to explain their reasoning. For example, reasoning may have included that *fused* has a distinctly different meaning to the others and that the other words are connected by word *use*. This task forced children to analyze the group of words and hypothesize about the reason *why* one word didn't belong in the group even when they were unsure about a word's meaning, or a word was mistakenly identified. In this task children were again encouraged at every opportunity to talk about what they knew, and why. This task generated the talk data necessary to identify those children able to treat the sub-lexical parts of words as significant from those children who relied on extrinsic world knowledge to solve spelling problems.

In the third task all the children interviewed were shown a word like *opened* alongside two incorrect spellings of the same word (e.g. *opend* and *openned*). The child was then asked to identify the correct spelling and justify the choice. For example they were asked, 'Why is that spelling (*opend*) incorrect?' The child may answer, 'Cause it doesn't have an *e* in it.' The researcher encouraged the child further by asking, 'Why do you need an *e*?*'* The child may respond, 'Cause the *ed* tells us it's in the past.' The goal of this task was to investigate the depths and extent of each child's word structure knowledge by asking many questions that continued the conversation between the child and researcher.

Each verbal response for each task for each child was scribed and taped for later analysis. The next sections report on the findings using Karmiloff-Smith's (1992) representational redescription framework for coding the verbal responses.

6.1 Children's verbal responses

6.1.1 Implicit Level Verbal Responses

Children who made no attempt to form a justification or reasoning in response to a chosen spelling belonged to the implicit level category. That is, these children made spelling choices, correctly or incorrectly, and did not give evidence through their talk that they understood why they made those choices. Table 11 sets out three samples of implicit level verbal responses from the three different exercises the children were asked to respond to.

Table 11 Implicit Level Verbal Responses

Sample Response 1 from Exercise 1(see Appendix E) **Researcher**: Do the words *know* and *knowledgeable* relate to each other, or are they connected to each other in some way? **Child**: Yes. **Researcher**: How do you know? **Child**: I don't know. They just are.
Sample Response 2 from Exercise 2 (see Appendix E) **Researcher:** Which word in this group do you think doesn't belong? **Child:** That one (*points to fused*) **Researcher:** Why did you pick that one? **Child:** I don't know

Sample Response 3 from Exercise 3 (see Appendix E)

Researcher: Why is *opend* spelled incorrectly?

Child: I don't know. It just looks wrong.

Implicit level responses indicate that some children were unable to justify correct or incorrect spellings of words and were unable to recognize and explain word components that were similar. For example, in the pretest interviews children were asked whether the word *help* was related to the word *unhelpfulness.* Nine children (out of 24 children) said these two words were not related, and those children who could say that they were related, were unable explain how they came to this conclusion. These types of verbal responses were coded at an implicit level.

Interestingly, many children also drew on their extrinsic world knowledge in the absence of explicit word level knowledge. This type of response was also coded as an implicit level response. Table 12 sets out two more examples of this type of implicit level response.

Table 12 Samples of Implicit Level Responses

Sample Response 4 from Exercise 1 (see Appendix E)

Researcher: Do the words *cook* and *look* relate to each other, or are they connected to each other in some way?

Child: Yes, because when you cook you have to look at what you're doing.

Sample Response 5 from Exercise 1 (see Appendix E)

Researcher: Do the words *help* and *unhelpfulness* relate to each other, or are they connected in some way?

Child: Yes, because help is when you help someone and unhelpfulness is when you don't.

Sample Responses 4 and 5 in Table 12 are extrinsic real world knowledge responses. They are not incorrect, but they reflect the child's use of real world knowledge to solve spelling problems, in the absence of explicit morphemic knowledge about word structure. Importantly, this type of implicit level response may also reflect children's powerful drive to make meaning that underlies all children's work on spelling. Perhaps children need to make spelling meaningful, but their attempts to do this can be more or less language savvy.

6.1.2 Verbal responses coded at explicit level E1

The emergence of explicit level spelling knowledge expressed in a verbal response is marked by Karmiloff-Smith's (1992) E1 level. At this level children begin talking about the sub-lexical components of words as they attempt to solve spelling problems. When children were asked, for example, if two words were related or connected to each other some way, children at this first explicit E1 level began to notice incidental features of words that while not necessarily incorrect did not directly address the issue of relatedness in a morphological sense. Before the intervention, sixteen out of the twenty-four children interviewed for this task said that the words *moth* and *mother* were related because these words begin with the same letter string. Even though these words do begin with the same letter string, this analysis has led the children to an incorrect assumption. All the intervention and comparison group children before the intervention, regardless of age or spelling ability, noticed a varying number of letter string patterns as significant, but in the discussions they were unable to talk about the

significance of letter strings related to meanings or sounds. Significantly, after the intervention all the intervention children were able to identify connections between letter strings, meanings and sounds for *some* words. The comparison group children did not develop a way of talking about words in this way. The following samples in Table 13 further illustrate this point.

Table 13 Sample of emergent Explicit Responses coded at E1 level

Sample Response 6 from Exercise 3 (see Appendix E)
Researcher: Which word in this group is spelled correctly? (*golled, gold, goled*)
Child: That one. *(Child identified correct spelling: gold)*
Researcher: Why is the word *golled* incorrect?
Child: Cause it has two L's and an *ed* and you don't need that.
Researcher: Why don't you need an *ed*?
Child: I don't know. It just doesn't look right.

Sample Response 6 in Table 13 highlights the emergence of this child's explicit word level knowledge. After correctly identifying the correct spelling of *gold,* and quickly dismissing the other two unfamiliar spellings, the child identified the superfluous L, and significantly, identified the *ed* as a unit. This suggests perhaps that this child was using implicit morphemic knowledge of *ed* in this spelling choice. Even though when asked to further justify the unnecessary need for *ed* in this word, the child returned to the implicit level responses, 'I don't know. It just looks right.' This emergent explicit level knowledge about word structure was evident regardless of age or spelling ability, and clearly marks the beginning of explicit word level knowledge that is often inconsistently applied.

Importantly, the emergent E1 responses are also evidence of the shift that children make from the exclusive use of real world knowledge to increasing access of specific word structure knowledge to justify spelling choices. However, it is important to note that children's talk was coded at E1 level for *some* words. These children often fell back onto simpler implicit knowledge like sounding out or extrinsic real world knowledge to justify their spelling choices. It was also expected that children often found it difficult to talk about spelling knowledge though clearly able to identify some correct spellings. The E1 level also accounts for the shift in children's focus as they begin to treat the internal aspects of words as significant, as they look inside words and take account of the internal structure (and hence morphemes) in words.

6.1.3 Verbal responses coded at explicit level E2

Karmiloff-Smith's (1992) next explicit level, E2, is marked in the current research by children's ability to talk about spelling in a way that reveals a level of understanding, although not a complete understanding, about component parts of words like phonemes and morphemes. That is, children's talk about words at this level confirms that they recognized some morphemes as meaningful and significant, but often over generalized morphemic knowledge that caused them to continue to make spelling errors. The verbal responses of two children coded at E2 level, example of their verbal responses number 7 and 8 below in Table 14, were observed to correctly identify regular past tense signified by *ed* in words like *opened* and *wished,* and they were confident about talking about the meaning and sounds of regular past tense, but these children were not consistently able to identify all instances of regular past tense given in the set tasks. In Sample Response 7 this child has identified that *nature* and *natural* are connected, but has mistakenly identified the '-al' suffix as an indicator of past

tense. In this case the child's knowledge about past tense has been inappropriately applied.

Table 14 Sample of Explicit Responses coded at E2 level

Sample Response 7 from Exercise 1 (see Appendix E) **Researcher:** Are the words *nature* and *natural* related or connected to each in some way? **Child:** Yes. You just add the 'al'. **Researcher:** Do you know why the 'al' is used? **Child:** It shows it happened in the past.
Sample Response 8 from Exercise 2 (see Appendix E) **Researcher:** Which word doesn't belong in this group? **Child:** usage **Researcher:** Why did you pick that one? **Child:** Cause all the others have 'use' in them.
Sample Response 9 from Exercise 3 (see Appendix E) **Researcher:** You chose the word *sleeped* as correct. Can you tell me why you chose that one? **Child:** 'Cause *sleeped* has a silent 't' sound but we write 'ed' to show it's in the past.

In sample response 9 this child is aware of the regular past tense rule but has imperfectly applied the rule to an irregular verb. Similarly, some children before the intervention correctly identified *opened* and *wished,* but incorrectly identified *wisht* as the correct spelling of *wished.* These children also identified the correct spelling of *sold* before the intervention, but after the intervention over applied their regular past

tense knowledge to identify *solded* and *sleeped.* When these children were asked to justify their choices they recited the need for *ed* because it indicated past tense. It can be inferred from these types of responses that these children had developed concepts, or ways of thinking about and talking about regular past tense, but at this stage it was still imperfectly applied. Children's talk about spelling coded at E2 level reveals how children's attempts to transfer sub-lexical knowledge to solve spelling problems are developing, but are imperfectly and inconsistently applied.

6.1.4 Verbal responses coded at level E3

The level E3 verbal responses provided evidence of children's consistent access to specific phonological and morphological knowledge. Children accessing this type of knowledge were able to balance information about word structure they had learned in the intervention with their own developing theories to improve spelling performance and understanding. Some examples of level (E3) verbal responses follow in Table 15.

Table 15 Sample of Explicit Responses coded at E3 level

Sample Response 10 from Exercise 1 (see Appendix E)
Researcher: Are the words *help* and *unhelpfulness* connected or related to each other in some way?
Child: Well, you have the base word there (points to *help* in *unhelpfulness*) and they're prefixes and suffixes (points to appropriate parts of *unhelpfulness*). *Un* means like not to do it, and *ful* means like you can't put anymore in.
Researcher: Excellent. Do you know what the *–ness* means?
Child: The state of being unhelpful.

In sample response 10, the child is clearly able to treat the smaller parts of the word *unhelpfulness* as significant, and talk about the connection between those smaller parts and meaning. The child in this sample has developed the meta-language needed for the specific purpose of talking about spelling and it was observed that this child was able to transfer this knowledge to talk about other words in a similar way. The next sample response in Table 16 reveals how this level of explicit knowledge about morphemes supports reasoning and problem solving.

Table 16 Sample of explicit response coded at E3 level

Sample Response 11 from Exercise 1 (see Appendix E)
Researcher: Do the words *cook* and *look* relate or connect to each other in some way? **Child**: Well, not really because even though they have the same letters at the end and they rhyme, they both have very different meanings. So they're not related.

Sample Response 11 demonstrates relational reasoning to justify a spelling hypothesis. There is a significant amount of information that we can infer from this verbal response. The child has noticed the individual letters in each word and compared each letter string for similarities and differences. The child has then compared and contrasted the sounds of each word and noticed that they rhyme. It can then be inferred that this child has reasoned whether these factors contribute to a *meaningful* connection between these words. This child then comes to the conclusion that these factors exist, but they do not connect these words in a *meaningful* way.

There were four children out of the ten intervention children (see Table 17 below) interviewed whose predominant verbal responses were coded at the E3 level, after the

intervention. Significantly, these children moved from their predominantly implicit and E1 level representations before the intervention to a predominantly E3 level of representation after the intervention. It appears the children whose verbal responses were coded predominantly at E3 did not appear to progress through a predominantly E2 level, although there were one or two instances of E2 in their post intervention talk. Another three children gave an instance of E3 level response, but were generally found to be at E1 or E2 level. Children coded generally at this E3 level were also recorded showing some instances of using E1, E2 level response and continued to use isolated instances of implicit knowledge. This verbal evidence demonstrates the complex nature of the multiple representations children hold for the spelling of words throughout spelling development.

After the intervention, all the children who participated showed increased attention to parts of words and the meaningful forms that connect words. This led to the intervention children exhibiting increased understanding through their talk about word structure. Table 17 shows that the children in the comparison group, who did not receive the intervention but received their usual spelling lessons, did not develop the language to talk about, or think about, spelling in an explicit way. All the intervention children moved from a dominant implicit type response to increasingly explicit type responses (E1, E2, or E3). However, the inconsistencies in children's talk about spelling are important and must be dealt with.

Even though children had increasingly used explicit type responses after the intervention all these children still used some implicit and some less explicit justifications and reasoning for some words. For example, a child that was able to

draw on an E3 type response to justify the connection between *help* and *unhelpfulness,* was simultaneously able to justify the spelling of *opened* simply with, 'I don't know, it just looks right.' This inconsistency was a common feature of the post intervention verbal responses for all the children interviewed. As children developed increasingly explicit word level knowledge they were able to talk about word structure in detail; however, the earlier formed representations stored as implicit knowledge and the still developing E1 and E2 knowledge remained part of the children's repertoires and they extracted different types of spelling knowledge for different words. It is crucial to understand these multiple representations, or different types of spelling knowledge children have, and the way they develop different types of spelling knowledge, inconsistently and unevenly.

Table 17 presents some samples of children's spelling approximations in the Morphological Spelling Test (MST) adjacent to children's predominant representation level (Implicit, E1, E2, or E3) coded after reasoning and justifying spelling choices. By comparing spelling approximations with coded level of talk about spelling, we can deduce the impact the development of meta-cognitive and meta-language has on spelling performance.

Table 17 Samples of Spelling Approximations in MST

Intervention	Misspellings in MST		Verbal Responses	
Student #	Pre Test	Post-Test	Pre	Post
1	emoshen opend	imotion opened	Implicit	E1
2	magishin opend	magichin opened	Imp-E1	E3
3	lergion brothers	lagition brother's	Implicit	E1
4	muden chinds	magicant chinen's	Implicit	E1
5	magican musican	magician musician	Imp-E1	E2

6	richnes musitianon	richness musition	Imp-E1	E3
7	magicion lagition	magician lagican	Imp-E1	E3
8	mudischion lagition	magician lagican	Imp-E1	E2
9	statment carlless	statement careless	Implicit	E3
10	caredless brouthers	careless brouthers'	Implicit	E1
Comparison Students #				
11	cerlose msecon	carles musishen	Implicit	Implicit
12	maddness sluppless	maddness sluppless	Implicit	Implicit

The development of children's meta-cognitive and meta-language for spelling through the intervention in this study has had a significant impact on spelling performance. Before the intervention all children had relied almost exclusively on sounding out strategies to spell words and this was reflected in the spelling approximations (e.g. *opend* and *richnes*). Five children before the intervention had also developed an emerging sense of word structure and this is reflected in the creation of a better representational fit between morphemes and phonemes in the spellings (e.g. *magicion* and *musican*) The verbal responses of this type were appropriately coded pre intervention between Implicit-E1. It must be reiterated here that children's verbal responses were coded to an overall level at pre and post-testing simply by looking at the predominant response type. It must be remembered that most children exhibited some implicit and some varying levels of explicit type responses before and after the intervention period.

In Table 18 the responses for student numbers 5, 6, 7, 8, provide excellent examples of developing spelling knowledge that are reflected in their attempts to spell *magican*,

magicion and *mudischion (*target word *magician)* and the dramatic shift they make after the intervention. Another excellent example of this is in the spelling approximations of student number 1 (Table 17) who wrote *emoshen* (target word *emotion*) before the intervention where it can be inferred that a sounding out strategy was used, and after the intervention this child wrote *imotion* (target word *emotion*). It can be surmised that this child has developed a sense of meaningful word parts that is reflected in his talk about words. These children have created spelling approximations that have integrated their existing knowledge of sounds in words with their emerging understanding that words have meaningful parts. Clearly, the meta-language that these children have developed after the intervention is reflected in the way they think about words for spelling. The comparison group did not show a notable shift in treating the meaningful parts of words as significant, and the way these children justified and reasoned about spelling choices remained consistently implicit throughout the research period. This was also reflected in the comparison groups' spelling approximations, which remained unchanged (e.g *maddness* for target word *madness* and *slupples* for target pseudo word *slupless,* pre and post test), and continued to represent sounding out strategies that neglected morphological representation (e.g. *carles* for target word *careless,* and *musishen* for target word *musician*).

Table 18 goes further to understand the impact explicit spelling knowledge can have on spelling performance by juxtaposing the raw scores for each child's two spelling tests, the SAST and the MST, with the predominant verbal response they gave in the interviews before and after the intervention according to Karmiloff-Smith's (1992) levels of representation. The children interviewed in the intervention group (numbers 1-10) and the children interviewed from the comparison group (numbers 11-12) all

exhibited some degree of implicit type responses before the intervention. Some children (2, 5, 6, 7, 8) provided talk that suggested they were beginning to notice the significance of smaller parts of words and were able to talk about that in a limited way, often with inappropriate application. Child number 5, for example was asked, 'Are the words *run* and *runner* related, or connected in some way?' the child responded, 'Yes, the *er* on the end means in the past, you've already done it.' This type of response indicated this child was noticing the smaller parts of words as being significant, but had developed a theory about past tense that was over-applied and caused errors.

Table 18 also reveals the shift between the types of responses children made in the interviews before the intervention, and the types of responses they were able to give after the intervention and the impact it made on spelling scores. All the children from the intervention group were able to give increasingly explicit type responses in the interviews after the intervention. For example, the children were able to identify meaningful forms within words even if they were unsure of the meanings or functions of those forms. The intervention children were also able to include terms like prefix, suffix and base into justifications and reasoning after the intervention that was not evident in the conversations before the intervention.

Table 18 Raw spelling test scores with verbal response levels for 10 intervention children and 2 from the comparison group

	SAST		MST				Verbal Responses	
Intervention			Real Words		Pseudo			
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	36	36	10	12	3	3	Implicit	E1

2	36	40	12	11	4	4	Implicit/E1	E2/E3
3	36	36	13	15	4	4	Implicit	E1
4	36	34	3	10	1	1	Implicit	E1
5	42	47	19	21	5	6	Implicit/E1	E1/E2
6	38	43	7	14	3	4	Implicit/E1	E3
7	41	47	18	19	4	5	Implicit/E1	E3
8	33	34	13	15	2	3	Implicit/E1	E1/E2
9	42	41	17	17	5	5	Implicit	E2/E3
10	29	33	10	10	3	3	Implicit	E1
Comparison								
11	30	26	7	5	3	3	Implicit	Implicit
12	40	37	16	19	3	2	Implicit	Implicit

Table 18 also shows that even though the children interviewed were able to develop increasingly explicit knowledge about the structure of words that assisted their ability to reason and justify spelling choices, their spelling performance in the SAST was only slightly improved. It is important to remember here that the SAST reflects correct spelling scores, only. The correct spellings scores do not reflect the dramatic improvements made by the intervention children in their ability to represent both phonemes and morphemes in words that were, nonetheless, misspelled.

The intervention children's talk about words revealed that correct spelling performance and talk about spelling do not necessarily develop consistently hand-in-hand. Just because children can talk about the spelling of words does not mean they will necessarily achieve consistently accurate spellings. Similarly, just because

children cannot talk about the spelling of words, does not mean they are necessarily poor spellers. However, this intervention was relatively short and it is anticipated that a longer, more ingrained relational approach to spelling would reveal stronger effects on understanding and performance results. The children's talk about spelling in the present study has served well to highlight the complexities and finer increments of change in children's developing spelling knowledge.

Summary

Children's verbal responses underwent a dramatic transition as a result of developing new ways of thinking about and talking about morphemes through the explicit teaching in the intervention. These findings emphasize how useful verbal explanations are in differentiating between implicit and explicit spelling knowledge and the impact these different types of spelling knowledge have on understanding and performance. The intervention children were observed to use predominantly implicit knowledge initially, and relied on their extrinsic world knowledge to justify spelling choices, and after the intervention they were observed to draw increasingly on their declarative sub-lexical knowledge. And yet, importantly, their implicit knowledge was undiminished and was often applied inconsistently for different spelling task demands. Some children, for example, were able to talk extensively and accurately about the meaning, sound and look of regular past tense, while simultaneously falling back onto implicit type responses like, "It just looks right" to justify other familiar, regular past tense words. The exclusive use of *either* implicit or explicit knowledge was not evident in good or poor spellers. These results concur with Critten et al. (2007) who also found that different types of spelling knowledge, or representations, could coexist and were often used to meet different types of spelling task demands.

Karmiloff-Smith's (1992) representational redescription model served to reveal the diversity and complexity of children's developing spelling knowledge through the coding of verbal responses. This model highlights the need to investigate further the finer details of children's developing spelling knowledge and the wealth of information that can be gathered through listening to children talk about spelling.

The intervention children experienced a dramatic shift in their understanding of spelling concepts as they transitioned from using predominantly implicit knowledge to increasingly explicit spelling knowledge. This shift was evident in children's talk about spelling. Children were developing explicit talk about spelling and this reflected the success teachers had in actively engaging the intervention students in spelling problem solving. These results concur with Critten et al. (2007) who argued that children progress beyond reliance on implicit knowledge by becoming *active* in the construction and interpretation of theories and ideas about spelling. The intervention children in the current study were encouraged to participate in conversations about spelling, while actively supported by their teachers to identify morphemes and phonemes, and motivated to explore possible connections between these linguistic elements and other related words. The teachers encouraged the children to override their focus on extrinsic world knowledge to solve spelling problems, and to look inside words. In addition, children were actively encouraged to think about *how* and *what* they knew about the spelling of words. The intervention children were developing an increasing ability to draw on the versatile, flexible and transportable declarative knowledge they needed to solve spelling problems and improve spelling performance. It can be inferred from these results that the intervention children improved their spelling performance by developing explicit declarative knowledge

about spelling that manifested to support each child's developing spelling theories and their ability to make connections between phonemes and morphemes.

Chapter 7

Discussion

Rethinking spelling development

"Theories are nets cast to catch what we call 'the world': to rationalize, to explain, and to master it. We endeavour to make the mesh ever finer and finer."

- Karl Popper

7 Discussion

Popper's quote, heading this chapter, alludes to the idea that scientific theory is perpetually changing and that modification, refinement and theoretical revision is necessary to discover new knowledge and to also discover the consequences that may flow from it (Popper, 1959/2010). The current study has drawn on this sense of discovering new knowledge by making refinements to existing theories of spelling development and spelling pedagogy and judging its fitness by the results of its application.

We may now return to the three research questions posed in Chapter 2: What do teachers know about spelling? How does teaching children about the relationship between meanings and sounds in words (a relational approach) contribute to spelling performance, and how does this influence the knowledge children use when reasoning about spelling? These questions are reviewed and discussed here in light of the

findings. Following this is a discussion about the possible implications for existing theories of spelling development, and the consequences that may flow from conceptualizing the complex nature of children's developing spelling knowledge by adapting Karmiloff-Smith's (1992) cognitive model for this special purpose. There will also be a discussion on the implications for understanding the transition of children's spelling knowledge as it develops in the performance of correct spellings, as well as children's spelling approximations. This will be followed by a discussion on the implications for understanding children's spelling development through their verbal reasoning and theorizing about words. Finally, recommendations will be proposed for teaching practice and future empirical research.

7.1 What do teachers know about spelling?

The current study assumed that how teachers thought about spelling was likely to drive the way they approached the teaching of spelling. So before the student intervention could begin it was important to have a clear picture of the twelve participating teachers' language knowledge, their levels of experience, and their attitudes and belief systems that supported their teaching of spelling. The questionnaire was specifically designed to reveal each teacher's working knowledge of language with a particular focus on morphological knowledge. The questionnaire comprised ten multiple-choice questions. The first five questions tested the teachers' morphological knowledge, followed by five questions that tested the teachers' general language knowledge about *how* spelling works. Crucially, the questionnaire also revealed how teachers in the current study used their knowledge about language to assist children who struggled with spelling in their classrooms.

The questionnaire data uncovered that even though all the teachers had attested to teaching morphology in their spelling lessons for many years prior to the start of the intervention, none of these teachers could correctly identify the definition of a morpheme as the smallest unit of meaning in a word. In other words, teachers had assumed knowledge about morphemes that differed significantly from their ability to demonstrate explicit morphemic knowledge in the questionnaire. These teachers often identified syllables as morphemes, and many teachers talked about their teaching of morphemes when in fact they were teaching spelling rules. All the teachers were able to demonstrate, before the intervention, some explicit morphemic knowledge, but it was very superficial. Teachers' morphemic knowledge was confined to an understanding of common prefix and suffix patterns, such as the *un* in *unhappy* and the *-ness* in *emptiness,* while they all had difficulty identifying less common prefixes like *com-* in *commit*. Importantly, none of the teachers could *confidently* identify affix meanings, or their functions. Few teachers, for example, could identify the inflected verb *impeached,* and only one teacher was able to identify the adjectival suffix *–al* used to transform the noun *nature* into *natural.* Most teachers admitted to guessing most of the answers, and all the teachers talked about their lack of confidence identifying both phonological and morphological features of words.

The teacher interviews also revealed the primary strategy for identifying and correcting the misspellings of their students was to draw attention to the *look* of the word as a whole, and to its dictionary meaning, in an attempt to build their students' sight words and vocabulary. Prior to the intervention teachers largely omitted or marginalized the teaching of morphemes as an optional or additive strategy. In other words, these teachers taught the spelling of words as whole units with little or no

attention paid to the meaningful parts inside words. The favoured strategy to help students with spelling was to make the troublesome word a sight word for the child to practise and learn by rote. The pre intervention interviews clearly showed that this group of teachers were either unaware of the importance of learning about morphemes when learning to spell, or at the very least, were unsure about *how* to use morphemic knowledge in the teaching of spelling. Their lack of explicit morphemic knowledge meant that they could not operationalize the teaching of spelling in a powerful way. Participation in the intervention trained the teachers how to treat the sub-lexical aspects of words as significant, to *look inside* words, to see each morpheme as a discrete and identifiable contribution to meaning and to develop an analytical approach to spelling problem solving that involved implementing morpho-phonemic knowledge within the boundaries of the written word.

The above findings raised important questions about these teachers' spelling concepts. Questions that address the way teachers think about words for teaching spelling, and whether teachers have enough language knowledge to support the teaching of spelling efficiently and effectively. The findings also raised the concern about whether teachers had adequate resources to support the use of morphological knowledge in their spelling lessons. Informal discussions with these teachers highlighted their collective desire for better spelling resources. The questionnaires and interviews provided some important insights into the gaps in teacher knowledge about language in general, and spelling in particular, but what was most revealing was the teachers' unsolicited talk recorded throughout the intervention. Here are two examples.

> ‘This intervention has taught me so much about the spelling of words. I can see patterns I never saw before… I really look forward to teaching spelling, because the children enjoy it so much.’ (Teacher No. 1)

> ‘My class has really enjoyed learning about and talking about spelling this term. Some children said they had even told their parents all about morphemes!’ (Teacher No. 2)

Before the intervention, these teachers had predominantly implicit knowledge about word structure. In other words, they were unable to analyze the morphological structure of words, or to develop a way of talking about morphemes that would have supported their teaching of spelling in their classrooms. That is, the teachers’ implicit knowledge enabled them to spell words but not to explain the basis on which they spelled them. Over the course of the intervention, however, their morphemic awareness and their meta-language became increasingly developed and explicit. Teachers made a cognitive shift while delivering the intervention by becoming increasingly aware of morphemic structures and treating them as significant in their classroom teaching. Teachers rapidly exhibited E3 level spelling knowledge as they led classroom conversations about morphemes. As the teachers developed an explicit awareness of morphemes, including how to analyze the morphological relatedness of words, they were simultaneously able to develop their students’ explicit morphemic awareness, with the result that their students’ spelling improved.

With these issues in mind, we turn to a detailed discussion of the core questions of this thesis. Section 7.2 addresses the question of whether teaching children about the

relationship between meaning and sounds in words improved children's spelling performance. Section 7.3 continues the discussion further by highlighting the complex nature of knowledge children hold when justifying and reasoning about spelling.

7.2 How did teaching children about the relationship between meaning and sounds in words contribute to spelling performance in spelling tests?

The overarching problematic in the current study was to investigate whether children's spelling performance and understanding could be improved by teaching a relational approach to spelling. It was argued that the written word simultaneously represents concepts about meanings and sounds, and a relational approach had the potential to assist teachers and students in the understanding that the meanings and sounds within words are in constant collaboration. Teachers in the intervention were advised to break words down into units of meaning, but it was also imperative for their students to understand how sounds (phonemes) and meanings (morphemes) in words related to one another in the orthographic form. Teachers were encouraged to assist children in understanding how to bolt these two abstract concepts together in a way that effectively assisted children's spelling performance and understanding. As detailed in the literature review (Section 2.2), recent studies have shown positive instructional effects from teaching children explicitly about morphemes. Building on this premise, the present study proposed that if children were taught about both phonemes and morphemes, and the relationship between them, this would be reflected in, and incorporated into, the conceptual framework they had available for spelling words correctly in their writing. This section focuses on the first research question of the study, a question that relates to performance.

To answer the first research question about spelling performance, the first phase of the study was designed to determine what children could *do* both before and after the spelling intervention specifically designed for the learning context. The results of the children's spelling performance results were considered in relation to the instructional effect of the intervention. There were two spelling performance test: the South Australian Spelling Test (SAST) and the Morphological Spelling Test (MST).

The SAST was the first test administered. It provided a standardized measure of spelling performance ability that reliably situated this population's spelling capabilities within the broader context of children's spelling ability. It also provided the necessary baseline data to determine the statistical significance of the intervention on children's spelling performance.

The second test, the MST, was devised to specifically highlight children's developing morphological knowledge. The MST included 14 words (11 real words and 3 pseudo words) that required children to use simultaneously both their phonological and morphological knowledge in order to produce the correct spelling.

Together the two spelling tests revealed what the children could *do* before and after the intervention. The analyses of correct spelling scores indicated that children's spelling production had progressed in terms of overall accuracy. Even though the positive effect size as a result of the intervention was small, the results need to be considered in light of the relatively short intervention period of ten weeks. According to Hattie (2009) and Cohen (1988) the effect size benchmarks as an index of improvements in performance are usually determined after a full academic year of

instruction. So, it can be inferred that a longer intervention than this project's 10-week intervention would yield stronger effects.

The impact of the intervention was measured by the difference between the pre and post-test scores for each of the participants in the study. These scores indicated that compared to the comparison group, the intervention groups had significantly improved correct spelling scores. The ten intervention groups were compared with each other and showed no significant difference. It can be inferred that the different teaching styles delivered in the ten intervention groups did not significantly impact the students' overall spelling scores. That is, the intervention teachers had, despite different teaching styles, improved their children's spelling. It is necessary however to refine the simple overall comparison of correct spelling scores in order to allow for the significant effect the intervention had on the students' spelling approximations. A scoring system for spelling performance needs to shift the focus from correct spelling scores to a system that measures and describes the wealth of linguistic knowledge children encode in their attempts to spell words.

The complex nature of children's spelling approximations had significantly improved between pre and post-test. Robust evidence for this was found in the writings of the poorest spellers. In the pretests poor spellers often struggled to make accurate sound to letter correspondences. The poorest spellers often produced spellings that were poor representations of the target word, for example one child produced *otm* (*target word: opened)* in the pretest showing limited ability to make connections between letters, sounds and their meaningful parts. After the intervention this speller was able to produce *opned.* Even though this spelling approximation has not reached the target

word, *opened,* it is clear this speller has identified two morphemes (i.e. *opn* + *ed*), the speller has also correctly spelled the past tense suffix in its correct position, and included representation of the phonemes *o, p,* and *n.* This shift is a significant one, and there are many examples like this in the data. Even though poor spellers often continued to misspell words, it is important to notice that after the intervention poor spellers were able to treat morphemes as significant and use a closer phonemic representational fit between sounds and letters. Thus the poorest spellers appeared to have made extraordinary progress as a result of the intervention. By examining children's spelling approximations, it was apparent that the poorest spellers had become increasingly aware of the written words at the sub-lexical level.

To summarize, the results of the spelling tests substantiates the proposition that increasing students' morphemic awareness through explicit instruction improves children's spelling performance and understanding. The relational approach required that teachers actively motivate children to develop ways of talking about words through teacher led conversations in the classroom. Teachers were also required to foster problem-based learning that included developing children's ability to analyze and hypothesize about the relationships between phonemes and morphemes in words. The relational approach to teaching spelling, and the testing of it in the classrooms was vital to determine what did and didn't work in the real world environment. The evidence positively indicates that the relational approach had a positive impact on children's deeper learning about word structures and directly impacted children's correct spelling and spelling approximations.

7.3 What knowledge did children use when reasoning about spelling?

One of the main purposes of this study was to investigate what underlies children's spelling performance. That is, what different types of knowledge do children have about words and how do they use this knowledge to support their spelling; the literature review cites many researchers that attribute improved spelling performance to learning explicitly about phonemes (Beers, Beers, & Grant, 1977; Ehri, 1991; 1992; 1998; Ehri et al., 2001; Frith, 1985; Gentry, 1982, and Henderson et al., 1985 among many others). In addition, the review notes the few emerging researchers interested in the effectiveness of learning explicitly about morphemes to improve spelling (Carlisle, 1988, 2003; Henry & Redding, 2002; Mann & Singson, 2003; Nunes, Bryant & Olsson, 2003; Nunes & Bryant, 2006). Together, this body of research has supported the proposition that the word level writing process requires young literacy learners to draw on both phonemic and morphemic knowledge. When children spell unfamiliar words they must draw on their explicit, or declarative knowledge about phonemes and morphemes to self-monitor and make choices about possible letter combinations to reflect the intended sounds and meanings of words. Children may of course draw on other spelling knowledge like orthographic knowledge (e.g. spelling rules) and etymological knowledge (word origin), but the current study has limited the scope and proposed that the *core* of learning about spelling fundamentally involves learning about *how to think* about phonemes and morphemes, and to understand *how* these aspects of words work *together* to create words.

Increasing children's explicit spelling knowledge also included giving them a way of thinking about spelling. That is, facilitating children's meta-cognitive knowledge about spelling. Further to this, children were provided with a meta-language for

talking about it. Meta-language is a subset of meta-cognitive knowledge (Birdsong, 2011; Gombert, 1992; Myhill et al., 2011). Forming an explicit understanding of word structure concepts facilitated these important aspects of learning about spelling (Paris & Winograd, 1990; Tumner & Chapman, 1999, 2003). The current study looked at the way in which children's meta-cognition and meta-language about explicit spelling concepts could be developed through an intervention and the way children expressed their understanding through verbal justifications and verbal reasoning responses (Guthrie, McRae & Klauda, 2007; Guthrie et al., 2004; Taboada et al., 2009; Wigfield et al., 2008).

The analysis of the verbal responses was the most interesting aspect of the current study. The children's verbal responses were successfully coded according to Karmiloff-Smith's (1992) general cognitive model. Karmiloff-Smith's model has at its foundation a theory that accounts for the way in which representations change over time and how developing representations can be understood as a process of increasingly explicit knowledge that can become progressively available for verbal report. That is, the learning process can reconstruct implicit representations (transform knowledge that is not accessible to verbal report) to establish more flexible, transferable explicit knowledge that becomes available declarative knowledge.

This model comprises a series of distinct levels to reflect this process and the range and type of knowledge stored in the cognitive system. At the entry level are implicit representations that may be innately specified, or acquired through the environment in a procedural format, but according to Karmiloff-Smith they are not available to the conscious mind. Karmiloff-Smith's (1992) model also allows for the discovery of

three distinct levels of increasingly explicit knowledge (Level E1, Level E2 and Level E3). This model provided a general cognitive paradigm that was adapted for the special purpose of understanding children's spelling knowledge. This model enabled this study to investigate, in depth, children's verbal reasoning and justifications that highlighted the dynamic interaction of information already in the mind with input from the intervention and gave me an opportunity to explore the role of meta-linguistic awareness in spelling pedagogy. It also allowed me to make some interesting observations about the way both poor and good spellers think about words.

The coding of children's verbal responses, as either implicit or one of three increasingly explicit levels, made it possible to observe some general trends in the development of children's spelling knowledge and the transitions occurring as children learned about the morphological structure of words. Initially, pre intervention most children exhibited a dominating implicit type response that transitioned to an increasingly explicit type response after the intervention. The intervention provided the necessary structured tuition in spelling concepts to shift the way the intervention children thought about and talked about word structure despite the level they started from. That is, children that had predominantly implicit type responses before the intervention could be successfully transitioned to higher levels of explicit knowledge, post intervention regardless of their initial spelling ability. All the children benefited from the intervention and there was no evidence of resistance to the intervention.

However, it is worth discussing some important fine-grained observations about the children's verbal responses and their cognitive transitions to more explicit levels. As already stated it was initially found that most of the children's verbal responses,

before the intervention, were dominated by implicit type knowledge. The children's implicit knowledge reflected an inability to access conscious information about word structure to justify or explain spelling choices. Implicit type responses were elicited from both the better and poorer spellers, so it did not necessarily follow that the better performing spellers had more explicit responses. However, after the intervention the greatest improvement in performance was observed in the poorest spellers, even though correct spellings scores may have dropped or stayed the same. Poor spellers showed the greatest improvement in the nature of their spelling approximations. The good spellers improved their correct spelling scores and were often able to identify complex morphological information in their reasoning and justifications. It is likely that the better spellers had better working memories, and once explicit word level knowledge was made available, they had ready access to it (Graham, Pegg, Bellert & Thomas, 2004; Hattie, 2009). However, the poorer spellers made significant improvements in their representations of both sounds and meaningful forms within words, notwithstanding the fact that they had often made a minor misspelling of the target word.

Evidence for the coexistence of multiple representations for spelling knowledge was one of the most intriguing aspects of children's talk about spelling. All the participating children had, in a general sense, transitioned from a predominantly implicit type response before the intervention to extracting predominantly explicit type responses after the intervention. Interestingly, the intervention children continued to use *some* implicit type responses for some words. For example, many children developed an E3 type response for the word *unhelpfulness.* This type of response included explicit knowledge about the prefix, suffixes, the base word, their meanings,

sounds and functions, but when asked to justify the spelling of *wished* some children fell back onto implicit type responses like, "It just looks right." This is an important observation and found to some degree in every set of the post intervention verbal response data. It is important, because it underscores the complex nature of spelling development and the fact that becoming increasingly explicit is not a once-and-for-all achievement.

As may be expected, the children in the comparison groups did not develop explicit type responses but continued to the end of the research period to use predominantly implicit type responses like, 'I don't know why it's spelled that way. I just know how to spell it'. This strongly suggests that the structured, explicit spelling tuition of the intervention had successfully assisted children in making their implicit spelling knowledge increasingly explicit and accessible to support talk about spelling. However, this would be an oversimplification. It is important to note that children in the current study had continued to utilize existing implicit knowledge despite their increased explicit word level knowledge. These findings support Karmiloff-Smith's proposition that explicit word level knowledge does *not* replace implicit knowledge, but reconstructs knowledge in a way that bolts on the increasingly explicit type knowledge to the pre-existing implicit type knowledge. If these different types of spelling knowledge are bolted together as multiple representations, or ways of thinking about word structure, they necessary coexist. The existence of multiple representations of word level knowledge implies a need for intermediate levels of increasing explicitness between the two poles of implicit and explicit knowledge. This evidence substantiates the appropriateness of understanding the process of transition from implicit to increasingly explicit spelling knowledge, and the appropriateness of

Karmiloff-Smith's levels of increasingly explicit knowledge to describe the complex nature of spelling knowledge in children.

The concept of multiple representations is also a useful way of accounting for the inconsistencies between what children can talk about and how they spell words. For example many children in this study misspelled the word *opened* (e.g. *opend*), while simultaneously quite capable of explaining the meaning, function and sounds of past tense and correctly identifying 'opened' in typeface. This suggests that performance and understanding do not necessary develop together. Performance and understanding may develop at different paces. This evidence supports Pellegrino and Hilton (2012) in their powerful report *Education for Life and Work* where they state the importance of teachers modeling thinking processes and teaching for transferrable knowledge that requires, "using multiple representations, encouraging questioning and self-explanation, providing guidance and support during exploration, teaching with examples, and priming motivation." (p. 6-24). Pellegrino and Hilton (2012) also found in a review of evidence that, "pure discovery (or unassisted inquiry) is not a particularly effective instructional method and that a more effective approach involves a combination of explicit instruction and guided exploration with meta-cognitive support." (p. 6-25).

It also follows that verbal explanations and spelling justifications may not be an accurate reflection of what children can do. Similarly, when a child spells the target word correctly it does not necessarily reflect what the child understands. If this is the case, we need to understand more about the development of children's multiple word

level representations to assess more accurately children's spelling performance and understanding.

The existence of multiple representations is also confirmed in the current study by children's 'change of mind' events. When children were asked to justify a spelling choice they often changed their minds from an immediate and reflexive implicit type response like, "I just know it" to an explicit type response after a moment of further thinking on the problem that drew on their more complex morphemic and phonemic knowledge. For example the intervention children often immediately responded to the justification of a correct spelling choice with an implicit response like, "I just know it", but when the researcher asked them to reflect further on *how* or *why* do they know it, the children often changed their minds and responded with something like, "Oh…no, not that one. It's this one, because there is an *ed* on the end and we need that to show it's in the past." Many children changed their minds about their initial implicit responses in the post intervention interviews. The 'change of mind' events signaled that perhaps children needed more time to access their explicit knowledge. It may also be that automatic recall of the responses is part of the very nature of the existing implicit type knowledge. When children changed their minds they were actively overriding their implicit knowledge response to access explicit knowledge they had about the problem at hand. Again, this strongly suggests that implicit knowledge and explicit knowledge can coexist and perhaps accessed for different purposes or accessed under different conditions.

The current study also supports the findings of Peters et al. (1999) who argued that implicit knowledge is not isolated from children's explicit systems. For example

teachers in this study had expressed great frustration that some children who had developed complex knowledge about word structure still fell back on earlier simpler spelling representations like sounding out in writing tasks, or when writing in stressful tests. Children's inconsistencies in spelling performance and falling back onto simpler implicit representations can be accounted for by Karmiloff-Smith (1992) model. Implicit and explicit spelling knowledge coexist to serve the demands of individual tasks.

In sum, children's talk about spelling highlights the complex nature of their developing spelling knowledge. Inconsistencies between spelling performance and understanding, the fall back to simpler implicit representations, and the 'change of mind' from implicit to explicit type responses strongly suggest the existence of multiple representations for word level knowledge. Understanding children's development of multiple spelling representations at all stages of spelling development has profound implications for spelling developmental theory and practical implications for helping children access the knowledge they need to improve spelling performance.

7.4 Implications

7.4.1 Use of a cognitive framework to understand spelling development

Three main implications for existing models of spelling development can be suggested in light of these findings.

1. A need for a cognitive framework that can account for and describe implicit and explicit knowledge in spelling development. Where children's ability to *talk* about spelling concepts is a crucial indicator of what they *understand* about spelling.

2. A model that accounts for the transitional process of conceptual change as children make the shift from predominantly implicit type spelling knowledge to increasingly explicit, or declarative spelling knowledge.

3. A model that reflects the way implicit and explicit knowledge works together by way of multiple representations to improve spelling performance.
These issues are elaborated and discussed here.

The question of how spelling concepts develop and what spelling concepts are needed to improve spelling performance is not well researched. The findings in the present research suggest that understanding the transitional process of conceptual change between implicit and increasingly explicit spelling knowledge is a useful way of understanding spelling development. It was also found that the way children think about the structure of words for writing is a complex process and directly impacts spelling performance.

A strong case can be made for Karmiloff-Smith's (1992) representational redescription levels as a useful way of understanding the progression of knowledge as it moves from a dominant implicit type spelling knowledge to increasingly explicit and accessible information (Steffler, 2001). Research does not often address implicit knowledge (Steffler, 2001), and Karmiloff-Smith's model distinguishes implicit

knowledge from increasingly explicit knowledge in an attempt to understand more about how our different types of knowledge assist our learning.

Karmiloff-Smith's representational levels are particularly well suited to reflect the fine-grained change that occurs in the way spelling knowledge transitions and develops. There is evidence in the current study that children's implicit knowledge about words can be assisted in the transition to increasingly explicit knowledge through teacher modeling and children becoming actively involved in solving spelling problems. As teachers model *how to think* about spelling and model *how to talk* about spelling, and with extensive practice, children developed increasingly explicit knowledge about how words work that became increasingly available for verbal report. The current study successfully encouraged teacher led conversations between themselves and their students about words, where children performed higher-level thinking skills like hypothesizing and theorizing about spelling problems. This important classroom activity increased children's ability to talk about word structure and ultimately improved children's spelling performance in correct word spelling and spelling approximations.

The strength of Karmiloff-Smith's model lies in the emphasis on understanding how to learn and organize knowledge through the understanding of the interrelationship that exists between implicit and explicit knowledge. This includes the interplay of processes and the development of increasing flexibility and transferability of spelling knowledge as explicit knowledge develops. For example, the children in the current study's comparison group did not receive the intervention but received their normal spelling instruction and remained at a level where thinking and talking about spelling

was dominated by implicit type responses. They were not able to use higher order thinking skills like hypothesizing or theorizing, and there was no evidence of knowledge specific transfer. Consequently, the comparison groups did not significantly improve their spelling performance or understanding of spelling concepts by the end of the research period. The children in the intervention groups, however, did receive structured explicit spelling instruction and were able to transfer word level concepts about phonemes and morphemes to solve the spellings of unknown words in the pseudo word task.

Karmiloff-Smith's model also provided a classification system of verbal explanations that is independent of behavioural performance. Verbal responses were coded and analyzed as unique indicators of what children understood about spelling concepts. This was an important distinction to make, because too often researchers, teachers and spelling developmental models focus on spelling performance, what children can *do* in spelling tests, as the primary indicator of what children *understand* about spelling. The current study presents strong evidence for investigating and classifying both performance and verbal justifications and explanations in children's spelling development as *independent* predictors of what children can do and what they understand about words. Karmiloff-Smith's model predicts that the more children can talk explicitly about spelling concepts, the more able they will be to manipulate and apply those spelling concepts to new spelling problems. Spelling instruction that encourages deeper learning about phonemes and morphemes and how these concepts knit together will support young learners and facilitate the development of explicit spelling knowledge. Karmiloff-Smith's representational levels could act as an

assessment of children's progress in understanding through the codification of their talk about spelling.

7.4.2 Use of a cognitive framework to inform pedagogy

This issue of course must be taken one step further. What level of explicit knowledge do teachers need to be effective teachers of spelling? Following the framework of Karmiloff-Smith's representational redescription model, a teacher would need the flexibility and creativity of a high level of explicit type (E3) representations in order to meet the demands of the varying abilities of spellers within their classrooms. It would not be enough for the teacher to simply be a good speller if the teacher is unable to draw on explicit knowledge about the structure and sounds of words. The teacher with E3 representations would have the ability to access and verbalize different levels of knowledge about words, whilst also having the ability to be aware of those students who need more assistance in moving from one level of representation to the next. For example, teachers need a high level of content knowledge about word structure, they need to be able to model the processes of thinking about spelling concepts and solving spelling problems and they need to be able to model the talk needed to describe spelling concepts. Teachers would also need a high level of declarative spelling knowledge to support active conversations in the classroom and deliver a relational approach to learning about the spelling of words.

Gaps between children's spelling performance and their spelling understanding need to be identified and accounted for in spelling developmental models. Spelling developmental models should consider articulating the different levels of representation that children can hold, simultaneously, about the spelling of words.

That is, spelling developmental models could recognize the significance of children's multiple representations for word level knowledge and the fine grained transition that children's spelling knowledge makes, as it moves from predominantly implicit to increasingly explicit. The impact of developing explicit knowledge on children's spelling performance and understanding is profound and needs to be included as a significant aspect of spelling developmental models.

In addition, spelling assessments could include both children's talk about spelling and children's performance in spelling tests. This dual approach to assessment is necessary because the correct spelling of the target word does not necessarily indicate a thorough understanding of a spelling concept. As found in Chapter 6, it may be that performance and understanding develop at different times. For these reasons spelling knowledge must be assessed by two equally important measures. The first measure assesses spelling performance and the second measure assesses understanding by explanation or justification of spelling concepts. If the child does not have correct explicit morphemic knowledge, or insufficient explicit morphemic knowledge, then it is likely spelling success for words will be delayed. That is, young literacy learners that rely on predominantly implicit word level knowledge, with a limited ability to notice morphemes as significant, will experience limited success in spelling performance and understanding (Nunes & Byrant, 2009). Therefore, it is important to know what children can *do* and what they *understand* about morphemes in spelling in order to effectively support learning throughout children's spelling development.

7.4.3 Use of misspelling or spelling approximation analysis to inform instruction

One of the most intriguing aspects of the research at hand was the thorough investigation of children's misspellings or spelling approximations. The children's spelling approximations highlighted the complexity of their word level concepts, their inspired creativity in applying that knowledge to solve spelling problems and the surprising abundance of linguistic knowledge they had about writing words. Recent research has undervalued the importance of children's spelling approximations and overlooked the wealth of information encoded in them.

Previous studies that have examined children's spelling errors have primarily focused on phonological errors, or errors in applying spelling rules. Few studies have investigated morphological spelling errors. One of the main goals of the current research was to take into consideration what children understood about writing morphemes and how this understanding mediated their performance. To achieve this, it was necessary to go beyond the counting of correct morphemes to a deeper level of analysis that brought to light the subtleties of how children were using and constructing their word level knowledge.

The spelling approximations of real words and pseudo words in the current study revealed that even very poor spellers encoded morphological knowledge in their spellings. This finding is contrary to the spelling literature that suggests that poor spellers fail to encode details of word structure (e.g. Frith, 1980; Holmes & Ng, 1993; Link & Caramazza, 1994). The encoding of morphological information in words by even the poorest spellers has important theoretical implications. It goes to the heart of understanding what children encode and what they understand about word structure at

different points in their spelling development. It is suggested here that if poor spellers attempt to encode the morphological aspects of words, then perhaps even very young literacy learners would benefit from explicit teaching about morphemes. This is contrary to the models of Frith (1985), Seymour (1997), and Ehri (1998, 2005) who propose children *only* make use of morphemes at advanced literacy levels (Quemart, Casalis & Duncan, 2012).

The analysis of children's spelling approximations in the current research also revealed that even though the struggling spellers often showed poor phonemic awareness manifested in a poor representation of sound to letter relationships, the intervention of explicit spelling instruction improved this aspect of their performance. This finding may be expected, but it is significant. It concurs with recent research on the effects of morphological instruction on literacy (See Bowers et al., 2010 for a meta analysis) that poor spellers benefited from increased attention to the sub-lexical aspects of words. In the current study the intervention increased the attention of poor spellers to the structure of words and effectively improved the quality of their spelling approximations. In one struggling spellers' pretest, for example, the spelling approximation *manss* was created as a representation for the target word *madness.* This spelling approximation reveals a poor representational fit between phonemes, morphemes and graphemes. After the intervention this struggling speller was able to use a better morph-phonological representational fit, like *madnes*. In another pretest example, a child made the spelling approximation *keles* for the target word *careless*. After the intervention this child was able to write the target word correctly showing this child had made a significant improvement in morpho-phonemic to grapheme mapping for this word. Significantly, poor spellers in the post-tests were increasingly

attempting to write words that looked meaningful. That is, poor spellers were able to reflect in their spelling approximations more meaningful structures, rather than simply transcribing the sounds they thought they heard in words.

The context of learning is undoubtedly a powerful predictor of successful spelling. The evidence here concurs with the findings of Graham (2000), and Nation and McLaughlin (1986) that implicit learning, that includes rote memorization and automatic processing through increased exposure to print, may not be as powerful for poor spellers as good spellers. Their rationale was based on the premise that explicit learning involved controlled active extraction of word level knowledge. Graham (2004) suggested that good spellers maybe better able to extract and transfer information needed from memory to solve spelling problems more efficiently. Poor spellers may need specific instruction in making implicit knowledge accessible and available for transfer. This has significant practical implications for teaching and these issues will be expanded in the following recommendations for teachers.

7.5 Recommendations

7.5.1 For teachers

Spelling, by the nature of the task, requires retrieval of both intentional explicit information and implicit knowledge or the automatic retrieval of word knowledge for writing. Children's spelling approximations and verbal responses to justify and explain spelling choices in this study are evidence of the highly complex cognitive process they use to spell words. Different educational experiences can generate different types of knowledge, and teachers need to identify the different types of

spelling knowledge and assist their students through the transition of developing increasingly explicit spelling knowledge.

The evidence in the current study suggests that children can be delayed in advancing in proficient spelling if they do not develop explicit knowledge about word structure. Teachers are encouraged to foster the formation of children's explicit declarative knowledge about the structure of words to aid spelling development. Evidence from the current study suggests that an effective way to begin to help children with the process of integrating implicit and explicit knowledge is to actively listen to what children think through their talk about spelling, rather than simply looking at results of weekly spelling tests and inferring what children know from misspellings alone. Teachers need to shift the primary focus from correct spelling to the processes of thinking that goes into getting the correct spelling (Pellegrino & Hilton, 2012). Listening to children talk about spelling will give teachers the clues about where to start to help them. For example, children's talk about spellings will reveal a great deal of linguistic knowledge and it is for teachers to recognize the gaps and misconceptions children may have developed about words and support the reconstruction of new word knowledge with expert modeling and scaffolding. Teachers could encourage students to talk about spelling as they spell, in retrospect, and within the classroom context. Hearing and discussing, hypothesizing and counter-arguing, engages and motivates children of all spelling abilities in problem solving the spelling of words.

Importantly, the relational approach has shown positive indications that it can be used as a useful tool to link the abstract concepts of linguistic knowledge and the concrete

understanding of orthographic knowledge in young spellers. The relational approach is concerned not only with the encoding of sound, but also with the relation between spelling as encoded sound and meaningful form. Furthermore, the approach supports explicit and systematic teaching by providing teachers and students with a shared *meta-language* for talking about spelling.

The findings from my intervention groups suggest it is possible to improve the performance of children's spelling by teaching children explicitly about the relationship between phonemes and morphemes simultaneously as part of the same program. All the teachers realized that prior to this intervention they had taught spelling strategies in isolation, one after another, and primarily focused on phonics and letter patterns that omitted, or marginalized, essential information about morphemes. All the teachers in this intervention acknowledged after the intervention, a new way of *seeing* the structure of words and how this structure determined spelling patterns that represented both sounds and meanings. The teachers' insights were the driving force behind a successful, but short intervention period. These teachers improved children's ability to treat as significant the smaller meaningful parts of words and initiate the process of integrating morphemic knowledge with children's established phonemic knowledge. Even though the quantitative data shows the intervention had a weak overall effect on correct spelling scores, the power of the intervention is found in the qualitative analysis of spelling approximations. A thorough analysis of the errors children made in both real and pseudo words revealed that they were using phonemic and morphemic knowledge, simultaneously. However, it was also found some children allow phonemic knowledge to dominate the writing of a word that is unfamiliar.

The post intervention results show that with specific sub-lexical instruction that develops children's awareness of morpho-phonological relationships in written words, children will spell, even unfamiliar words, primarily for meaning. That is not to say children don't need, or fall back onto sounding out strategies, but it does perhaps indicate that children will benefit from learning about higher order skills like morphemes from an early stage in their literacy learning. As Pellegrino and Hilton (p. 6-23, 2012) found, "in observational studies of cognitive apprenticeship, beginners successfully learn high-level skills through a process of *assisted performance* (Tharp & Gallimore, 1988) in which they are allowed to attempt parts of complex tasks before they have mastered basic skills. These findings suggest that higher-order thinking skills can be learned along with lower-order ones early in the instructional process." As Pellegrino and Hilton (2012) suggest children may find integrating knowledge about written language very difficult and they need expert assistance from their teachers to do this, but the current study has shown that teachers themselves need expert training and excellent resources to support this important aspect of teaching.

Teachers have been advised in educational policy documents to use the *Look Cover Say Write Check* strategy as a main strategy to help their students automate their knowledge of spelling words. Memorizing the individual spellings of words is an enormous task for any child and many teachers attest to children rote learning spelling words for a Friday test, and then forgetting all these words by Monday. According to Westwood (2005), the *Look Cover Say Write Check* strategy is based on improving a learner's visual memory of words that are not phonemically regular. However, automating the visual look of individual words does not assist the child in recognizing

the patterns or connections between words. That is, developing automaticity without understanding is not the basis for being able to transfer knowledge from one context to the next. For example, a child using the *Look Cover Say Write Check* strategy may in the short term remember the spellings of *prints* and *prince,* but it may be more important for the child to understand that even though these words sound the same, we write them differently to indicate different meanings. Similarly, it is important for learners to know that words like *product* and *produce* are related because the same morpheme is used to indicate a related meaning, even though the sound changes. Assisting young literacy learners make the shift from relying on rote memorization and sounding-out strategies to spell words to a deeper understanding of the foundation content of how words work is essential to improve children's spelling performance and understanding.

The relational approach to spelling instruction informs the learner about *how* morphemes and phonemes work together in predictable ways in our English spelling system. This is achieved by discovering the interconnections that exist in the spelling of the word, the sounds in the word and the way the spelling and sounds can indicate meaning. This includes the identification of bases, homophones, affixes, roots, and the possessive apostrophe. Thereby encouraging children to develop multiple representations, or ways of thinking about spelling that are more analytical than automatic. In addition to this, children and teachers need to develop the meta-linguistic tools to think about and talk about the structure of the English language at the level of the phonemes and morphemes that construct words and how these linguistic features relate to each other in spelling. In doing so, children will be able to

approach each spelling difficulty with using multiple strategies and knowledge sources with an attitude of problem solving.

The relational approach is different from other current theories, because other theories tend to atomize learning and promote one aspect of spelling by focusing on sound *or* meaning and extending that one feature at the expense of the other. It is also often the case that morphemes are not taught until phonemes are mastered. The relational approach recognizes the distinct contribution and autonomy of both phonology (sound) and morphology (meaning) in the construction of words where a synthesis of both components collectively creates an interface that is the English spelling system. In the classroom this can be achieved by discovering the interconnections that exist in English spelling by looking at the sounds in the word and the way the spelling and sounds can indicate meaning. This includes the identification and understanding of the role bases, homophones, affixes, roots, and the possessive apostrophe play in the creation of meaningful forms. This encourages children to develop multiple representations, or ways of thinking about spelling that is more analytical than automatic. In this way, the relational approach attempts to resolve the debate over *either* sound (phonics) or meaning (whole language) based approaches and offers a way of conceptualising and teaching spelling that takes advantage of *both* sound and meaning in a coherent approach that is practical to teach and learn in the classroom.

7.5.2 For researchers

The findings of the current study have important implications for spelling research design. Children's behaviour in spelling tests should not be viewed as *full* indicators of children's spelling knowledge. It is possible that a correct spelling may be achieved

without understanding, and correspondingly, it is possible that children may misspell words but understand a great deal about word structure. Researchers need to examine both performance and verbal explanations, concurrently. If these aspects are not taken into account the research risks underestimating, or indeed overestimating children's spelling abilities.

Most spelling research to date has focused on phonology as the main influence on children's early spelling. However, recent morphological studies, that laid the groundwork for the current research, suggest that further investigation is required. A thorough understanding of this aspect of children's spelling development is essential. Children's spelling approximations and verbal responses in the current study indicated that children are using morphological knowledge to convey meaningful writing from a very early point in literacy learning. Intervention studies using larger populations and controls could further investigate the role morphology plays in early literacy learning and the best conditions to facilitate morphological development.

There is still a great deal to understand about how children learn and think about spelling. Whilst Karmiloff-Smith's (1992) cognitive model was found to be an appropriate framework for understanding the cognitive system that underlies spelling development, it fails to adequately address the issue of *why* it is that some children do not experience the process of transition from implicit to explicit spelling knowledge as easily as others. More qualitative and quantitative studies are necessary to inform us as to the best conditions to facilitate this transition in young spellers.

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Appendices

Appendix A

School of Education
University of New England
Armidale NSW 2351
Australia

Phone: 61 2 6773 3562
Fax: 61 2 6773 2445
Email: education@une.edu.au
www.une.edu.au/education

The Principal,

Public Primary School

Date

Dear Sir/Madam,

My name is Michele Herrington and I write to you regarding a project entitled ***The effects of a morphological intervention on children's spelling performance and understanding: Toward a Relational Approach.***

This project is part of the requirements for my PhD in Education at the University of New England, Armidale, New South Wales. I am the main researcher of this project under the close supervision of Associate Professor Mary Macken-Horarik and Dr.

Susan Feez of UNE. This project is an investigation into how we can help poor spellers. I write to you to formally seek the school's permission to proceed with this mutually beneficial project.

Many children struggle throughout their education with learning to spell and despite being provided with explicit and sustained instruction about the sounds within words (phonology), they may not know about meaningful chunks such as, prefixes, suffixes and roots (morphology). There is emerging evidence that explicit knowledge about morphemes and how this knowledge relates to other linguistic knowledge, such as phonemic and orthographic knowledge, may be important for all children learning to read and write (Carlisle, 2003; Nunes & Bryant, 2006).

Aims of the project:

This investigation will focus on children in Year 4, and it will be developed in 3 stages.

Stage 1 – Teacher Survey

This small survey will collect information about current spelling instruction, teachers' knowledge about spelling, and their beliefs and concerns about the practical aspects of teaching spelling to Year 4's. It is anticipated that this survey will take approximately 20 minutes to complete.

Stage 2 – The Student Intervention

The proposed intervention will be intensive, sustained and comprehensive teaching of Year 4 in the explicit understanding of the meaningful parts of words. This intervention will be delivered by the classroom teachers in Term 3 and integrated into their normal spelling lessons. The intervention aims to teach Year 4 children that spelling represents sounds and meanings by:

1. The children discovering the interconnections between what the word looks like, what the word sounds like and the way spelling can indicate meaning including the identification of homophones, affixes/roots, and the possessive apostrophe. Thereby encouraging children to develop multiple representations, or ways of thinking about written language.
2. Give children the metalinguistic tools to think about and talk about the structure of the English language in its written form.

Stage 3 – Teacher Interviews

The teachers that participate in the delivery of the intervention will be invited to give their feedback and comments as to the effectiveness and practicalities of teaching this spelling approach in the classroom. It is anticipated that these interviews will take no more than 20 minutes to complete.

Time Requirement:

In general, only modest additional time will be required over and above that which is already invested by committed and engaged professionals. Teachers that agree to participate in the delivery of the intervention to their classrooms will be required to undertake a small amount of content instruction prior to the start of the intervention. Teachers will be free to take the information and plan and deliver the lessons in the way that best suits their teaching style. The intervention will start at the beginning of Term 3, 2011 and finish at the end of Term 3, 2011. Post and retesting will continue into Term 4, 2011. All testing will be incorporated within the spelling lesson time allotted to the class each week. Teacher interviews before and after the intervention will take no more than 30 minutes of out of class time. Similarly, three selected students from each class will be required to attempt a small number of think-aloud exercises before and after the intervention, which will take no more than 20 minutes.

I will require access to the classroom to observe the teacher/student interactions during the spelling lessons and testing time. It is anticipated that I will visit each participating classroom once a week and be as unobtrusive as possible by sitting at

the back of the class taking notes. I will make arrangements with each teacher to observe the class at the most convenient and opportune time for the teacher. It is anticipated that these observation session will last for approximately 20-30 minutes once a week. I will be available by phone, or by email at anytime to offer support and discuss any updates or concerns. Alternatively, we could arrange a meeting each week that need only take 10 minutes or so. **Videotaping** will <u>not</u> be required in this study. I will not disrupt the lessons, but merely observe. I will be ever mindful that the teachers and their students need to maintain routines and feel comfortable with my presence. The busy and complex life of the school and the classrooms will be respected at all times.

Methodology:

This study includes surveys, observations, written spelling tests, and think-alouds in a pre/post/retest design. It will enable me to investigate the effectiveness of the morphological intervention on children's spelling and comprehension performances, but also on their improved understanding of the relationship between the different linguistic concepts that contribute to spelling knowledge. In addition to this, the design seeks to discover the statistical significance of the spelling test results and how they relate to the students' NAPLAN results of the previous year. Also of particular importance will be the data that reflects the teachers' perspective about the practicalities and effectiveness of teaching a relational approach to spelling in the reality of the Year 4 classroom context.

Educational Benefit:

The proposed study aims to contribute to the common goal of Australian Governments in their commitment to provide effective quality teaching and develop young learners' capacity to learn the essential skills in literacy. This project will develop a program grounded by research and tested in the classroom that supports

the development of deep knowledge about the structure of words. This research and the teaching programs that will be developed as a result will be beneficial to all young literacy learners, but it is hoped that this work will have a particularly beneficial impact on those who struggle with reading and writing.

Process:

This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. **HE11/025** Valid to **27/04/2012**.). Following school approval, I will write to participating teachers and parents inviting them to participate.

It is anticipated that the research will start at the beginning of Term 3, 2011 and finish at the end of Term 4, 2011. The results will be written up in a thesis without any identifying information.

If you have any complaints about the way this research is conducted, please contact the Research Ethics Officer at the following address:

Research Services
University of New England
Armidale, NSW 2351.
Telephone: (02) 6773 3449 Facsimile (02) 6773 3543
Email: ethics@une.edu.au

Thank you for considering this request and I look forward to further contact with you. If you have any questions regarding this request, you are more than welcome to be in touch.

Regards,

Chief Researcher: Associate Professor Mary Macken-Horarik

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Appendix B

Research Project: The effects of a morphological intervention on children's spelling performance and understanding: Toward a Relational Approach

Agreement from School Principal

Please insert your name, and circle the yes/no responses as appropriate.

I, _____ have read the information contained in the Information Sheet and any questions I have asked have been answered to my satisfaction.

Yes / No

I agree for the nominated teachers and their classes

_____

to participate in this activity, realizing that the school may withdraw its support at any time.

Yes / No

I agree to inform the research team, as soon as practicable, of any personal, professional or organizational circumstances which may limit the participation of any teachers or classes in this study

Yes / No

I understand that consent/assent forms will be distributed to teachers, students and parents for their completion, and that the timely and thorough completion of them will be prioritized by the school (e.g. treated with the same level of importance as consent forms for attending a school camp).

Yes / No

I understand that good communication between the school principals, the teachers and the project team is important and there will be a need to have regular (i.e. 1-2 weekly) discussions between myself and the project team and that I should feel free to initiate such conversations as necessary.

Yes / No

Agreement continued on the following page

Agreement continued from the previous page

I understand that e-mail and informal teleconferences may be used to promote good communication between (a) the research team and participating teachers, (b) the research team and school principals and (c) between teachers from all project schools.

Yes / No

I understand that the project requires a "main contact person" at the school. My nomination for that contact person is _____

Name of principal: _____

Name of school: _____

Contact e-mail address: _____

Contact telephone number (work): _____

Contact telephone number (out of hours): _____

_____ _____

Signature Date

Please return the two pages of this agreement as soon as possible to Michele Herrington.

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Appendix C

Teachers' Language Knowledge Questionnaire

1. What is a morpheme?
(a) the smallest unit of sound
(b) a pronounceable group of letters containing a vowel
(c) the smallest unit of meaning (correct answer)
(d) a sliding vowel
(e) I don't know

2. Which of the following is an inflected verb? (Pick one)
(a) Scarecrow
(b) Nameless
(c) Impeached (correct answer)
(d) Unbelievable
(e) I don't know

3. Which of the following is a bound root? (Pick one)
(a) Once
(b) Tables
(c) Phonograph (correct answer)
(d) Weakly
(e) I don't know

4. Which of the following words has a prefix? (Pick two)
(a) Missile
(b) Unhappy (correct answer)
(c) Commit (correct answer)
(d) Interest
(e) I don't know

5. Which of the following words has an adjective suffix? (Pick one)
(a) Natural (correct answer)
(b) Apartment
(c) Encircle
(d) Emptiness
(e) I don't know

6. If a student spelled the word "electricity" as "elektrisuty" which of the following is most likely true?
(a) The student does not know sound-symbol correspondence.
(b) The student has a poor ear for the symbols in our language.
(c) The student has a poor visual memory.
(d) The student does not know the base word and suffix from which the word 'electricity' was constructed. (correct answer)
(e) All of the above
(f) I don't know

7. A student writes: ‘I have finely finished my book.’ Her misspelling of the word ‘finally’ most likely indicates that she:
(a) is not attentive to the sounds in words
(b) does not know basic letter-sound relations.
(c) has not matched spelling to the meaningful parts of the word. (correct answer)
(d) has a limited vocabulary
(e) has a limited knowledge of sight words.

8. Choose the sentence that is punctuated correctly.
(a) The children’s shoes were in the ladies toilets.
(b) The childrens’ shoes were in the ladies’ toilets.
(c) The childrens shoes’ were in the ladies toilets’
(d) The children’s shoes were in the ladies’ toilets. (correct answer)
(e) I don’t know.

9. The spelling system of the English language primarily represents:
(a) speech sounds
(b) spelling rules
(c) orthographic patterns
(d) meaning (correct answer)
(e) I don’t know

10. To be a good speller you need to:
(a) have a good visual memory
(b) have a gift for it
(c) have phonemic awareness
(d) have morphemic awareness
(e) have phonemic and morphemic awareness (correct answer)
(f) I don’t know.

Appendix D

Teacher Survey/Interviews

Part A

Date

School

Grade you are teaching at present?

Teaching qualifications & year obtained (e.g. Bachelor of Education, 1984)

How many years of teaching experience do you have?

How many children are in your class?

How many children in your class struggle with spelling?

What is your school's current spelling program?

Whole language based

Phonics based

Other

What method of spelling instruction do you think is most appropriate for teaching poor spellers?

Which spelling strategy do you favour teaching in the classroom?

Teacher Survey Continued

Part B

Do you think spelling is important?

What role do you think spelling plays in literacy development?

What concerns regarding literacy teaching/learning would you like researchers to address?

What are the difficulties that your students have with spelling and how would you address them?

What are the common mistakes your students make with the word *'opened',* and how would you help them address their difficulty spelling this word?

Look for a similar response to these words:

Slept

Prepare

Beginning

Combination

Uncovered

Happiness

Magician

Appendix E

Materials used to stimulate children's talk about spelling

EXERCISE 1

Row 1	**Row 2**
moth	mother
runner	run
cook	look
help	unhelpfulness
knowledgeable	know
untie	unite
sharpen	pencil
nature	natural
quick	quickly
consequence	sequel

Questions

1. Does the word in Row 1 relate to the word in Row 2?

2. How are they related?

3. If not, why not?

Materials used to stimulate children's talk about spelling - continued

EXERCISE 2

Questions

In each group, pick the word that does not belong with the others.

Why doesn't it belong?

How do you know?

Group 1

portable	porch	support	export

Group 2

happy	happiness	chaplain	perhaps

Group 3

reuse	useless	fused	usage

Materials used to stimulate children's talk about spelling - continued

EXERCISE 3

You will be shown 5 words that have been spelled 3 different ways. You have to choose which spelling is correct, and tell me why you chose that spelling.

1. opened openned opend

2. goled gold golled

3. sleeped slepped slept

4. washt washed washd

5. wishhd wisht wished

Appendix F

Morphological Spelling Test – Real words

1. magician On Sunday we are going to see the *magician*.
2. statement The policeman asked me to make a *statement*.
3. opened I *opened* my eyes.
4. madness To tease a gorilla is *madnes*s.
5. musician My sister wants to be a *musician*.
6. careless You must not be *careless* when you drive.
7. richness The *richness* of the colours made the painting beautiful.
8. emotion He was overcome by *emotion* and began to cry.
10. buy I would like to *buy* some chips.
11. brother's My *brother's* bag was left in the car.
12. children's The *children's* playground was closed.

Morphological Spelling Test – Pseudo Words

13. lagician A person who does *lagic* is a *lagician*.
14. slupless A felt *slupless* when I had no *slup*.
15. reblod When I *reblod* my shoe, I have to *blod* it again.

Appendix G

Spelling principles for teachers to teach students in the intervention.

Writing is a system with rules and patterns that represent, not only the sound of our language, but its meaning. Most children understand that words have meanings, but most children do not understand that the meaning of any word depends on its structure, or morphology. Learning about morphemes can make learning to spell easier to master.

Roots, affixes and bases

Before tackling the questions of 'how' and 'what' morphemes to teach, it is important for teachers to have clear and accurate definitions of the relevant linguistic concepts.

- **Morphemes** are the smallest unit to carry meaning in a word, but there are a number of types of morphemes that contribute to meaning in different ways. For example, there are roots, bases and affixes.
- **Free root** is the basic part of a word that has meaning and can stand-alone and cannot be broken down any further into smaller meaningful units (e.g. *teach).*
- **Bound root** is the basic part of a word that has meaning but cannot stand-alone (e.g. *hap* meaning chance or luck is the bound root in the word, *happy* and *perhaps*).
- **Base** is part of the word that carries meaning when inflectional affixes have been removed (e.g. *teacher* is the base of *teachers* and *teach* is the root of both).

There are two types of affixes, **derivational** and **inflectional**.

- **Derivational** affix to a word creates a different word based on the original word (e.g. *music* becomes *musician* by adding the ***–ian*** suffix which changes the word from a noun to a person noun). Sometimes the derivational affix can change the grammatical class of a word, for example the suffix ***-ness*** can change the adjective *happy* into an abstract noun, *happiness.* There are many derivational affixes some are prefixes like ***un-*** and ***re-,*** and suffixes like ***–ful, -less*** and ***–ion***.
- **Inflectional** affix gives essential information about the root or base. For example, all nouns can indicate plurality by attaching an ***-s*** or **-es** to the end of a word, as in *cats* and *dogs.* The sound at the end of these two words is different, i.e. /s/ and /z/, but the morpheme is represented by the same letter showing consistency in representing meaning. Other inflectional affixes include, ***-ed*** indicating past tense, ***-er*** indicating the comparative, ***-est*** indicating the superlative, ***-ing*** the progressive tense, and the third person present plural ***-s*** and the possessive ***-'s.***

Morphological instruction is more than teaching common prefixes and suffixes.

Curricula often include instruction about prefixes and suffixes, such as '*ing*' and '*ed*', but not in a way that is designed to reveal the consistent meaning structure of the English spelling system. Teacher resources often present prefixes and suffixes as a disconnected set of spelling rules (that consequently generate many exceptions), such as dropping the final '*e*' before adding a suffix, but do not attempt to build a coherent understanding of the underlying principles of the spelling system (Bowers, 2006).

It is proposed here that teachers need to develop a relational approach to teaching the essential elements of spelling. Initially, teachers need to provide detailed information on which the graphemes of a word represent particular phonemes. This gives the student a phonemic reference point. Then it must be explained why a specific grapheme is most appropriate for a given word. For example, the word's meaning may need to be preserved by using a consistent letter pattern. Take for example the word *mean.* Students will quickly identify the only choice they have to use an 'm' at the beginning of the word and an 'n' at the end. However, the middle sound, long /e/ sound presents a couple of obvious choices. Bowers (2006) suggests that by a process of elimination teachers can guide their students with a bit of detective work. Students could say that either 'ee' or 'ea' could be used. Which one is correct? One strategy could be to think of words with similar meanings or spellings like the word *mean.* The word mean is the base word of *meant* and the students could be directed to make the connection between the meaningful-base *mean* and the way it changes its sounds to create the word *meant.* Only the *ea* diagraph can make the long and short vowel sound, so this letter pattern is the logical representational fit (i.e. the *ee* digraph can only represent the long vowel sound in English spelling). This relational approach to spelling instruction informs the learner about how morphemes and phonemes work together in predictable ways, and are determined by the orthographic rules of our English spelling system.

A relational approach to teaching spelling

This intervention aims to teach children that spelling represents sounds and meanings by:

1. Discovering the interconnections between what the word looks like, what the word sounds like and the way spelling can indicate meaning including the

identification of homophones, affixes/roots, and the possessive apostrophe. Thereby encouraging children to develop multiple representations, or ways of thinking about spelling.

2. Give children the metalinguistic tools to think about and talk about the structure of the English language in its written form.

Table 1: A matrix illustrating the three important aspects of spelling

<table>
<tr><td>Phonemes</td><td colspan="4">Morphemes</td><td>Orthography</td></tr>
<tr><td>Sounds within words</td><td colspan="4">Meaning</td><td>Spelling Rules</td></tr>
<tr><td></td><td>Prefixes</td><td>Root</td><td colspan="2">Suffixes</td><td></td></tr>
<tr><td>/h//a//p/</td><td>un-
(not)

per-
(by, through)

mis-
(bad)</td><td>-hap-
(chance, luck)</td><td>-y

-s
en</td><td>(derivational)
-er
-est

-ly
-ness
(inflectional)
-S
-ing (present progressive
-ed (past tense)
- stance (from circumstance)
- hazard (risk)</td><td>When a one-syllable word, with a short vowel is followed by a single consonant, you must double the consonant before adding the suffix that starts with vowel e.g. happy.

Change the ‘y’ to ‘i’ before you add a suffix e.g. happier.</td></tr>
</table>

The comprehensive nature of the intervention will require that even though the focus will be on teaching and learning the principles of morphology, it is expected that orthographic instruction (spelling and letter conventions) as well as phonemic instruction (concepts about the sounds in words) will be incorporated where

necessary. It has been shown that when morphemic instruction is given alone it is not as effective as integrating it with other aspects of literacy instruction (Bowers, Kirby & Deacon, 2010). Children need to understand the relatedness of the three aspects of written language: phonology, morphology and orthography. Bowers, Kirby and Deacon (2010) also suggest that the most successful intervention studies incorporate a theme of problem solving or detective work to frame the instruction for the students that will enhance their motivation and enjoyment of the lessons. Mindful of this, the suggested instructional sequence for each lesson will be:

1. To find the sounds within the word

2. To problem solve the correspondences between the sounds and letters including digraphs, trigraphs and silent letters.

3. Identify the syllable breaks

4. Look for the clues that indicate the meaningful parts of the word including base or root, prefixes and suffixes.

5. Use analogy by looking at similar sounding words with similar meanings to find the clues to spelling patterns

6. Identify the orthographic rule (spelling convention) for adding the affix.

7. It is important to teach children the morphemic principles that determines the word structure, rather than specific word learning. This could be done by assisting children to extend and explore their morphemic knowledge by creating word sums for each word, an approach that extends the problem solving nature of understanding the written word. For example:

Help

Help + s -> helps

Help + er -> helper

Help + er + s -> helpers

Help + ed -> helped

Help + ing -> helping

Help + less -> helpless

Help + full -> helpful

Un + help + full + ly -> unhelpfully

Un + help + full + ness -> unhelpfulness

Word sums give the teacher and class the opportunity to not only explore the many words that can be generated using the root word, but how affixes can change, or add different shades of meaning to the root and how they may be used in different contexts. Word sums may also assist in integrating the features of phonology, morphology and orthography in one engaging task. Homework could include doing word sums with the words from their spelling lists and then writing them in the context of a sentence.

SUGGESTED CLASSROOM ACTIVITIES

- Initiate classroom conversations about the spellings of words
- Count sounds in words
- Find and count morphemes in words
- Make connections between meaningful forms in words
- Word sums
- Match prefixes and suffixes with meanings
- Match suffixes with their parts of speech
- Identify morphemes and notice the way they sound
- Match roots and meanings
- Match words and meanings
- Define roots
- Identify affixes in a passage of text
- Use words in context
- Add suffixes to polysyllabic base words
- Make morpheme webs
- Contrast morphemes using homophones
- Play games such as ‘Spelling Jeopardy’

Appendix H

Email Samples communicated between researcher and teachers

No 1

Hi Michelle

Glad you enjoyed your visit today. Hoping you can add some helpful information for the words for next week.

towards
moment
seemed
saying
afraid
closer
fire
paw
front
forward

Many thanks

Heather

No.2

To Heather

Poster size charts for prefix study. If I get
some I will pass them on.

'Fix" in suffix and prefix means to build onto, or attach onto. So, prefix means to attach onto the beginning of the word and suffix means to attach onto the end of a word.

All the activities you mentioned are excellent. Just a thought, what about word webs. Put the root word in the middle, for example "min" and get the children to create a word web with as many words using this root as possible. Let me know how you go.

If we could finish the pre testing in week 2 that would be great.
Aiming to take observation notes in week 3. Would Wednesday at 11.20 be a good time for that?

No. 3

Thanks Michele,
I received the packages you dropped off at school today.
I will email my timetable asap, after tomorrows staff meeting I will have more details to finish it.
Would you consider taking any extra comments/thoughts I make by email rather than in a notebook?
I intro'd the concept of root words, word building, words from other languages contributing to meaning today J AND my class coved the whole concept, the new power over language.
Some kids expressed real happiness in being able to spell pterodactyl!! And were amazed and delighted with the connection to helicopter. Overall, a satisfying experience for me to see their 'light bulbs' ignite with success and excitement.
I have to work on an approach to homework and building word families... is that terminology beneficial? Or does a better phrase exist?

No. 4

Hello Michelle,

The first email went to you unfinished. As did the attached word list.

As you can probably gather, I am doing last minute preparations for school as my holidays have hi-jacked my time into relaxing.
Anyway, this week I am going to present to my class the skills/ideas/language to build words. I will be covering prefixes (please see attached list). Dinosaurs will be the theme for this week which I can tie in with work on environments. Also I will hang the new knowledge on other words and the 'sci' family as you have indicated in previous email.

What does the 'fix' in prefix and suffix mean?

So, a recap, please check if I have this right.

1. Words are interpreted/spelt so that the sound of them indicates a meaning.
2. Many words are in families with 'root' words.
3. By using word sums, more words can be made

Is 'con' a prefix if so what does it mean. Maybe alternate?

I must have left your info pack at school, so I will have to do further work filling out my spelling list tomorrow.

No. 5

Hello Michelle,
As you can probably gather, I am doing last minute preparations for school as my holidays have hi-jacked my time into relaxing.
Anyway, this week I am going to present to my class the skills/ideas/language to build words. I will be covering prefixes (please see attached list). Dinosaurs will be the theme for this week which I can tie in with work on environments. Also I will hang the new knowledge on other words and the 'sci' family as you have indicated in previous email.

What does the 'fix' in prefix and suffix mean?

So, a recap, please check if I have this right. Words are interpreted/spelt

Is 'con' a prefix? If so, what does it mean?

I must have left your info pack at school, so I will have to do further work understanding prefixes tomorrow.

No. 6

Hi again Michelle,

Upon a quick reflection – here are my initial thoughts

I believe I should teach my class about how to build words as you showed me and is illustrated in your notes. I am working on formulating the language the kids should know to access you spelling approach. Perhaps the initial lesson to hook them in would be the dinosaur example. Which is a departure from the spelling sequence, but i think necessary to build foundation for new type of information delivery.

Looking forward to working on this.
Im leaving the house for the day now, and will be working on school stuff tonight.

No. 7
Good Morning Michele,

Thanks for the lesson. I am loving the new knowledge you are sharing with me.

I have no preference in being part of the control or intervention. What I want out of the experience is to be able to teach my children how to be confident spellers and language users and I see that you have some of the keys and knowledge I need to achieve that aim.

If you need a control group ii will happily take that role; however I want to re-jig my approach to teaching spelling and use the approach you have outlined.

I will msg you in a couple of hours with next weeks word list.

No. 8

Hi Sandy

I'm back at my desk and I thought I'd try and tackle some of your queries sent in your email of 5/07/11.
1. If you feel that this spelling intervention will be too difficult to incorporate into your current spelling program, then there is the option of being my control group. That is, you would deliver the pre/post tests, but there would be no intervention.

2. If you want to be part of the intervention study then you can include as much as you feel you and your students can handle as long as the core message is that spelling (or a word's structure) represents BOTH sound and meaning. So, I would suggest that with each list of words the relationships between sound and meaning within each word are explored. For example, you asked me how to teach the 'sc' words like 'science'. Well, "sci" means 'knowing' and a lexical map would look like this:

un		ent	ist
un - con	SCI	ence	
omni	(knowing)	ous	ly
pre			ness

So, you end up with words like; science, scientist, scientific, conscious, conscience, unscientifically etc. If your thinking where does the word 'scissors' relate - it doesn't! It has a different base or root being 'cis' meaning 'to cut'. The word 'scissor' is related to the words 'incisor' and 'incision.' I'm not suggesting that all this needs to be taught to your children - just for your information and to show you how words hide clues to sound and meaning.

A great one for your students may be to show them the connection between 'helicopter' and the 'pterosaurs' dinosaur. The 'pter' is a Greek morpheme that means 'wing' in both words. The 'helic' means 'spiral', therefore the word 'helicopter' literally means 'spiral wing'. There are many dinosaurs that use 'pter' to indicate the dinosaur has wings e.g. pterodactyl, trichoptera, isoptera, mecoptera etc. If they're into dinosaurs, it is a great way to introduce them to the idea that letter patterns can give clues to meanings.

If your working with particular letter patterns to indicate sound - just add as many suffixes/prefixes as you can. Remember that it is important that they understand the meanings of the prefix/suffix. Word sums are great for this.

If you like, you can send me your word list each week and I'll send you back teaching tips.

Hope this helps
Michele

No. 9

Hi Michele,
I have just returned to the internet-land today after nearly a week off. I'll be happy to hear from you whenever you can msg me, I am not in a hurry with planning. In fact I think some of your ideas may shape my classroom approach.

No. 10

Hi Michele, It was good speaking with you the other day. I would like to take part in your research in the impending school term. I have a couple of niggling qualms: 1. That my existing spelling program is time consuming/difficult/inappropriate to adapt to required spelling approaches. As write this I acknowledge that such an adaption to your approach to Spelling would only be of immense benefit to my students. 2. That I may omit part of your explicit Spelling message when delivering to my students, or indeed that I may not understand the content well enough. I have attached the current program I am using. We will begin the Term at 11. - Diagraphs -the H brothers. What and Who on earth are the H brothers? In a future email I can forward the weekly list of words used in the classroom for the previous two terms if they of interest to you. Regards

---

No 11

Hi Michele,
It was good speaking with you the other day. I would like to take part in your research in the impending school term.
I have a couple of niggling qualms:
That my existing spelling program is time consuming/difficult/inappropriate to adapt to required spelling approaches. As I write this I acknowledge that such an adaption to your approach to Spelling would only be of immense benefit to my students.

That I may omit part of your explicit Spelling message when delivering to my students, or indeed that I may not understand the content well enough.

I have attached the current program I am using. We will begin the Term at 11. – Diagraphs –the H brothers. What and Who on earth are the H brothers?
In a future email I can forward the weekly list of words used in the classroom for the previous two terms if they of interest to you.

Appendix I

Sample of Student Interviews from Intervention groups

Student # 1
10 years / Year 4
Intervention Group Sample

Pre Test

Researcher: Are the words 'help' and 'unhelpfulness' related or connected to each other in some way?

Student: (long pause)…Yes.

Researcher: How? Why do you think they are connected to each other?

Student: (Shrugs, no answer.

Post Test

Researcher: Are the words 'help' and 'unhelpfulness' related or connected to each other in some way?

Student: Sought of.

Researcher: How?

Student: Well, you have the base word there (points to help in unhelpfulness) in unhelpfulness.

Researcher: What about the other parts of this word?

Student: They're prefixes and suffixes.

Researcher: Excellent. Do you know what this prefix means?

Student: 'un' to like not do it.

Researcher: Excellent. What does 'ful' mean here.

Student: like you can't put anymore in.

Researcher: Excellent. Do you know what the 'ness' means? Do you remember that?

Student: (pause) state of being.

Researcher: Well done.

Student # 2
10 years/ Year 4
Intervention Group Sample

Pre Test

Researcher: Are the words 'help' and 'unhelpfulness' related or connected to each other in some way?

Student: Yes. Help is when you help someone and unhelpfulness is when you don't help someone.

Post Test

Researcher: Are the words 'help' and 'unhelpfulness' related or connected to each other in some way?

Student: Yes. There is the word help in unhelpfulness.

Researcher: Excellent. Do you remember what we call this part of the word?

Student: (pause) um…the base word?

Researcher: Yes. Do you remember what we call the part in front of the base word?

Student: ummm (long pause)

Researcher: Say you don't know it if you don't know.

Student: A prefix?

Researcher: Yes! You got it. So the bits added on the end of a base word are…?

Student: I can't remember.

Researcher: OK. It's a suffix. Do you remember what the un means in unhelpfulness?

Student: Not helpful?

Researcher: Yes. Great. What about the 'ful' part, what does that mean?

Student: Full.

Researcher: Yes. Do you know what the ness part means?

Student: No…I forgot.

Student # 3
9 years/ Year 3
Intervention Group Sample

Pre Test

Researcher: Are the words 'help' and 'unhelpfulness' related or connected to each other in some way?

Student: No.

Post Test

Researcher: Are the words 'help' and 'unhelpfulness' related or connected to each other in some way?

Student: This word has help in it.

Researcher: Good. Can you tell me what part of the word that is called?

Student: (long pause) A base word?

Researcher: Good girl. Do you remember what the bit on the front of that word is called?

Student: A…(long pause)

Researcher: A pre…

Student: Oh! A prefix!

Researcher: Excellent. What about the bit added onto the end, do you remember what that is called?

Student: A suffix.

Researcher: Good. Do you remember what un means?

Student: undo?

Researcher: OK. And what about 'ful' do you remember what that means?

Student: No.

Researcher: And ness, do you remember what that means?

Student: No.

Student # 3
9 years/ Year 3
Intervention Group Sample

Pre Test

Researcher: Are the words quick and quickly related to each other in some way?

Student: Yes, cause they're the same.

Post Test

Researcher: Are the words quick and quickly related to each other in some way?

Student: Yes, cause they have the base word and you just add the suffix 'ly' on the end.

Pre Test

Researcher: Which one doesn't belong? (*portable, porch, support, export)*

Student: support

Researcher: Why did you pick that one?

Student: Because it has a double p and all the rest only have one.

Post Test

Researcher: Which one doesn't belong? (*portable, porch, support, export).*

Student: Porch

Researcher: Why did you pick that one?

Student: Because all the others have 'port' in them and this one is just missing a 't'.

Pre Test

Researcher: Which one doesn't belong? (*happy, happiness, chaplain, perhaps)*

Student: perhaps

Researcher: Why did you pick that one?

Student: Because it has an 'er' and all the rest don't.

Post Test

Researcher: Which one doesn't belong? (*happy, happiness, chaplain, perhaps)*

Student: Chaplain

Researcher: Why did you pick that one?

Student: Because it has an 'l' in it and the others don't.

Pre Test

Researcher: Which word is spelled correctly in this group? (*opened, opened, opend)*

Student: (points to *opened*)

Researcher: Why did you pick that one?

Student: It sounds better than those two.

Post Test

Researcher: Which word is spelled correctly in this group? (*opened, opened, opend)*

Student: (points to *opened*)

Researcher: Why did you pick that one?

Student: It looks better than those two.

Pre Test

Researcher: Which word is spelled correctly in this group? (*washt, washed, wasd)*

Student: (points to *washed*)

Researcher: Why isn't *wisht* correct?

Student: It doesn't sound right.

Post Test

Researcher: Which word is spelled correctly in this group? (*washt, washed, washd)*

Student: (points to *washed*)

Researcher: Why did you pick that one?

Student: Because…um…'ed' is a suffix and 't' isn't.

Researcher: Ok. And what does 'ed' mean on the end of a word?

Student: umm…I can't remember.

Student No 4
9 years/ Year 4
Intervention Group Sample

Pre Test

Researcher: Are the words moth and mother related to each other in some way?

Student: No.

Researcher: How do you know?

Student: Don't know.

Post Test

Researcher: Are the words moth and mother related to each other in some way?

Student: Yes. Cause there's moth in that word (*points to 'mother'*)…*(pause)* Oh..No, 'cause they don't mean the same. *(student changed his mind).*

Pre Test

Researcher: Are the words run and runner related to each other in some way?

Student: Yes. Run is when you run and runner is when you've done it.

Researcher: How do you know?

Student: Don't know.

Post Test

Researcher: Are the words run and runner related to each other in some way?

Student: Yes. Cause a runner is someone who runs and you know cause it has an 'er' on the end.

Pre Test

Researcher: Are the words help and unhelpfulness related to each other in some way?

Student: No they're not the same cause help is when you help someone and unhelpful is when you don't.

Researcher: How do you know?

Student: Don't know.

Post Test

Researcher: Are the words help and unhelpfulness related to each other in some way?

Student: Yes. Cause help is in unhelpfulness. And I remember prefixes are the bit on the front and suffixes are on the end.

Pre Test

Researcher: Are the words know and knowledgeable related to each other in some way?

Student: Yes. When you know something.

Researcher: How do you know?

Student: Don't know.

Post Test

Researcher: Are the words know and knowledgeable related to each other in some way?

Student: Yes because knowledgeable means when you know stuff.

Student No 5
9 years/ Year 3
Intervention Group Sample

Pre Test

Researcher: Are the words moth and mother connected or related to each other in some way?

Student: Moth is in mother, but they don't relate.

Researcher: How do you know?

Student: Don't know.

Post Test

Researcher: Are the words moth and mother related or connected to each other in some way?

Student: No. Because a moth has wings and a mother doesn't. Mother has 'er' and has a very different meaning.

Pre Test

Researcher: Are the words run and runner connected or related to each other in some way?

Student: Runner has the word run in it.

Post Test

Researcher: Are the words run and runner related or connected to each other in some way?

Student: Yes a person who runs is a runner. Run is the base word.

Pre Test

Researcher: Are the words cook and look connected or related to each other in some way?

Student: They have the same ending three letters, but they don't relate.

Post Test

Researcher: Are the words cook and look related or connected to each other in some way?

Student: No cause they're different meanings. Just because it rhymes it doesn't mean they're related.

Pre Test

Researcher: Are the words sharpen and pencil connected or related to each other in some way?

Student: You sharpen a pencil, so they sought of relate, but they sought of don't cause they're not the same thing..

Post Test

Researcher: Are the words sharpen and pencil related or connected to each other in some way?

Student: No they're not connected even though you can sharpen a pencil.

Pre Test

Researcher: Are the words help and unhelpfulness connected or related to each other in some way?

Student: Yes, well help is like helping a friend and unhelpfulness is not helping.

Post Test

Researcher: Are the words help and unhelpfulness related or connected to each other in some way?

Student: Yes. Well help is like helping someone, but unhelpfulness is when your not. 'Un' means not and 'ful' means full of something and 'ness' means…I can't remember.

Student #6
9Years/Year 4
Intervention Group Sample

Pre Test

Researcher: Which one doesn't belong? (*portable, porch, support, export)*

Student: export. Because the others have a 'p' in them and they look the same

Post Test

Researcher: Which one doesn't belong? (*portable, porch, support, export).*

Student: Support.

Researcher: Why did you pick that one?

Student: Because they sound the same and they as if they should be in a group..

Pre Test

Researcher: Which one doesn't belong? (*happy, happiness, chaplain, perhaps)*

Student: Chaplain. Because that one has an 'L' in it and the others have 'hap' in them.

Post Test

Researcher: Which one doesn't belong? (*happy, happiness, chaplain, perhaps)*

Student: Complain.

Researcher: Why did you pick that one?

Student: Because the other words are the same. Perhaps means you might do it and that makes you happy. Complain is when someone complains about something and that means you are sad.

Sample of Student Interviews from Comparison Group

Student # 7
10 years/ Year 4
Comparison Group

Pre Test

Researcher: Which one doesn't belong? (*portable, porch, support, export)*

Student: No idea.

Post Test

Researcher: Which one doesn't belong? (*portable, porch, support, export).*

Student: I don't really know.

Pre Test

Researcher: Which one doesn't belong? (*happy, happiness, chaplain, perhaps)*

Student: Perhaps doesn't really connect with the others.

Researcher: Why?

Student: I don't know.

Post Test

Researcher: Which one doesn't belong? (*happy, happiness, chaplain, perhaps)*

Student: Perhaps cause it doesn't have anything to do with happy or happiness.

Researcher: How can you tell?

Student: I don't know. It just looks right.

Appendix J

Sample of spelling lessons

Teacher # 8

Year 3 Class

Teacher read a story to the class with pictures. At the end of story words were chosen to focus on for spelling lesson.

Teacher: Let's talk about these words. Let's have a conversation (writes the words *swollen, haunches* and *remember* on the board). What does this word say, class?

Class: Swollen

Teacher: Words like to different – how do we say this word when it happens now?

Class: Swell

Teacher: Write it down on your white boards.

Teacher: Let's imagine this word has gone into the past. Have a go at writing that word.

Teacher: What can you tell me about the sounds in these words?

Some students call out: The word swell has different sounds like 'e' in it.

Teacher: That's right. Do you think 'swell' and 'swollen' are connected by meaning?

Some students call out: Yes.

Teacher: So who can give me a sentence with 'swell' in it and a sentence with 'swollen' in it?

Class: Students volunteer examples.

Teacher: So ‘swell’ means it’s happening now and ‘swollen’ means it’s already happened. Right?

Class: Yes

Teacher: What about the word ‘haunches” ? What sounds can you hear in this word?

Class: ‘h’ ‘or’ ‘ch’ ‘s’

Teacher: How do we usually write ‘or’?

Class: ‘or’

Teacher: That’s right. So have a close look at this word what letters do we use to write the ‘or’ sound in this word?

Class: ‘au’

Teacher: That’s right. What about the end of this word what can you see?

Class: ‘s’

Teacher: There is an ‘es’ on the end. What does ‘es’ on the end of a base word tell us?

Class: More than one.

Teacher: That’s right. So the base word in haunches is?

Class: Haunch

Teacher: That’s right. Turn to your dictionaries now and look up the word ‘haunch’.

Teacher: Let’s talk about the word ‘remember’. What sounds can you hear in this word?

Class: (shouts out sounds)

Teacher: I want you to focus on this little bit inside the word ‘mem’. What other words have this little piece ‘mem’ in them?

Class: memory, memorial, memo, memoir, memorable, remembrance

Teacher: What do all these words have in common?

Class: the ‘mem’

Teacher: So what do you think ‘mem’ might mean?

Class: something to do with remembering?

Teacher: something to do with thinking about something again.

Teacher # 5

Teacher: (defines morphemes) Some words have chunks of meaning and sometimes there can be more than one chunk of meaning with a word. For example *replayed*

Someone come up to the board and circle the prefix.

Teacher: Ok. Now I want someone to come up to the board and circle the suffix.

Teacher: I want someone to come up to the board and circle the base word.

Teacher: I know ‘play’ is a simple word but I want you all to look it up in the dictionary.

Teacher: So the meaning of ‘play’ is an action. If you replay the soccer game, you do it again. If you add ‘ed’ to the end what meaning does it add to the word? It’s past tense.

Teacher # 9

Teacher: What is a suffix?

Class: Something we add to the end of a word.

Teacher: Why do we add something to the end of a word?

Class: To change the meaning.

Teacher: And to add to the meaning.

We are going to do the suffix ‘ful’ today. (writes it on the board). Is that the way we spell ‘full’ usually?

Class: No

Teacher: No. When the word full is used as a suffix we drop an ‘l’ don’t we?

(writes the words ‘delightful’ and ‘frightful’ on board)

Teacher: Look in your dictionaries and write down the extended meaning of the suffix ‘ful’ and then find some more ‘ful’ words.

Teacher: Let’s now go round the room and each one yell out a new ful word.

Appendix K

Sample of teacher comments

Teacher # 4

Teacher: The children are much more engaged with learning spelling. I Particularly enjoyed teaching the new material you gave me. There’s more depth. In fact, I have learned so much more about words teaching this. ‘Cause you know, I’m a really bad speller. Always have been. It’s really helping me. I’m using on your emails for each lesson, that’s all I need really. My other spelling programme doesn’t really work. Can I use this past the end of the research?

Research: Yes.

Teacher: I can actually see these lessons extending their vocabularies and forcing them to take notice of the ends of words.

Teacher # 2

Teacher: I'm very happy with the spelling programme and I've got no problem continuing the study into term 4. I intend to teach spelling this way from now on. Much more interesting to teach and I can really see a difference in the way the kids approach spelling and reading.

Researcher: How do you think their approach has changed?

Teacher: Well, they're looking for bases and prefixes and suffixes now in all words. When they're reading they're looking at the ends of words more- looking at the suffixes and working out the meaning more – instead of just looking at the beginning of the word and having a guess.

Researcher: Do they enjoy the spelling lessons still?

Teacher: Yes. In fact, the better they're getting at finding the prefixes and suffixes the more they enjoy it. It's really extending their vocab.

Research: Do you want me to keep sending more material by email?

Teacher: Yes please. That's really helpful. It's really hard on Friday night to get word list together.

Teacher # 10

Research: How are things going?

Teacher: Ok. This week I'm doing 'dis' as a prefix. Last week we did 're'. My kids really struggle you know, but I think this is really helping.

Researcher: Do you have a good list of words to work with?

Teacher: No. I'm doing them today.

Researcher: How are your students going with these lessons?

Teacher: Oh, really well. They're looking for meaning in all parts of words now. Kai has gone up a level in his reading!

Teacher # 1

Teacher: I am very excited about these spelling lessons!

Researcher: Do the children enjoy it?

Teacher: They love it. Even in other lessons (other than spelling lessons) the kids are spotting prefixes and suffixes all over the place! They're learning so much about meanings and sounds in words. Stuff we haven't done before. I really think it's helping them.

Researcher: You had parent teacher interviews last week, how did that go?

Teacher: Great. Yeh, even the parents have noticed a change. They were very positive about the spelling progrqamme. Some parents had said they felt they're children were improving on this spelling programme.