

## Review of the Literature and Research

This literature review is divided into four parts.

1. Why spelling is an important literacy skill.
2. How children learn to spell.
3. What skills are necessary for the development of good spelling.
4. How spelling should be taught

### Why is Spelling an Important Skill?

#### The Influence of Spelling on Other Curriculum Areas

Literacy is not just about reading. As Waters, Bruck and Malus-Abramowitz (1988) point out: "To become literate, the child must become proficient not only in reading but also in spelling. Despite its importance, there has been less research on spelling than on reading" (p.400).

Children must become proficient with written language in order to communicate with others. As Croft (1983) states: "The only possible justification for learning to spell is that accurate spelling is necessary for effective writing" (p.8). Assessment procedures in most education settings rely on students having good written communication skills. In theory, poor spelling skills should not affect these skills. In practice, it appears they do. Moseley (1993) surveyed 1254, eight and nine year old students in inner-city British schools and found that 39% of the poorest spellers scored in

the average to above-average range in vocabulary tests. He also found that many of these poor spellers made errors in high frequency words and that the errors were often taken to indicate low intelligence. His survey revealed that poor spellers used a lot of high-frequency words, avoided using hard-to-spell words and repeated words they knew how to spell. The results of this research, suggest that children who are poor spellers may limit their written language in quantity and quality, in an attempt to minimise their spelling errors. It is unfortunate that a student's ability and intelligence is often measured by the quality of their written expression - by teachers and by the students themselves (Moseley, 1993).

The flow-on effect of poor spelling to the quality of written language has implications for most curriculum areas. It may also impact on the development of a negative academic self-concept. In their research with five year olds, Chapman and Tunmer (1996b) showed that reading self-concepts were developed after just one year at school and they demonstrated how difficult it was to change a negative reading self-concept, once it had developed. It is possible that a similar process could occur in the development of written language self-concepts, which appear to be influenced by spelling skills and knowledge. This may in turn affect several curriculum areas, with implications for the student's

overall academic self-concept.

### The Relationship Between Reading and Spelling

There are differing views about the nature of the relationship between spelling and reading: Whether they are based on different processes or different styles of learning, whether they are inter-related processes and whether the acquisition of one influences the acquisition of the other. There are numerous studies which suggest a link between the acquisition of spelling skills and reading achievement in beginning readers.

Some researchers suggest that reading and spelling depend on different processes. Frith (1980) argues that reading is a recognition process, while spelling is a retrieval process. She states:

To spell well, words must be represented in a detailed way in the mind of the speller and this memory image must be recoverable. In the absence of spelling knowledge, an individual will be forced to spell words according to the way they sound. (pp. 80,81)

Nelson (1980) and Snowling (1985) also discuss the recognition and reproduction differences between spelling and reading, suggesting that reading is the easier task.

Other researchers suggest that reading and spelling are related skills. Bruck (1988) suggests that the differences

she found between reading and spelling processes in dyslexic and non-dyslexic children related to strategy use rather than basic processes. She found that the dyslexic children used different processes to read and spell because of inadequate spelling-sound correspondence knowledge.

Mommers (1987) five-year research project in the Netherlands, revealed components of reading and spelling that were positively related. However, despite the influence spelling and reading skills appeared to exert on one another, Mommers states that they are still relatively independent and discrepancies may exist between the stages of development of the respective skills.

Other researchers have examined the possibility that there are individual differences among children in their spelling and reading styles. Treiman (1984) found that the Phoenician - Chinese continuum (Phoenician referring to children who rely on spelling-sound rules and Chinese, referring to children who rely on word associations as well as, or instead of, meanings) she had identified in beginning readers, also extended to beginning spellers. She also found that a reliance on rules (Phoenician) played a larger role in spelling than it did in reading which suggests that there are differences in the processes used for reading and spelling.

Castles, Holmes and Wong (1997) described similar results in their study, which found that individual differences existed in children's spelling styles, which corresponded to those previously identified in reading. This study differed from Treiman's (1984) in that it did not find evidence to support the view that either approach was more important in determining children's ability to spell. Castles et al. suggest that since children are capable of using both lexical (storage of visual representations of words) and sub-lexical (sound-letter knowledge) processes in spelling words, the strategy they adopt may have more to do with external factors such as teaching style, than internal factors.

Numerous studies suggest that spelling plays a major part in developing knowledge of the alphabetic structure of the English language and that it has a direct impact on early reading progress. Cataldo and Ellis (1990) state, "Spelling practice, as it occurs in various contexts, may enhance the knowledge base from which novice readers draw information in their attempts at phonetic-cue and cipher reading" (p.106). In their longitudinal study, they found that the early flow of information between reading and spelling appeared to be unidirectional: Knowledge gleaned from spelling contributed to reading. They also discuss Frith's (1985) framework within which spelling and reading

interact to advance the learner towards increasing proficiency in both abilities. They highlight Frith's (1985) suggestion that spelling plays a fundamental role in the movement from a visual, or logographic reading strategy to an alphabetic approach.

Mommers (1987) also found a relationship between decoding speed and spelling. He suggests that:

The ability to spell accurately and the ability to apply basic phonic rules in decoding are closely related. If this relation were found to be causal, it would be expected that ... spelling instruction would have the greatest impact on reading achievement. (p.126)

Ehri and Wilce (1987) suggest that there is a strong positive relationship between learning to read and learning to spell and that each contributes reciprocally to the development of the other. Their research showed that learning to spell did make a contribution to reading acquisition among children who were just learning to read. These findings supported a causal interpretation. Ehri and Wilce state, "Spelling instruction promoted word reading skill in beginning readers... by helping readers to store words in memory using letter-sound associations" (p.61).

Uhry and Shepherd's (1993) study into the effects of teaching

phonemic segmentation skills and spelling skills, on the reading skills of first grade readers, showed that trained subjects were superior to controls after six months, on measures of nonsense word reading, timed word reading and timed oral passage reading. At the end of one year they also showed improvements in segmentation, blending and spelling.

The findings from these research studies suggest that there is a strong relationship between reading and spelling and that spelling skills provide the beginning reader with strategies that assist reading acquisition.

### How Do Children Learn to Spell?

#### An Overview of Spelling Development

When children begin to learn that print maps the spoken word they are developing an awareness of the alphabetic principle (Ehri, 1987). In some languages spelling of words mirrors their pronunciation in a reliable fashion - Italian is one such language (Perfetti, 1997). English on the other hand, has a much less reliable link between phonology and orthography. There are many more ways of representing a sound graphemically (turning sounds into correct spellings) than there are ways of turning the graphemic representations into sounds (reading written language) (Ehri & Wilce, 1987; Treiman, 1993; Bosman & Van Orden, 1997). Perfetti (1997)

states that spelling is more difficult than reading. Reading can be accomplished with incomplete word representations, whereas spelling requires the retrieval rather than the recognition of the graphemes. He suggests that retrieval processes are more prone to errors because memory representations of words may be imprecise and there is often interference from competing letter sequences, which represent the same sound. Perfetti says:

... reading by itself will not dramatically improve spelling because reading does not practice the full orthographic retrieval process demanded by spelling. Moreover, it is spelling itself that is most effective at improving the quality of the word representation. Practice at spelling should help reading more than practice at reading helps spelling. (pp. 30, 31)

Although English is an alphabetic writing system, there are linguistic constraints at many levels, which affect the way in which sounds are translated into graphemic units. Perfetti (1997) outlines the significance of the orthographic system (the way in which rules relate graphic units to linguistic units) on developing spellers and readers:

English is generally held to be an alphabet, although the correspondence between phonemes and graphemes is far from straightforward. ... the treatment of English orthography as a simple alphabet is, in principle,

inadequate as an approach to the achievement of competence. Almost any word might, legitimately, be written in a number of ways. Because each word is assigned a unique and conventionally agreed spelling, it becomes essential to know the precise arrangement of letters that is appropriate in each case. (Perfetti, 1997, p. 319)

### Processes That Influence the Development of Spelling Skills

Seymour (1997) describes the different processes that are concerned with development of knowledge of the structure of the English language. He suggests a dual-foundation model, which encodes information at both a lexical and morphemic level as well as at an alphabetic level. This is similar to the dual-route hypothesis for spelling acquisition suggested by Nelson (1980), Jorm (1983) and Stackhouse (1985). These researchers identify both a sub-lexical process, relying on phonological processing, and a lexical process, relying on accurate storage of visual representations of whole words. Seymour suggests that spelling disabilities may take different forms that relate to the lexical versus the non-lexical processes. Children who are having difficulties with spelling mastery need to be assessed to determine which of these processes is difficult for them and instruction tailored to meet their needs.

Seymour's model of orthographic and morphological development demonstrates how various processes influence literacy acquisition. Using this model, it is possible to identify points at which children might have difficulties.

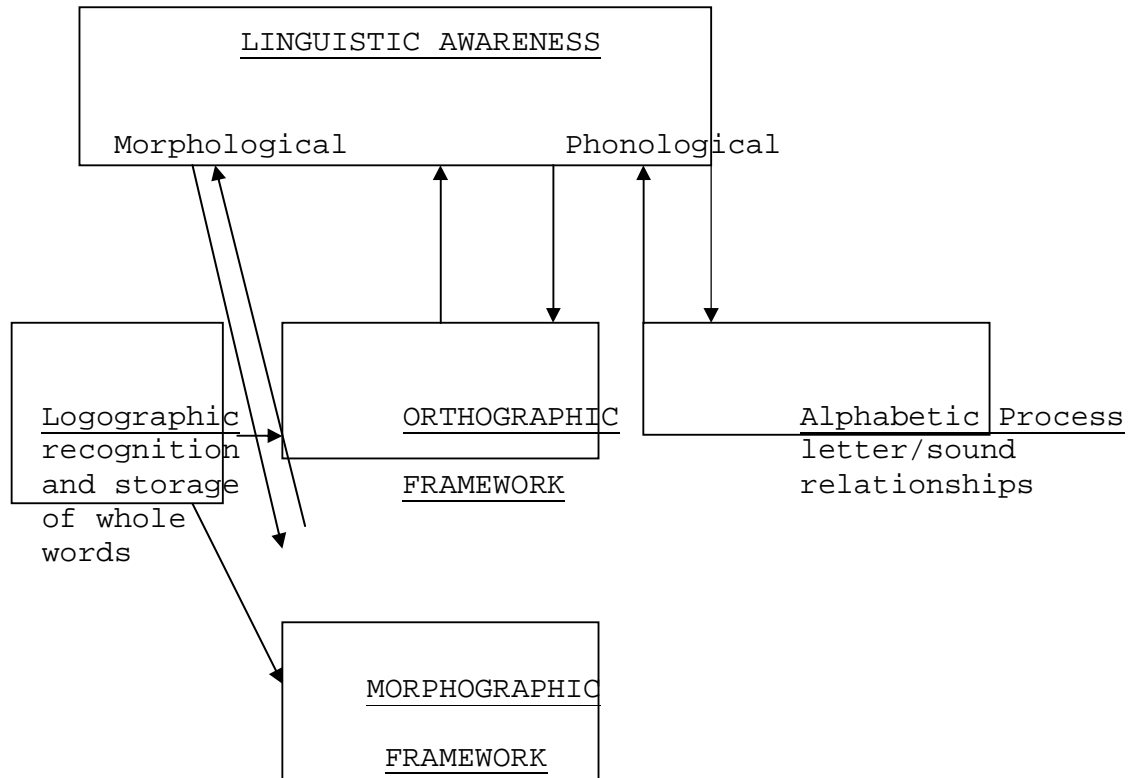


Figure 1. Modified diagrammatic representation of the dual-foundation model of orthographic and morphographic development (Seymour, 1997, p. 324).

### Phonological awareness.

Phonological awareness refers to the ability to discriminate between and to manipulate sounds in words. This works through a hierarchical system from awareness of rhyme (words

and syllables - cat, mat, sat) to awareness of onset (initial consonant or consonant cluster - c ) and rime (vowel and following consonants - at in cat) to an awareness of individual phonemes (c - a - t ) (Treiman & Zukowski, 1991).

The awareness of individual phonemes is critical to the development of literacy since children must learn how individual letters map sounds in spoken language. This is the beginning of learning the alphabetic principle.

There has been a considerable amount of research into the role of phonological awareness and literacy acquisition (Tunmer & Nesdale, 1982; Rohl & Tunmer, 1988; Bruck & Treiman, 1990; MacDonald & Cornwall, 1995).

Morais (1991) differentiates between phonological awareness skills and phonemic awareness. Aspects of phonological awareness include the ability to discriminate between sound patterns, an awareness of rhyme, the ability to break syllables into onset and rime. Phonemic awareness (the ability to discriminate between and manipulate individual sounds in words) on the other hand, is not thought to develop until children are exposed to the alphabetic writing system (Treiman & Zukowski, 1991; Muter, Hulme, Snowling & Taylor, 1997).

There is considerable debate as to the significance of these two skills in literacy acquisition. Some researchers believe that the ability to segment words into phonemes (phonemic awareness) is more predictive of literacy success

than phonological awareness (Muter et al., 1997). There is no doubt that children must be able to segment words into correct phonemes in order to read and write.

Perfetti (1997) discusses Goswami and Bryant's (1990) theory of literacy acquisition.

The main assumptions of this theory are: (a) Children arrive at the task of acquiring literacy with rhyming skills in place, (b) rhyme-based phonology provides a basis for categorising words in terms of similarity of sound and orthography, and (c) this basis is used to build a lexicon of words by a process of detection of analogies between known words and unfamiliar words.

(p. 322)

Developing readers and spellers need to use analogy in order to make links between words to reduce the cognitive load of word storage and retrieval. Greaney (1992), in a study of the development of rhyme awareness and analogical transfer in normal young and older poor readers states:

Probably the most significant benefit derived from using analogy processes for decoding is that the strategy encourages activation of known phonological knowledge. This was demonstrated in the research when more than 80% of the analogical units in the original reading errors were already known to the reader, suggesting that many poor readers already have a 'substantial analogical unit

base' from which to activate the strategy. Teaching strategies need to be developed that encourage such activations. (p.83)

Phonological awareness skills will contribute to the beginning reader and speller's ability to use analogy between sound patterns in words in their reading and spelling attempts.

#### Logographic process.

This is concerned with the direct recognition and storage of words and it includes both visual and phonetic cues. Young children can however, often "read" familiar logographs such as McDonald's signs, advertisements for Coca Cola and may be able to identify their names before they have any understanding of the alphabetic principle or knowledge of phonetic cues. They are able to use the logographic process to translate some written words into the spoken word. As they learn to read, many familiar words are stored and recognised in this manner, without the need to use phonetic cues. Children who have difficulties with this process will have problems acquiring a sight vocabulary. This can affect fluency with both reading and spelling.

#### Alphabetic process.

The alphabetic process is founded on the knowledge of the letters and their equivalent sounds. It involves basic

letter-sound reading, for example c-a-t says cat. Knowledge of letter names has been shown to cause confusion for children grasping the alphabetic principle because many of them do not give correct information about the sound they make in words (Seymour, 1997; Treiman & Tincoff, 1997; Thompson, Fletcher-Flinn & Cottrell, 1999). Seymour (1997) suggests that learning letter sounds may be easier for children since the target phonemes are embedded in a more systematic and complete way. Children may use this alphabetic processing (sounding out words) frequently in the early stages of literacy development until a base of sight words is established. After that time, it may be used for unfamiliar words. Skills in alphabetic processing form the basis of the development of an orthographic framework (Seymour, 1997).

#### Linguistic awareness.

This has as its primary outcome, an awareness of phonemes. Seymour (1997) points out that the natural development of phonological awareness proceeds from words and syllables to onset and rime and finally to phonemes. Alphabetic literacy on the other hand demands that awareness of phonemes proceed to the onset and rime level and on to syllables and whole words. This may create a conflict in the developing phonological awareness of children since most teaching programmes encourage awareness at the phonemic level in the

development of the alphabetic principle. Even when children have learned to recognise alphabet letters and translate them into the sounds they make in words, it is possible for them to have difficulties mastering spelling if they do not have the linguistic and phonological skills to take words apart and put them back together again (i.e., blending).

Consider children who have excellent letter-to-sound and sound-to-letter knowledge and who can spell a word correctly if someone else breaks the word into phonemes, but who are unable to do this themselves. Linguistic and phonological awareness skills are thus important and necessary for letter-to-sound knowledge to be useful in spelling and reading.

#### Orthographic framework.

According to Seymour (1997) "The heart of the theory of literacy acquisition is the formation of the orthographic framework. This is viewed as a structure that encodes a generalised knowledge of the correspondence system together with word-specific features" (p. 328).

The orthographic framework is seen as a core structure that arises out of the basic phoneme-grapheme knowledge developed in the alphabetic phase. It moves from quite simple structures to multi-letter structures, which include consonant groups and vowel and consonant spelling patterns. As this is developing, so is the store of words in the logographic system. Seymour suggests that the orthographic

system stores both phonological and orthographic information, which is scanned to determine appropriate phonemic and orthographic elements when a word is being read.

Rohl and Tunmer (1988) also link the development of knowledge about the orthographic system with phonological awareness skills: "... the process of acquiring working knowledge of the orthographic system as a map for speech, in turn, provides the basis for performing more difficult phonological awareness tasks" (pp. 348, 349). Once the orthographic core is established, Seymour suggests that it should be possible to read and write all relevant words and non-words without the need to sound out sequences of letters. This suggests that full generalisation from taught to untaught items has occurred. This generalisation distinguishes orthographic acquisition from logographic acquisition and the ability to read words without sounding them out distinguishes the orthographic process from the alphabetic process. Seymour suggests that further development of more complex and variable structures in the orthographic system may in part depend on the teaching that occurs. Explicit identification of such things as vowel and consonant clusters means that they may be assimilated into the core structures. Knowledge of advanced structures in the orthographic system, which aid reading and spelling, develops between 6 and 10 years of age. Children who have not developed this basic structure will not be able to read and spell non-words because they have not

generalised the phonological and orthographic patterns of words.

#### Morphological framework.

The morphological framework is the system that underlies the way English is written. It refers to the rules and conventions that dictate spelling patterns in words. For example: Long vowel sounds are spelled using two vowels together (groan), a silent 'e' (bone) or a vowel digraph (sewn); suffixes added to the ends of words usually change the characteristics of the word - invent (verb) plus 'tion' gives invention (noun).

"The orthographic system is not capable of dealing with words composed of more than two or more syllables, including words that have a complex morphemic structure (a stem combined with prefixes and suffixes)" (Seymour, 1997, p 331).

The morphological structure only develops when there is an adequate orthographic framework, adequate linguistic awareness and adequate phonological awareness skills. Instruction that attempts to teach higher-order processes before skills from more fundamental areas have been established, is unlikely to be successful.

#### Different groups of poor spellers

Further examination of the spelling skills of children who are poor spellers, reveals some interesting differences.

Some of these children struggle with reading but others have no difficulty learning to read and many of them read above their age level. It appears that spelling skills are not necessarily related to reading skills in some of these children at least.

A review of the literature revealed that this phenomenon has been identified in a number of research studies. Frith (1980) describes three groups of spellers: Those who are good readers and good spellers, those who are good readers and poor spellers and those who are poor readers and poor spellers. Frith's (1980) analysis of the nature of the spelling errors in the different groups of spellers suggests that students who are good readers but poor spellers make errors that resemble those of the good readers and good spellers. Their errors appear to be phonetically correct which suggests that they can use sound-to-letter correspondence rules but that they do not seem to know letter-by-letter structures of words (e.g., mend, bend, frend). The spelling errors made by good readers, whether they were good spellers or not, appear to be made in the selection of the conventionally correct graphemes that accompany phonemes, particularly when there is a choice. Children who were poor spellers and poor readers made more non-phonetic errors (for example: sanek for stomach, higey for giddy), which suggest that they had difficulties with

phoneme analysis and/or phoneme-to-grapheme conversion.

Ehri(1987) also describes the phenomenon of children who are competent readers but poor spellers. These children are thought to operate with partial memories for spellings. She says:

They know enough letters in words to read them accurately. They can spell phonetically and can recall some letters in words. However, because they lack memory for all the letters, they have difficulty producing perfect word spellings.(p.10)

Sloboda (1980) puts forward the hypothesis that:

... some good spellers may have direct access to some sort of visual memory for words, possibly experienced as visual imagery, which might supplement or replace rule-based spelling. Less good spellers would then be those who did not have access to a comprehensive visual memory. (p.232)

He asks the question "Do good spellers store information about which letters a word contains whilst less good spellers store mainly information about which phonemes a word contains?" (p.246). If this were the case then it is likely that less good spellers should still be able to accurately spell regular words and words where there is a one-to-one phoneme-to-grapheme correspondence. The children who are good readers but poor spellers appear to do just that, but the children who are poor readers and poor spellers appear to make some errors in turning phonemes into graphemes.

Waters, Bruck and Seidenberg (1985) suggest that there may be a difference between older children who are good readers and poor spellers and younger children who show the same pattern. They say:

It is possible that older children who are good readers but poor spellers have adequate knowledge of spelling-sound correspondences and have more difficulty with spelling than reading because of the greater ambiguity of the mappings for spelling, while younger children who are good readers and poor spellers simply do not know the correspondences between spelling and sound. (p. 528)

This of course raises the question of whether the older group of good readers and poor spellers maintain their difficulties for the same reason as the younger good readers and poor spellers - they continue to lack knowledge about the correspondences between spellings and sounds. Whether this is because of an intrinsic difficulty acquiring this skill or whether it is because of the way in which the skill is taught is open to debate. If it is, as Sloboda (1980) suggests, that less good spellers do not have access to a comprehensive visual memory, they will need to rely on rule-based strategies for spelling. If spelling rules are not taught, as appears to be the case in many New Zealand schools (Brann & Hattie, 1995), these children are left with no alternative strategies to refer to and must rely on a poor visual recollection of the words they are attempting, or a phonetic

sounding-out approach which is not useful when words contain digraphs and phonograms or multiple spelling patterns for one sound.

Castles, Holmes and Wong (1997) suggest that spelling training contributes to developing spelling and reading skills. They found that:

Spelling training enabled subjects to process more letter-sound constituents in words. They could locate and use phonetic cues in reading...Spelling instruction promoted word reading skill in beginning readers...by helping readers to store words in memory using letter-sound associations. (p.61)

The ambiguities of the English language may be at the root of many spelling problems. Jorm (1983) raises the following point:

It is interesting to consider whether people with spelling-only retardation would exist with a language which had a simple regular correspondence between sounds and spellings. In an ideal spelling system of this sort, there would be only one possible spelling for each sound and hence no problem selecting the appropriate spelling from a range of possibilities. (p.103)

These research studies highlight the fact that all children do not acquire spelling skills with the same ease. Some do not appear to have any difficulties mastering the

complexities of reading and spelling the English language. Others appear to have no difficulties learning to read in English but find the ambiguities of the spelling patterns difficult to master. Another group of children appears to have difficulties mastering the skills that enable them to read and spell in English. These three groups of spellers were represented in the writing samples analysed by the author, which are discussed in Chapter 3.

### What Skills are Necessary for the Development of Good Spelling?

Perfetti (1997) suggests that there are two distinct areas of competence that developing readers and spellers must acquire.

1. Knowledge of sound-letter correspondences, which represent the alphabetic basis of the language.
2. Storage of a large amount of word-specific and morphological information regarding the actual spellings of words.

He discusses various studies, which consider reading and spelling disability and concludes, "Developmental orthographic impairments may selectively affect either the lexical or the alphabetic aspects of written language" (p. 321).

In other words the nature of children's difficulties may be in their acquisition of the sound-to-letter knowledge or in word specific information - the knowledge of various letter

and letter cluster representations for sounds.

### Alphabetic Processing

#### Letter-sound knowledge.

Written English is an alphabetic writing system, along with, for example, Italian and French (Perfetti, 1997). Languages that are based on an alphabetic system depend on the translation of sounds within words, to their graphemic representations - letters and letter clusters. The orthographies of different languages "vary in the degree to which they encode the surface phonology of the language relative to the morphology" (Perfetti, 1997, p. 24).

English is considered to be at the deep end of the continuum between a shallow or transparent orthography and a deep orthography. This means that it is less reliable than Italian, for example (a shallow orthography), in the way in which spellings are faithful to the phonology of the language. Despite the influence of a fairly complex orthography, the ability to spell in English still depends on the same skills that all alphabetic systems depend on, in order for the spoken language to be written. The spoken word must be able to be broken into its component sounds, individual sounds must be identified and these individual sounds must be translated into the correct letters and letter clusters that represent them. The acquisition of phonological awareness skills allows words to be taken apart

into component sounds. As the child begins to learn to read, the sound patterns (rhyming sounds, onset and rime, syllables) are further broken down into individual sounds. This is the beginning of phonemic awareness. Once the child can hear individual sounds in words he/she must decide which letter or letter cluster best represents that sound in the written word. The choices made are influenced by the levels of morphological knowledge children have about written English. Letter-sound knowledge and the acquisition of phoneme-grapheme knowledge are therefore critical for learning to spell in an alphabetic writing system.

The relative importance of learning letter-sound correspondences.

The role that letter-sound knowledge plays in the development of literacy skills in an alphabetic, but complex orthographic system, such as English, is discussed by a number of researchers. Treiman, Tincoff, Rodriguez, Mouzaki & Francis, (1998) state that:

Knowledge of letter sounds helps children to decode printed words and to construct the spellings of words in their spoken vocabularies. Of course, knowledge of basic letter-sound mappings is not the *only* prerequisite to literacy. Children also need to know the contexts in which various mappings occur. (p. 1524)

Adams (1994) also discusses the significance of letter-sound relationships.

Learning about spellings and spelling-sound relations is a very small component of the literacy challenge. Yet, it is also wholly necessary in meeting that challenge. In the end the print on the page constitutes the basic perceptual data of reading. Rather than diverting efforts after meaning, the reader's letter and word-wise processes supply the text-based information on which comprehension depends. (p. 20)

Tunmer, Chapman, Ryan & Prochnow (1998) also emphasise the significance of letter-sound relationships in developing literacy. They state:

...knowledge of spelling-to-sound patterns is necessary for both learning to recognise new words, including irregularly spelling {sic} ones, and for taking advantage of the constraints of sentence context in identifying unfamiliar words. Moreover, knowledge of spelling-to-sound patterns is more strongly related to beginning literacy development than the ability to use the constraints of sentence context. (p. 14)

There seems to be no doubt that learning of spelling-sound correspondences, which includes letter-sound knowledge, is critical to the development of literacy. Advocates of the whole language approach to learning to read might disagree

with its relative importance in learning to read, but there is little doubt that in order to spell at least, knowledge of letter-sound correspondences is a necessity.

How do beginning readers and spellers acquire  
letter-sound knowledge?

The approaches to the teaching of reading and spelling skills tend to fall along a continuum, which ranges from an isolated skill-and-drill approach, which emphasises teaching sub-skills in isolation, to a whole language approach, which has minimal emphasis on word analysis activities (Tunmer et al., 1998). Most children in New Zealand schools learn in programmes which tend towards the whole language end of the continuum. For this reason, the teaching of letter-sound correspondences is not explicit. Children are expected to acquire this knowledge as they learn to read and spell.

Thompson, Fletcher-Flinn and Cottrell (1999) conducted three studies designed to examine the sources of knowledge from which beginning readers learned letter-sound correspondences, without explicit instruction. They examined three possible sources of knowledge: Knowledge of letters' names, induction from accumulated print lexical experience (Induced sublexical relations, IRS) and spelling experience. Thompson et al. (1999) found that letters that had a high level of compatibility between the application of the acrophonic

principle ("the initial pronunciation element in the spoken name of the letter is taken as the corresponding phoneme for that letter" (p. 22)) and letters that occurred regularly as initial graphemes in beginning reading books, achieved higher scores for accuracy with a standard phonic response. This work suggests that young children, in the absence of being taught letter-sound correspondences explicitly, use their knowledge of letters' names and their experience with print (particularly with high frequency letters that occur at the beginning of words), as strategies to identify sounds that accompany letters.

There are various research studies that show how children use their knowledge of letters' names to inform them of the letters' sounds (Treiman, Weatherston & Berch (1994, Study 3) cited in Treiman, et al., 1998; Thompson, Fletcher-Flinn, & Cottrell, 1999). Treiman (1994) found that "Letter name effects are larger for some letters than for others, the differences reflecting the phonological properties of the letters' names" (p. 576). Thompson et al. (1999) also found support for this theory. They classified the alphabet letters as compatible or incompatible with the acrophonic principle. The phonological properties of the letter names will therefore influence the accuracy of the sound children will assign it, if they use the acrophonic principle as a strategy for determining letter-sound correspondences.

Children's knowledge of letters' names is typically better than their knowledge of letters' sounds at school entry (Treiman & Cassar, 1997; Treiman & Tincoff, 1997). If children use the initial sound of the letter name as their cue for its sound, they are likely to make errors such as saying /dih/ for the letter 'w' and /wih/ for the letter 'y'. Treiman et al. (1998) found this to be the case in their research study. They state: "The findings show that children use their knowledge of letters' names when learning the letters' sounds rather than memorising letter-sound correspondences as arbitrary pairings" (p. 1524).

It does seem then, that in the absence of explicit teaching of letter-sound correspondences, young children will use their knowledge of letters' names, in many instances, as a strategy to work out the sound for a letter, if the sound is not instantly known. This strategy will often give inaccurate information. There are 17 letters which have a name that is incompatible with their sound (*c, f, h, m, s, g, l, n, r, w, y, e, x, a, i, u, q*) (Thompson et al., 1999), which are therefore not likely to produce accurate sounds if this strategy is relied on. Despite this, the use of letters' names to infer the sound of letters is still the most common strategy used by developing readers and spellers, when the sound is not known. Thompson et al. (1999) found

that:

... children, without explicit instruction in letter-phoneme correspondences, used letter name knowledge by application of the acrophonic principle as a major source of knowledge when giving phoneme responses to letters in isolation. The children did not receive instruction on the acrophonic principle; hence, their use of it was self-generated (p. 41).

Thompson et al. (1999) also point out that there is not necessarily a connection between making connections between letters' names and their sounds and knowledge of the alphabetic principle. They state:

The children's use of acrophones for letter names does not imply an ability to use the alphabetic principle. ... In the absence of instruction to the contrary, these children inferred that the letter name labels they already knew would help them provide sound labels for isolated letters. ...As a result of their inference, the children responded to some letters with sound labels that did not coordinate with their use of the alphabetic principle. (p. 46)

These research studies suggest that failing to teach letter-sound correspondences explicitly may encourage young children to use their knowledge of letters' names to infer the letter-sound correspondences, which is a strategy that frequently gives inaccurate information.

### Orthographic and Morphological Processing

#### The influence of orthographic and morphological knowledge on spelling acquisition.

It is the orthographic and morphological conventions of written English that make it a complex alphabetic language.

- One sound can be represented in a variety of ways, graphemically (/t/ as 't' in sit or 'ed' in jumped; /or/ as caught, awful, chalk, sore, soar, door, pour, fought, cause, wall)
- One letter or letter cluster may be sounded in a variety of ways (/ed/ may be sounded 't' as in hopped, 'd' as in fanned, and 'ed' as in handed; the letter /a/ may be sounded differently as in grass, apple, ape, war.)
- Clusters of letters may make new sounds that have no relationship to their original letter sounds (/ch/ in chocolate, /aw/ in awful, /tion/ in invention).

Once the orthographic patterns are learned, children must then learn when they are to be applied in spelling and reading. They need to learn the orthographic and morphological relationships between letters and words if they are to develop a framework, which will allow them to use context to determine which spelling pattern is appropriate. As Muter and Snowling (1997) state " ...children need to learn

hierarchical spelling rules (such as lexical and morphemic word patterns) that go beyond simple and predictable phoneme-grapheme consistency if they are to become proficient spellers" (p. 409). This presupposes that they will also have developed knowledge of the alphabetic principle and accurate sound-letter knowledge. Ehri (1992) proposes, "...the development of orthographic representations depends on the integrity of underlying phonological representations" (cited in Muter & Snowling, 1997, p. 409).

Phonological and orthographic knowledge appear to each influence the development of the other. Children's ability to use orthographic and morphological information to inform their spelling attempts appears to be somewhat developmental, in that it increases as their exposure to print increases (Muter & Snowling, 1997; Nunes, Bryant & Bindman, 1997).

Nunes, Bryant & Bindman (1997) found that:

...when children first adopt...spelling patterns, they do so with little regard for their morphological basis. They generalise the patterns to grammatically inappropriate words (e.g., *sofed* for *soft*). Later these generalisations are confined to the right grammatical category (e.g., *keped* for *kept*) and finally to the right group of words (regular verbs). The authors conclude that children first see these spelling patterns merely as exceptions to the phonetic system and later grasp

their grammatical significance. (p. 637)

In their study which examined the effects of morphology on children's spellings of final consonant clusters, Treiman and Cassar (1996) found that even children with a reading age as low as first grade level, had some ability to use morphological information in their spelling attempts. They state:

Although children's ability to use morphological and orthographic information may be limited at first, the fact that they possess such abilities at all is impressive. Children's spelling is more sophisticated than often believed. (p.168)

Many children appear to 'pick up' this grammatical structure through their exposure to print, but those who do not may be disadvantaged in that they have less knowledge to use when trying to spell unknown or irregular words - they have fewer strategies to rely on. Because of the influence of orthographic and morphological knowledge on the development of accurate spelling skills, it may be necessary to teach this explicitly to ensure all children are able to use such knowledge.

Brann and Hattie's (1995) study of spelling practices in New Zealand schools found that overall, information about research into spelling production and development was not evident in most classrooms they studied. They say:

If spelling programmes in schools are to reflect research findings, they must be directed at increasing children's awareness of the way the orthographic system works by providing information from which children can draw analogies and make generalisations (Marsh, Friedman, Welsh & Desberg, 1980). (Brann & Hattie, 1995, p.40)

Proofreading for spelling errors.

Proofreading is a highly complex process. It involves more than just reading text. "In proofreading, the reader must be trained to look consciously at what he (sic) would normally need to ignore--features of the code itself (Shaughnessy, 1977, p.85)" (cited in Davis, 1995, p. 87). Proofreading involves looking closely at orthographic structures in words and using morphological information to check their correct usage. This is a highly developed skill and is a skill that needs to be taught. Children with limited orthographic and morphological knowledge are likely to find this very difficult. Madraso (1993) suggests a number of techniques for teaching proofreading skills, which help the reader focus on aspects of orthographic and morphological knowledge. These techniques, such as choosing a common error (for example adding the suffix /ly/ to a whole word - gradual + ly = gradually) as a proofreading 'target', not only help the reader find such errors in their writing,

but also highlight the orthographic and morphological information contained in such words. The hope is, as Davis (1995) says, "...if teachers help students perform error analyses of their texts, students will correct the tendency to make error (sic) in the first place" (p.87). Proofreading skills, if adequately taught, may be another source of knowledge about the orthographic and morphological structures of written English.

### How Should Spelling be Taught?

#### Principles of Spelling Instruction

##### Explicit strategy instruction versus developmental acquisition.

Groff (1986) discusses the views of researchers who suggest that children's spelling abilities progress through a series of developmental stages. He describes Gentry's (1982) research which categorises young children's spelling into five different stages: pre-phonetic, semi-phonetic, phonetic, transitional and the correct spelling level. Groff states:

When children reach the correct spelling level it is said that they have gained full knowledge of the basic rules of English spelling. Researchers into developmental spelling infer that children accumulate this knowledge as they proceed through the developmental stages. At each developmental level, children are

encouraged to discover the knowledge needed for correct spelling by inventing the spelling of words. The researchers believe it is best that children's progression through these levels not be interrupted with formal spelling instruction. (p.318)

The overall theme that appears to run through the views of advocates of developmental spelling, is that teaching spelling skills to young children before they reach level five ('correct' spelling level) will inhibit their spelling and writing performance. They also state that it is not necessary for children to learn letter-sound correspondences in order to spell (Groff, 1986). Groff presents a number of other research studies, which question the validity of the views put forward by those advocating a developmental approach rather than explicit instruction, to the teaching of spelling. He states:

This advice is not supported by most of the research that has been done on spelling, nor that done on direct (vs. indirect) instruction in general. ... In sum, the researchers of developmental spelling levels have asked teachers to abandon direct instruction in spelling to primary-grade children without providing sufficient evidence that this radical alteration in instruction will benefit children more than is otherwise possible. (pp.321,322)

Varnhagen, McCallum and Burstow (1997) also examine the

theories of developmental spelling acquisition. They state:

Children's spelling development, as investigated through their naturalistic writing, cannot be simply described as progressing through a series of stages. A stage description of children's spelling development is too broad and doesn't account for the depth of children's knowledge about the spelling system or for the variability in children's use of their understanding.

... Developmental research on children's spelling needs to be geared toward investigating the multiple strategies children have for spelling specific types of words and examining how children select among those strategies, as well as why and how children discover new strategies and modify old strategies as they attempt to master the English language spelling system. (p.479)

Butyniec-Thomas and Woloshyn (1997) describe their research, which explored whether explicit-strategy instruction combined with whole-language instruction would improve third-grade students' spelling more than either explicit-instruction alone or whole-language instruction alone. They found that the students involved in the explicit-strategy plus whole-language instruction, outperformed students in the other two instruction groups in measures of spelling dictated training words and dictated transfer words. They state:

Many other researchers have also found that students benefit from explicit-strategy instruction and that they

often fail to use effective strategies unless they are explicitly instructed to do so (reviewed by Pressley & Woloshyn, 1995). Our results also corroborate the finding that young students can successfully be taught to use multiple spelling strategies (Kernaghan & Woloshyn, 1995). (p. 300)

Tunmer and Chapman (1993) also point to the need for direct instruction to ensure knowledge from one domain is transferred to another. They cite research by Thomson, Fletcher-Finn and Cottrell (1991), which found that:

Knowledge of phoneme-to-letter correspondences acquired through spelling did not automatically transfer as a source of knowledge for letter-to-phoneme correspondences in reading. ... Direct instruction in word analysis skills must be included in the instructional programme. (Tunmer & Chapman, 1993,p.11)

### Components of Spelling Instruction

Spelling instruction, if it is to be successful, needs to provide explicit information about the processes that influence written English. Seymour's (1997) representation of the dual-foundation model of the development of orthographic and morphographic development (Seymour, 1977, p.324.) provides an excellent structure for the development of teaching initiatives.

Logographic process.

This emphasises the storage of whole words as patterns to read and spell. Children often learn to spell common essential words by rote, using this process. Learning of essential word lists fits into this category.

Alphabetic process.

Knowledge of letter-sound correspondences allows the developing speller to tackle unfamiliar words. It is the basis for phonological recoding skills. Accuracy with letter-sound correspondences is therefore critical if this skill is to be used effectively. Letter sounding encourages the emergence of phonemic awareness (Seymour, 1997), but children also need to have good phonological awareness skills if they are to be able to use this emerging phonemic awareness in their spelling and reading attempts. Tunmer & Chapman (1999) also point out the link between letter-sound correspondences and phonological recoding skills. They suggest that:

To discover mappings between spelling patterns and sound patterns, children must be able to segment spoken words into subcomponents... Children who are experiencing difficulties in detecting sound sequences in words need explicit instruction in the development of phonological awareness skills, a claim supported by a considerable amount of research (Lundberg, 1994). (p.86)

### Orthographic process.

Seymour (1997) suggests that a stress on word families promotes a 2D organisation of the orthographic framework and onset-rime awareness. Word families may be developed around common letter clusters, which make up spelling patterns. For example, consonant clusters / vowel phonograms / digraphs (tion, ly, ight, est, oi, ch, sh, th) and consonant blends (sl, sc, br, nt, spl, squ). Proofreading skills related to searching for these common spelling patterns will support the learning of the visual images and sound-letter correspondences of these patterns.

### Morphological process.

An understanding of the morphological framework that underpins written English, is developed through knowledge about the derivational structures of complex words. This involves learning common rules and conventions used in written English. Some examples are:

Adding endings to words -doubling consonant after short vowel- hop - hopping but not after long vowel, hope - hoping

Adding endings to words ending in 'y' - crying but cried.

Conventions for spelling words with long vowel sounds - (silent 'e' - like, cake, cute, rope, Pete; two vowels together - train, meat, goat, pie, suit; vowel digraphs and phonograms - show, weigh, flew).

Forming plurals (car - cars, but church - churches)

Using possessive apostrophes (The boy's foot. The boys' heads.)

Forming and expanding contractions (did not - didn't.  
aren't - are not)

Word origins and meanings (centenary, century, cents - to do with one hundred)

Adding suffixes and prefixes (investigate - investigation,  
legal - illegal)

It is this advanced knowledge of the complexities that govern written English that beginning spellers are working towards. However, they must have the foundation skills in place before this more complex information will be useful to them in their reading and spelling attempts. As Seymour (1997) says:

If development is blocked at the foundation level...then the appropriate intervention is an attempt to establish the elements of the foundation, with emphasis being directed toward whichever subprocess (logographic or alphabetic) seems more seriously impaired. At more advanced levels, the aim must be the step-by-step construction of an orthographic or a morphographic framework. (p.334)

### Strategies for Making Learning Memorable

#### Stories.

Research into the memory difficulties of children with

learning disabilities showed that these children did not perform poorly on all memory tasks when compared with children without learning disabilities (Torgesen, 1988). Torgesen quotes an experiment where children were required to recall the "gist" of interesting stories that were presented aurally. Children with learning disabilities were able to remember just as high a proportion of important idea units from these stories as children without learning disabilities, but had performance impairments on any task that required short-term retention of sequences of familiar verbal information, whether presented aurally or visually. If children with learning disabilities are able to recall the idea units in stories as well as those without learning difficulties, a strategy for teaching letter-sound correspondences through stories is likely to be of particular benefit for these children. The relevance and logic associated with how print maps the spoken word may not be obvious to young children as they begin to learn to read and spell and often remains this way for children with learning difficulties. One resource which teaches letter-sound links through the use of pictures, stories and sound-letter mnemonics, is "Letterland", developed in England by Lyn Wendon (1994). It teaches letter-sound relationships in such a way that there is a method and logic behind them and it provides students with an accurate strategy for making sound-to-

letter links. Each letter is represented by a character and students learn to listen for **who** they can hear in a word (Dippy Duck or Bouncy Ben?) They are taught to look at a letter and ask themselves **what sound** does this letter make in words? (The letter 'c' makes a "k" sound, as in Clever Cat's name, or the letter 'r' makes a "rrrr" sound as in Robber Red's name).

#### Picture mnemonics.

Mnemonic instruction is a memory-enhancing strategy designed to improve storage and recall of information. The target information to be learned is linked in some way to some other more memorable cue from prior learning. When that cue is activated it promotes recall of all the stored information linked to that cue. Mastropieri and Fulk (1990) discuss the role of mnemonic instruction in enhancing academic performance in learning disabled students. They discuss the factors that make learning more memorable:

...it is known that effective elaborative techniques facilitate the recall of information. Moreover, it has been seen that when information is more meaningful, it is more memorable. Additionally, when information is made concrete, it is more memorable than when it

is

abstract. Finally, it has been seen that when information is encoded effectively, direct retrieval routes are established and thus new information is more

readily recalled. ... Each of these variables - elaboration, meaningfulness, concreteness, and effective

encoding - contributes toward a theoretical framework for explaining why mnemonic instruction ... facilitates the performance of LD students. (p.119)

"Letterland" uses picture mnemonics to assist beginning readers and spellers learn the letter-sound correspondences between alphabet letters and letter clusters. This technique for teaching letter-sound correspondence learning is described by Ehri, Deffner and Wilce (1984), and Fulk, Lohman and Belfiore (1997).

Ehri et al. (1984) state:

"For mnemonics to be effective, not only must the response term involve something concrete and meaningful, but the mnemonic must effectively *link* the visual stimulus to the response so that when learners see the letter shapes, they are reminded of the mnemonic pictures or actions" (p.881). They conducted two experiments using picture mnemonics to help pre-readers learn letter-sound associations. Some

children were taught using pictures integrating the associations (the shape of the picture included the letter - the letter /f/ drawn as the stem of a flower - and the name of the picture - flower - began with the letter sound), some children were taught using pictures with no associations and others were taught without the use of pictures at all. The children taught with the integrated picture-mnemonics learned more letter-sound associations and also more letter-picture associations than did the other two groups, which did not differ from each other. Ehri et al. (1984) found that:

Integrated pictures were effective because they linked two otherwise unconnected items in memory. The shapes of letters included in pictures reminded learners of previously seen pictures with those shapes whose names began with the relevant letter sounds. (p.880)

Learning letter-sound relationships is not easy for beginning readers and spellers. Ehri et al. (1984) suggest that the difficulties arise from several sources. The number of associations to be mastered (more than 40 sounds for 52 visual figures, plus sounds for letter clusters); the visual similarities of many letters,

particularly lower case letters; phoneme sounds and visual letter symbols are meaningless; associations between letters and sounds are totally arbitrary - there is nothing in the visual symbol of a letter that suggests its sound. Using integrated picture mnemonics overcomes many of these difficulties and provides a highly successful strategy for teaching letter-to-sound correspondences. Fulk, Lohman and Belfiore (1997) found that the use of integrated picture mnemonics was an effective instructional technique to teach letter-sound acquisition and letter recognition to three transitional first-grade students with special needs. They provide two explanations for the success of this technique.

1. Integrating a picture into the form of the letter provides a strong link between the visual stimulus and the verbal response, which allows a meaningful connection to be made between information that was previously unrelated.

2. Mnemonic techniques provide students with an effective strategy to transform previously un-learnable material into learnable material. The mnemonic makes overt the strategy to use to recall the information.

"Higher achieving students may develop learning strategies independently, but this is unlikely for students with learning disabilities" (Fulk et al., 1994, p.40).

### Summary

Spelling is important to the development of written language skills. This has implications for academic performance in curriculum areas that rely on written language for assessment purposes. Children who have poor spelling skills often limit the quantity and quality of their written language in an effort to minimise errors. Because of this, they may judge themselves, and be judged by others to be less capable than they really are, in the area of language expression (Moseley, 1993).

The reasons for children's spelling problems vary. Some children have problems with reading and spelling and others are fluent and even excellent readers, but poor spellers. These two groups of poor spellers have problems with different component skills of spelling. The lack of explicit teaching of rules and strategies, which provide a framework for written English, is implicated in the poor spelling skills of many children. Teaching interventions which take into account the process of how children develop spelling knowledge and at which points they have difficulty, are more likely to improve spelling performance than those which aim to fit the child to the needs of a teaching programme. In order to become proficient spellers, children need to acquire the following: Phonological awareness skills, phonemic awareness skills, accurate letter-sound knowledge, knowledge of spelling patterns in words (digraphs, vowel

phonograms, blends) and knowledge of the rules and conventions that underpin the way in which letter-sound knowledge and spelling patterns work in words. If this knowledge is taught to children as they are developing spelling skills, in a manner that is memorable, spelling skills should improve. Since spelling skills have also been shown to influence reading skills, it is likely that a good foundation knowledge of spelling skills will also have a positive flow-on effect to the development of reading skills.

### The Research Questions

1. To what extent do learning strategies that use picture-mnemonics and metaphor to teach letter-sound correspondences, influence the accuracy of letter-sound and sound-letter knowledge?
2. How significant is letter-sound knowledge in the development of phonological recoding skills?

3. To what extent does explicit teaching of spelling skills (letter-sound correspondences, initial blends, digraphs and simple spelling rules) influence the reading, spelling, phonemic awareness and proofreading skills of year 1, 2 and 3 students, when compared with children of the same age, from a matched school, who have not been involved in the same teaching programme?

4. To what extent does explicit teaching of spelling skills influence the spelling, reading and phonological awareness progress of the lowest performing children when compared with the progress of the lowest performing children of the same age, from a matched school, who have not been involved in the same teaching programme?

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