THE EFFECTS OF RIME-BASED ORTHOGRAPHIC ANALOGY TRAINING ON THE WORD RECOGNITION SKILLS OF CHILDREN WITH READING DISABILITY

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ABSTRACT

Phonological processing abilities among a group of older disabled readers were investigated in the first of two experimental studies. A second study was undertaken to determine the extent to which a group of disabled older readers could be trained to use rime spelling unit knowledge to make orthographic analogies when decoding unfamiliar words.

The purpose of the first study was to assess (using a reading age match design) specific phonological processing abilities among a group of disabled readers. The disabled readers' performances on the tasks were compared to the performances of a group of younger normally developing readers who were reading at the same level as the disabled readers.

The rime analogy training study was designed to encourage disabled readers to capitalize on their limited but sufficient phonological knowledge to assist them to make greater use of rime spelling units as a basis for making orthographic analogies when decoding unfamiliar words. In the rime analogy training study 57 disabled readers were assigned to either one of two training groups or to a third standard non-intervention (control) group. All of the disabled readers were enrolled on Resource Teacher of Reading (RTR) programmes. Thirty-six of these RTR children received one of two specifically designed 5-minute decoding interventions on a daily basis for 11 weeks. The remaining 21 disabled readers received only their standard RTR lessons. The Neale Analysis of Reading Ability Accuracy Subtest (1981), the Peabody Picture Vocabulary Test (1981), the Burt Word Test (1981) and five tests of phonological processing ability were administered to all 114 children (i.e., 57 disabled readers and 57 younger normal readers) at the beginning of the reading age match study. The 57 disabled readers were also posttested on all the measures (except the PPVT) at the conclusion of the training study. Follow-up tests one year after the completion of the training study were also administered to 52 of the disabled readers and to a randomly selected group of 20 of the younger normally developing readers.

The results from the reading age match study confirmed findings from earlier studies indicating that disabled older readers' poor reading abilities are more likely to be caused by phonological processing deficits rather than by a general developmental delay in their word processing abilities.

The results from the rime analogy training study indicated that disabled readers can be trained to focus on specific rime spelling units and to use this knowledge to assist them to decode a large proportion of unfamiliar words encountered during context reading. Results from the one year follow-up study further indicated that the positive gains made during the training intervention study were maintained. The strategies taught in the training programme were also shown to generalize to uninstructed reading materials.

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CHAPTER 1

INTRODUCTION

Before a reader can gain meaning from what he/she reads, the print must first be decoded. The mechanisms which the reader uses to decode print have been a subject of ongoing debate both overseas and in New Zealand (Adams, 1990; Carbo, 1988, 1989; Chall, 1967, 1989; Elley, 1996; Goodman, 1967, 1993; Gough & Hillinger, 1980; Smith, 1978, 1992; Smith & Elley, 1996; Tunmer & Chapman, 1996a).

Some researchers argue for example, that printed words are recognised mainly through a reliance on context cues (Clay, 1991; Goodman, 1967; Smith, 1978). This view of the reading process maintains that unfamiliar words are identified largely through the meaning inherent in the surrounding sentence context, and that phonological (letter-sound) knowledge is of only minor importance. Other researchers argue however, that the decoding process is reliant primarily on an ability to use phonological information within the words (Adams, 1990; Adams & Bruck, 1992; Bruck, 1992; Ehri, 1991, 1992; Gough & Hillinger, 1980; Perfetti, 1992; Nicholson, 1994; Tunmer & Chapman, 1996a, 1996b, 1996c). Furthermore, an increasing number of researchers also argue that inefficient word-level decoding strategies are probably the most likely cause of reading disability (Bowers & Wolf, 1993; Bruck, 1992; Bryant & Bradley, 1990; Carr & Levy, 1990; Jorm, 1983; Olson, Wise, Conners & Rack, 1990; Rack, Snowling & Olson, 1992; Snowling, 1981; Tunmer & Chapman, 1996a).

While reading research findings are now demonstrating that there may be at least six different ways in which English written words may be identified (see Chapter Two for discussion) there is growing evidence to suggest that those processes involving phonological strategies are more representative of fluent reading behaviours rather than of poor reading (Glushko, 1979, 1981; Lesgold, Resnick & Hammond, 1985; Perfetti, 1985, 1986; Tunmer & Hoover, 1992).

One particular phonological-based decoding strategy that is gaining increasing attention in the reading research literature involves the use of rime-based orthographic analogies (Brown, Sinatra & Wagstaff, 1996; Ehri & Robbins, 1992; Gaskins, Downer, Anderson, Cunningham, Gaskins & Schommer, 1988; Goswami, 1986, 1988, 1991; Goswami & Bryant, 1990; Greaney & Tunmer, 1996; Treiman, 1992; Wylie & Durrell, 1970).

Most monosyllabic words may be divided into subsyllabic (i.e., smaller than a syllable) units known as onsets and rimes (Treiman, 1985, 1992). The onset refers to the initial consonant or consonant blend while the rime includes the vowel plus any following consonant(s). Research findings have demonstrated that many very young children are able to divide spoken syllables at the onset/rime boundary even before they begin formal reading instruction (Treiman, 1985; Goswami, 1986, 1988, 1991, 1993). Furthermore, some researchers have demonstrated that the awareness of onsets and rimes appears to emerge spontaneously in development prior to formal reading instruction (Goswami & Bryant, 1990, 1992), and continues to develop during early reading instruction (Bowey & Hansen, 1994; Goswami, 1993).

The ability to make orthographic analogies in reading requires the reader to be able to recognise familiar spelling patterns to decode unfamiliar words. The familiar spelling pattern that triggers the analogy is usually located within the rime (hence rime-based). The normal reader who already knows the word night for example, would be expected to use the rime knowledge (e.g., ight) to decode similarly spelled words that contain the same rime unit. However, while normally developing readers appear to use rime-based orthographic analogies as a decoding strategy on a spontaneous basis, the same cannot be said for disabled readers (Gaskins et al. 1988; Greaney & Tunmer, 1996). Most disabled readers lack efficient word learning strategies and tend to rely instead, on the use of only partial letter-sound knowledge to identify unfamiliar words (Reitsma, 1983; Ehri & Saltmarsh, 1995). Furthermore, research evidence indicates that children who continue to rely on compensatory visual strategies (at the expense of phonological information), will continue to experience progressive deterioration in the rate of reading development as they grow older (Bruck, 1992; Bryne, Freebody & Gates, 1992).

The ability to take full advantage of phonological information within words, including rime-unit spelling patterns, allows the reader to receive positive word learning trials which in turn, lead to the amalgamation of orthographic and phonological representations of the word in lexical memory (Ehri, 1992). Such representations further allow the reader to identify the word on subsequent occasions and in subsequent contexts.

Rationale For the Studies

Within the New Zealand school context many children who are failing in reading may enter the Reading Recovery programme (for 6-year olds) or, in the case of older children, the national Resource Teacher of Reading (RTR) programme. The focus of the current study involved disabled older readers who were enrolled on RTR programmes during 1994. The primary aim of the study was to determine whether systematic training in the use of rime-based orthographic analogy strategies would, when integrated with metacognitive strategies for how and when to apply such strategies, improve decoding skills in a group of disabled older readers. A secondary aim was to examine the question of why disabled readers do not spontaneously use rime-based orthographic analogies as a strategy to assist them to decode unfamiliar words.

The Studies

To answer the question of why disabled readers fail to spontaneously use rime-based analogies in reading, an experiment employing a reading level match design (Backman, Mamen & Ferguson, 1984; Bowey, Cain & Ryan, 1992; Bryant & Goswami, 1986) was used to compare normally developing and disabled readers on a series of phonological-based tasks. A second experiment involving a training intervention study was carried out to determine whether disabled readers who received systematic strategy training in the use of rime spelling units to make orthographic analogies, would achieve greater gains in word recognition skills than a matched group of disabled readers who received training that focused on sentence-level decoding strategies. A further follow-up study (one year later)

was also undertaken to determine the extent to which any reading gains made as a result of the training intervention, were sustained over time.

Overview

The development of early rhyme awareness, onset-rime sensitivity and orthographic analogy use in beginning readers is the focus of the second chapter (Literature Review). The relationship between phonological recoding skills, sight word knowledge and rime-unit analogy use (including training studies involving disabled readers) is also investigated. The sample of disabled readers used in the current research included children who were enrolled on national Resource Teacher of Reading (RTR) programmes during 1994. The Resource Teacher of Reading programme is the focus of Chapter Three. The chapter includes a brief discussion of the role of this particular group of remedial reading specialists and compares them with the national Reading Recovery programme.

Chapter Four (Experiment 1) investigates the phonological processing deficit hypothesis among a group of 57 disabled readers by comparing their performances on a series of phonological processing measures with those from a reading level matched group of younger normal readers. Chapter Five (Experiment 2) is the focus of the rime-based orthographic analogy training intervention involving the disabled reader groups.

The final chapter presents a general discussion of the major findings from both studies. Some implications for teaching children with severe reading difficulties in the regular classroom are also discussed. Finally, some suggestions for future research investigations are presented.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

Because English orthography is not completely phonetically regular, it is not possible to decode every word using the same decoding process. For beginning readers, many words may also be decoded in more than one way. However, as reading skills improve and the text becomes more difficult, some decoding strategies become more effective than others.

Chapter Two will begin with a brief discussion of some of the ways in which English written words may be read including the relative importance of graphophonic correspondence (GPC) knowledge to the decoding process. Research studies investigating the phonological processing deficit hypothesis among disabled readers will be presented followed by a discussion of the relationship between phonological recoding skills, sight word reading and the development of analogy use in student's reading. Some recent orthographic analogy strategy training studies will be outlined and a summary of the advantages of teaching rime-based analogies as a strategy for improving decoding skills among disabled readers will be discussed. The chapter will conclude with the presentation of the research questions.

Ways to Read Words

Although the dual route view of reading development maintains that words are read in one of two ways, either by phonological recoding or by sight, research now suggests that there are in fact more than two ways. There are at least six ways in which (English) written words may be read. While there are several different ways in which

words may be read, these word-learning skills also change as the reader becomes more fluent. Other factors relating to how words are read include, the kinds of words being read (Brooks, 1977; Ehri & Wilce, 1983; Juel & Roper/Schneider, 1985; Spring, 1978) the kinds of literacy activities practiced (Barr, 1972), the general cognitive maturation level of the individual reader (Juel, 1984) and their prior experience with the particular words (Ehri, 1978; Gough & Hillinger, 1980).

Paired Associate Reading

Early attempts at recognizing printed words is known as paired associate reading (Frith, 1985). During this stage of reading the reader relies on recognising cues to a word's identity based on gross features such as the word's general shape, print colour and/or surrounding features including any distinctive symbols (Seymour & Elder, 1986). Young children have been shown to be able to initially learn some environmental print sight vocabulary during this stage. Masonheimer, Drum and Ehri (1984) noted for example, that a number of three and four year old "environmental print experts" were able to "read" up to 100 words during the paired associate reading stage. However, further analysis revealed that these children were "reading" by associating the distinctive features (such as the M in the McDonald's sign, or the particular colour/design of the wrapping paper surrounding a chocolate bar) with the appropriate spoken word rather than activating any specific phonological strategies. However, when given the words to read in the absence of the distinctive surroundings, very few children were able to successfully recognise any of them. This was because the development of relevant phonological knowledge about the words' identities had not yet developed (Ehri & Wilce, 1985; Mason, 1980). Paired associate reading therefore eventually becomes ineffective as a decoding strategy because the distinctive features of words become too similar to remember as individual units and the decoding process becomes increasingly difficult.

Sight Word Reading

The second way in which words may be read is by sight. While there is general agreement that readers read many frequently occurring words as single holistic units, and without recourse to phonological processing, authorities differ about the kind of words that are read by sight (Hood, 1977). Some authorities include sight words as all those words that the reader has learned to recognise by rote memory (Baron, 1977, 1979; Frith, 1980, 1985) but others include only the irregularly spelled words that cannot be read by normal phonological processing (Adams & Huggins, 1985). Still others restrict the sight word definition to the high frequency core vocabulary group of function words only.

Regardless of which group of words are included as sight words, there is, nevertheless, an increasing number of words that the developing reader is able to read quickly, accurately and effortlessly (e.g., by sight) without needing to activate any form of phonological mediation, or to activate phonological information very rapidly (Adams, 1979). Ehri (1991) suggested that several behaviours indicate sight word reading as opposed to reading by using other processes. These include, reading words as whole units with no obvious pause between letters, reading words quickly/accurately, reading irregularly spelled words correctly rather than phonetically and distinguishing the correct spellings in homophonous words (e.g. rain vs rane).

Phonological Recoding

The third way in which words may be read is by phonological recoding. This process involves converting the spellings of words into pronunciations by applying grapheme-phoneme correspondence (GPC) rules. Sometimes it may also involve activating a phonological set for diversity (Gaskins, Downer, Anderson, Cunningham, Gaskins & Schomer, 1988) whereby various pronunciations are generated until one matches the meaning of the particular word. Ehri (1991) notes for example, that because the English spelling system is not perfectly phonemic, some experimentation with

alternative pronunciations may be necessary to derive a recognisable word. In their self-teaching model of reading acquisition, Share and Jorm (1987) and Share and Stanovich (1995) also propose that if the reader uses phonological cues to derive an approximate pronunciation of a word in text (and then combines this pronunciation attempt with contextual constraints) a solid basis for the acquisition of an orthographic representation of the word usually results.

However, while phonological recoding may be most successful with words that represent perfect spelling-to-sound correspondences (e.g., regularly spelled words) this process is not always effective for words that do not conform to regular spelling patterns. For these words, further reading processes come into play.

Detecting Spelling Patterns and Analogizing

Two other (very similar) ways to read words involve the detection of orthographic spelling patterns and analogizing the words to other known and similarly spelled sight words. Although both processes involve accessing spelling patterns (i.e., groups of letters) they are nevertheless, different processes.

According to Baron (1979) reading by analogy occurs when the reader pronounces the unfamiliar word as if it were another similarly spelled word, e.g., reading *tashion* by analogy to *fashion* (Ehri, 1991). However, where a word is recoded via the segmenting and blending of the frequently occurring spelling patterns (e.g., reading *tashion* as *t-ash-ion*) the detection of orthographic patterns becomes a more accurate description of the process (Marsh, Friedman, Welch & Desberg, 1981). Furthermore, Glushko (1979, 1981) argues that reading words by analysing and synthesising the orthographic patterns portrays more accurately how fluent readers are able to read unfamiliar words than does phonological recoding of the individual letter-sounds.

Sentence Cue Reliance/Contextual Guessing

A sixth way that words may be read is by using sentence context cues. A number of reading researchers suggest that young readers often substitute words that while incorrect, are nevertheless semantically and syntactically consistent with the text (Biemiller, 1970; Goodman, 1993; Weber, 1970). The contextual guessing hypothesis for word reading forms the basis of Goodman's (1967) "Psycholinguistic Guessing Game" model in which reading is claimed to be a process in which minimal word-level information is used to confirm language predictions. This approach maintains that readers are able to use syntactic and semantic redundancies of language to generate hypotheses (i.e., guesses) and that unfamiliar words may be read by using language prediction skills, with little necessity for activating any phonological processing strategies.

There are some major difficulties associated with the contextual guessing hypothesis of word reading. The first concerns the claim that language is predictable. Because nearly all sentences are novel, the meaning that is embedded in each sentence must also be novel. It is therefore important that all the words in the sentence are read accurately otherwise the intended meaning is likely to be distorted.

The second problem associated with relying on contextual guessing to read words is that not all words in sentences carry equal meaning. The words that carry the most meaning in a sentence are usually the less frequent content words, and while the more frequent function words may well be predicted from context alone, most content words generally cannot. Tunmer and Chapman (1996b) argue for example that the words that can be predicted in text are typically frequently occurring function words that the child can already recognise rather than less frequently occurring but more meaningful content words.

A third major difficulty associated with the contextual guessing hypothesis is that poor readers process words slowly because they are unable to recognise the individual words quickly and accurately. Poor readers who rely on contextual guessing to identify unfamiliar words are also unable to process the words quickly and accurately because this strategy does not encourage the reader to focus on such sub-word level characteristics as letter-sound patterns. While there may be occasions where contextual guessing may lead to a particular word's identity (e.g., as in early reading texts where predictable sentence patterns and picture cues are purposely present) this strategy soon becomes inefficient when higher level and less predictable texts are encountered.

Instructional Effects of Differing Cue Emphases

When formal reading instruction begins at school entry, the beginning reader initially relies heavily on context cues including using prediction and picture cues to identify many unfamiliar words. This is because knowledge of many of the letter-sound patterns including graphophonic correspondence (GPC) rules, are likely to be relatively weak. However, as beginning readers' GPC knowledge increases (as a direct result of explicit reading instruction) a corresponding decrease in the reliance on context/picture cues results. This is due to the reader's increased ability to identify a greater number of unfamiliar words using more efficient phonological processing skills. Some of these skills include using a developing knowledge of the correspondences between the subcomponents of written and spoken words to generate word pronunciations, analogizing to known words that are stored in lexical memory and using the constraints of sentence context to narrow the possibilities of what the word might be. Furthermore, as sight word knowledge continues to develop, the beginning reader is also able to read larger groups of words by analogizing familiar letter-strings from known words. After a relatively short period of reading instruction, the normally developing reader's cue emphasis shifts from a reliance on context to one involving a greater use of both GPC knowledge and analogies to decode unfamiliar words (Ehri & Saltmarsh, 1995). Classic early studies by Biemiller (1970), Weber (1970) and Bissex (1980) reported that

children who were to become the better readers were those who rapidly moved out of what Biemiller characterised as an early stage of context cue reliance to one that relied more on graphophonic knowledge (Perfetti & McCutchen, 1982).

Children who experience early reading difficulties and who continue to be taught to rely on context cues as the main source of information with which to decode unfamiliar words, will not develop concomitant GPC knowledge and will therefore be unable or less likely to activate efficient phonological processing strategies. The graphophonic correspondence knowledge for these children will remain weak, due to their continuing reliance on context cues. Because of their poor general word processing abilities, these readers also lack the ability to recognise any analogy potential inherent in similarly-spelled words, unless they are given specific training to do so (Greaney & Tunmer, 1996).

The Relative Role of Graphophonic Information to the Decoding Process

A contentious issue relating to reading instruction in New Zealand schools concerns the perceived relative importance graphophonic information plays in the decoding process. In the most recent Ministry of Education reading handbook for teachers Reading and Beyond (1997) graphophonic cues are considered as one of the 4 sources of information available to the reader. However, this publication also advises teachers that learning to read "is much more complicated than just being able to decode" (p.7). While the publication advances the reading process as meaning driven and integrated, it nevertheless lists the main reading strategies as "sampling, predicting, checking, confirming and self-correcting" (p.7). According to this view, word identification processes are derived mainly from meaning and the graphophonic information is seen as a source of confirmation rather than as the source for initial decoding strategies.

Because the reading research evidence is now demonstrating that there are strong causal links between poor phonological processing ability and poor reading progress (see previous discussion) it follows that remedial reading programmes should

incorporate strategies that explicitly encourage the development of phonological skills. While semantic, syntactic and visual components of written language act as partial determinants in a student's reading development, the reader must still be able to distinguish the graphic and orthographic attributes of words to identify them. Success in reading English orthography is ultimately determined by the student's ability to master the alphabetic code. In support of this suggestion Vellutino, Scanlon and Sipay (1997) argue that "semantic, syntactic and visual ability carry less weight than do phonological abilities" (p. 373).

The Role of "Natural Discovery" of the English Orthographic System

It is generally accepted that the predominant and current approach to reading instruction in New Zealand primary schools is aligned more with whole language (whole-word) philosophy than with code-emphasis (phonics) philosophy (Clay, 1991; Smith & Elley 1994; Reading in Junior Classes, 1985). Little differentiation is made in the whole language writings that the "phonologically deprived" subgroup of students require different, and often more explicit teaching approaches than do the normally developing readers. All students, regardless of their phonological weaknesses are deemed to be able to acquire by themselves, the necessary letter-sound relationships required to become fluent readers. It is suggested that such "natural discovery" occurs simply by immersing students in high-interest books and giving them a purpose for reading. Smith and Elley (1994) argue for example that "if children are immersed in high-interest print, and given real purpose for learning to read it and write about it, they will acquire by themselves the understanding that sounds are represented by letters, and learn these letter-sound links along with other cues for meaning" (p. 145).

Smith and Elley (1994) concede that while some children may benefit from explicit letter-sound teaching, these authors are very hesitant to recommend this approach. They argue that although specific tuition about letters and sounds may help some students when they read, "it may also convey the wrong impressions about the difficulty and purposes of reading" (p.145). The New Zealand junior class teachers'

reading handbook Reading in Junior Classes (1985) also comments that "the recommended practice is to have children discover the letter-sound relationships" (p.49).

Although many students appear to discover the letter-sound relationships, such discovery does not usually occur prior to formal reading instruction. Therefore it must be that such "discovery" occurs as a result of direct teaching. Because many students do learn to read well under a predominantly whole word approach, it does not necessarily follow that all students will succeed under this approach. The reality is that many students (possibly as many as 30%) continue to struggle with reading throughout their schooling, which suggests that they certainly have not "discovered" the orthographic system.

An earlier study (Barr, 1974-75) addressed the question of whether particular instructional methods determine strategy use in relation to word reading responses of first grade children. Half of the students were taught using a phonics-based approach and the other half were taught by a whole word method. Inferences regarding the subjects' use of either a recoding strategy or a sight word strategy were based on two aspects of reading errors. A recoding strategy was inferred if the subjects produced either non-words or word substitutions that did not come from their reading vocabulary. A sight word reading strategy was inferred if subjects substituted only real words of which at least 75% came from the subjects' reading vocabulary.

The results showed that midway through the first year, 63% of the phonics students were exhibiting decoding strategies while the remainder were using sight word reading strategies. By the end of the year however, nearly all the phonics-taught students were using decoding strategies. Ninety-five percent of the whole word students exhibited sight word strategies at mid-year and almost the same number were reading this way at the end of the year. In fact, there were only two whole word subjects who had shown signs of recoding words by the end of the year, and these two students were among the best readers.

Athough the Barr study is more than twenty years old, it may have implications for New Zealand reading teaching methodologies. This is because, while the predominant method of teaching reading in New Zealand is based on the whole-word

approach, students who continue to experience reading difficulties have very weak phonological processing skills. Such students would be considered sight word readers in the Barr study and would therefore require more explicit phonological-based teaching programmes than those offered via whole-word interventions for them to develop efficient decoding strategies.

Phonological Processing and Children With Severe Reading Disabilities

An important development in reading research over the last two decades is the emerging consensus about the importance of phonological processing abilities on the acquisition of reading skills (Bryant & Bradley, 1990; Bruck, 1992; Carr & Levy, 1990; Firth, 1972; Jorm, 1983; Rack, Snowling & Olson, 1992; Shankweiler & Liberman, 1989; Snowling, 1981; Olson, Wise, Conners & Rack, 1990; Stanovich, 1988; Vellutino, 1979; Wagner & Torgesen, 1987). The term phonological processing refers to an individual's mental operations that make use of the phonological or sound structure of oral language when he or she is learning how to decode written language (Torgesen, Wagner & Rashotte, 1994, p.276).

The kind of phonological processing skills and knowledge that have been given recent attention in the research literature include phonological awareness, phonological memory, rate of access for phonological information and pseudoword decoding (Bryant & Bradley, 1990; Cardoso-Martins, 1991; Cunningham, 1990; Iversen & Tunmer, 1993; Griffiths, Klesius & Kromrey, 1992; Stanovich, Cunningham & Feeman, 1984; Tunmer & Nesdale, 1985). Studies have demonstrated that early performance on phonological awareness tasks in kindergarten children correlated positively with word reading skills in later grades (Ball & Blachman, 1991; Liberman, Shankweiler & Liberman, 1989; Lundberg, Frost & Petersen, 1988; Lundberg, Oloffson & Wall, 1980; Stanovich, 1988; Stanovich, Cunnungham & Cramer, 1984; Torgesen, 1993).

Research is now also suggesting that without an awareness of the phonological segments in words, the (English) alphabetic system of writing would not be very comprehensible (Bradley & Bryant, 1978; Gough & Tunmer, 1986). Beginning readers

of alphabetic writing systems must eventually learn to make use of the systematic correspondences between elements of written and spoken language to be able to identify unfamiliar words, and gain speed and automaticity in word recognition. This in turn, frees up cognitive resources for allocation to higher order cognitive functions, such as comprehension monitoring, and determining the meanings of unknown words (Perfetti & Lesgold, 1977; Daneman & Carpenter, 1980). Further evidence in support of this theory comes from studies that report correlations between speed of word recognition and reading comprehension (Perfetti, 1985) and from logitudinal studies that show causal relationships between word recognition speed in grade 1 and reading comprehension in grades 2 and 3 (Lesgold, Resnick & Hammond, 1985). Children who continue to read words only as whole word visual patterns with no concomittant phonological representations, will be limited in their ability to read progressively more difficult words. Learning to read 2000 non-phonological Japanese kanji for example, takes approximately 10 to 12 years of devoted study, whereas the average high school reader of an alphabetic orthography such as English has learned to recognise 20000 or more printed words with considerably less effort and time. This is because many English written words contain phonetically regular and frequently occurring spelling patterns which, once learned, offer the reader strong clues as to the identities of many words.

Research also confirms that a relatively small number of frequently occurring words represent a high proportion of the total words found in home and school reading materials. Carroll, Davies and Richman (1971) sampled word frequencies of over five million words from school and home reading materials and they reported that 50% of the words were represented by just 109 different words, and that 90% were represented by just 5000 different words. It can therefore be assumed that most children will be able to read those 5000 words with very little need for phonological mediation. However, because the information in running text depends disproportionately on the meanings of the less frequently occurring words (Finn, 1978) it is important that these less frequent words are correctly identified for the reader to gain maximum understanding. It is also these less familiar content words that often require the reader to activate higher order decoding processes for accurate identification.

Adams (1990) suggests that fluent readers (compared to children with severe reading difficulties) activate phonological processing strategies in the form of sounding out, to identify unfamiliar words. She states that "the skillful reader's habit of sounding words out becomes invaluable. Even for wholly unfamiliar words, the spelling-to-sound correspondences are typically so over-learned that they are run off with near effortlessness" (p.28).

While many older poor readers do acquire a reasonable level of sight vocabulary, the problem appears to be that most sight words are recognised and viewed as whole units that have little or no accompanying orthographic representations beyond the boundary letters. Gaskins et al. (1988) note for example that by the time the poor readers enter the intermediate grades, they may possess a sight vocabulary but without having developed concomitant orthographic knowledge. Gaskins et al. (1988) also suggest that older poor readers unlike skilled readers, depend upon more explicit instruction in letter-sound relationships in order to understand how written English language works. This suggestion is consistent with similar findings reported by Barr and Dreeben (1983), Calfee and Drum (1986), and Johnson and Bauman (1984). Research also indicates that older poor readers often have a minimal conscious awareness of the sound units in words. This is reflected in poor performances on tasks involving phoneme segmentation and blending, print-to-sound conversions, spelling pattern awareness and pseudoword decoding ability. According to Rack et al's. (1992) definition of the phonological processing deficit hypothesis "dyslexic individuals have a highly specific deficit in the phonological language domain which leads to problems in short term memory and sound blending and consequently, to problems in reading and spelling" (p.31).

Further evidence in support of the phonological processing deficit hypothesis comes from studies which show that reading disabled students perform at lower levels than reading age matched younger children on phonological-related reading measures (Snowling, 1980, 1981). Snowling (1980) gave dyslexics and reading age matched younger normal readers a cross-modal matching task involving reading and hearing nonwords. Pairs of 3 and 4-phoneme nonwords were presented both visually and in an auditory condition. Sometimes the word pairs were identical (e.g., trop-trop) and

sometimes they were different (e.g., trop-torp). The subjects were required to say whether the stimuli were the same or different when presented in each condition (e.g., visual-visual, auditory-auditory or visual-auditory). No differences between the normal and dyslexic children were found for the auditory-auditory and visual-visual presentation conditions. However the dyslexics' scores for the visual-auditory condition were inferior to those of the normal younger readers. This result suggests that the dyslexics' problem was specific to the condition requiring nonwords to be recoded into phonological form.

In a second study Snowling (1981) found that dyslexics read nonwords containing various consonant clusters, more slowly and with more errors, than did reading age matched younger normal readers. An increasing number of studies are reporting similar findings in support of the phonological processing deficit hypothesis (Adams, 1990; Adams & Bruck, 1993; Baddeley, Ellis, Miles & Lewis, 1982; DiBenedetto, Richardson & Kochnower, 1983; Holligan & Johnston, 1988; Kochnower, Richardson & DiBenedetto, 1983; Manis, Szeszulski, Holt & Graves, 1988; Olson, Kliegel, Davidson & Foltz, 1985; Olson, Wise, Conners, Rack & Fulker, 1989; Siegel & Ryan, 1988 ; Rack, Snowling & Olson, 1992).

Finally, in their meta-analysis of 16 studies that investigated the phonological processing deficit hypothesis among almost 12000 disabled older readers, van Ijzendoorn and Bus (1994) concluded that their "fail-safe analysis showed that 423 further studies finding no support for the phonological deficit hypothesis are needed to render this hypothesis implausible" (p.273). On the basis of their findings, van Ijzendoorn and Bus (1994) argued that it was "safe to consider the phonological deficit to be an established fact" (p.273).

Causes of Phonological Processing Deficits

Two general views have been put forward to explain the phonological processing deficits in students with severe reading difficulties (Tunmer & Chapman, 1996c). According to one account, the various phonological processing deficits are a reflection of a more general underlying deficiency in the phonological component of working

memory. More specifically, a deficient language processing module in the left dominant cerebral hemisphere is thought to be responsible for the limitations on the use of phonological structures in working memory (Tunmer & Chapman, 1996c).

The second account proposes that phonological deficits are a consequence of a developmental delay in control processing ability and/or inadequate environmental stimulation. Children who are developmentally delayed or who have not received adequate exposure to appropriate language activities cannot readily perform the low level metalinguistic operations necessary for acquiring basic reading skills. Children who do not possess adequate phonological processing skills at the critical time will therefore not be able to derive maximum benefit from reading instruction. They will also be prevented from taking advantage of the reciprocally facilitating relationships between reading achievement and other aspects of development such as growth in vocabulary, syntactic knowledge, and phonological processing skills, which facilitate further growth in reading. It is possible that these children may eventually overcome their initial weaknesses in the phonological domain and gradually develop along normal lines. They will eventually learn to read, but do so more slowly. However, without specific intervention, a more likely possibility is that most of these children "will not await phonological development but will start to read using compensatory visual strategies guided by contextual cues" (Snowling, 1987, p.143). The continued use of selective association (the pairing of a partial stimulus cue to a response) and context cues at the expense of phonological information will almost certainly result in severe reading difficulties.

The Importance of Phonological Information to The Development of Word-Specific Knowledge

The reason that the ability to use phonological information is so critical to the decoding process is because sublexical analyses involving phonological information are more likely to result in positive word learning trials. These positive word learning trials will in turn lead to the amalgamation of orthographic and phonological representations

in semantic memory (Ehri, 1992). These amalgamated representations provide the basis for rapid and efficient access to the mental lexicon. Students who use ineffective or inappropriate word identification strategies (such as relying on sentence context and initial letters to guess words) will experience progressive deterioration in the rate of reading development as they grow older (Bruck, 1992; Byrne, Freebody & Gates, 1992). Because there is little interaction between orthographic and phonological codes in the word processing of poor readers who rely on compensatory strategies, the development of an awareness of individual phonemes and knowledge of correspondences between graphemes and phonemes is not fully promoted. Consequently, the word recognition skills of these students remain relatively weak.

Phonological Set For Diversity

While many of the basic (written) words in English are phonetically regular in all positions (e.g., cat, dog) most of the remainder do have phonetically regular units in at least one position. However, although English is not perfectly phonetically regular for all words, sometimes phonetic approximations are sufficient for the reader to be able to identify most words. As Ehri (1991) points out "because the English spelling system is not perfectly phonemic, some experimentation with alternative pronunciations may be necessary to derive a recognisable word" (p.385).

Adams and Huggins (1985) also note that this approach (i.e., set for diversity) is frequently activated when readers are confronted with unfamiliar words that are not yet recognised by sight. The effectiveness of activating such a phonological set for diversity was further illustrated in a recent study by Tunmer and Chapman (1996b). Tunmer and Chapman administered a mispronunciation task to a group of year 2 and 3 students in which a hand-held puppet mispronounced 80 irregularly-spelled words (e.g., stomach). The puppet pronounced the words phonetically (e.g., "stow match") and the students had to work out what the correct pronunciation should have been. The results showed that the students recognised up to 25% of the words. However, when the same mispronounced words were presented in under-determining sentence contexts, 66% of

the words were correctly identified. These findings suggest that, provided a reasonably accurate level of phonological information is obtained about a word's identity, there is a likelihood that such information (particularly when combined with context information) will be sufficient for the word to be correctly identified.

The Tunmer and Chapman study is particularly important because the words they used in their study were all irregularly spelled words. If such positive results can be obtained from this particular (and minor) group of words, it must follow that even higher success rates would occur with the more regularly-spelled words. However, because there is little interaction between orthographic and phonological codes in the word processing of disabled readers, the development of an awareness of graphemes, phonemes and rime units is not promoted (Bruck, 1992). The word recognition skills of such readers remain relatively weak because they do not develop as rich a network of sub-lexical connections between orthographic and phonological representations in semantic memory as do the normally developing readers.

The Development of Early Rhyme and Onset-Rime Awareness

Recent research suggests that there is a level of structure in spoken words that is intermediate in size between syllables and phonemes (Treiman, 1992). Studies indicate that the ability to segment words into phonemes may be preceded by the ability to segment syllable units into the intrasyllabic units of onset and rime, where onset is the initial consonant or consonant cluster, and rime is the vowel and any following consonants. Figure 1 presents three ways in which words may be segmented phonologically.

Figure 1

Ways That Words May be Segmented Phonologically

Word	Syllables	Phonemes	Onset	Rime
ship	ship/	sh/i/p	sh	ip
take	take/	t/a/ke	t	ake
stick	stick/	s/t/i/ck	st	ick

The word ship for example, although consisting of one syllable, can be further divided into an onset sh and a rime ip. Treiman (1985) found that initial consonant clusters appear to be treated as single units by young children. When asked to judge whether spoken syllables like spa, sap, sa and nik began with /s/, 5-year old children more often failed to recognise the target consonant in syllables like spa than in syllables like sap or sa. Similar findings have been reported for rimes. Using a phoneme oddity task in which children were asked to judge which spoken word out of three contained an end sound not shared by the other two, Kirtley, Bryant, Maclean, and Bradley (1989) found that 5-year olds performed better when the common end sound was the rime rather than when it was part of the rime.

A commonly used measure of onset-rime sensitivity is children's awareness of rhyme. To recognise that two words rhyme, children must divide each word at the onset-rime boundary and notice that the words share a common rime unit, as Goswami and Bryant (1990) note:

> Just as the rime tends to consist of two or more phonemes, so the written version of this speech sound usually contains more than one letter. The sound which *cat* and *hat* share contains two phonemes: but these words share a common spelling sequence *at*, which represent the shared sound, and that sequence consists of two letters. So if children connect rhyming

> sounds with reading, the connection will be between particular sounds and sequences of letters (p. 30).

Bradley, Bradley, Maclean and Crossland (1989) suggest a significant cause-effect relationship between children's early nursery rhyme knowledge and their later reading and spelling development, arguing that "familiarity with nursery rhymes enhances children's sensitivity to the component sounds in their language, and that this in turn, affects their progress in reading and spelling" (p. 426).

Studies using rhyme production tasks (Calfee, Chapman & Venezky, 1972; Maclean, Bryant & Bradley, 1989), rhyme deletion tasks (Lenel & Cantor, 1981) and rhyme oddity tasks (Bradley & Bryant, 1983; Kirtley et al. 1989), have demonstrated that children as young as 4 years are aware of rhyme. It also appears that for most children, onset-rime sensitivity, as measured by rhyme awareness emerges spontaneously in development prior to exposure to reading instruction.

The development of rhyming ability does not seem to be strongly dependent on formal training. Rather, rhyming ability seems to require less conscious and deliberate manipulation of the segments than other phonological tasks (Morais, Bertelson, Cary & Alegria, 1986). In contrast, the ability to completely segment a word or syllable into phonemic elements seems to develop only under certain learning conditions, such as when children are exposed to instruction in an alphabetic script (Bowey & Francis, 1991) or given specific training in phonemic segmentation skills (Lundberg, Frost & Peterson, 1988).

Bowey and Francis (1991) extended the work of Kirtley et al. (1989) by examining a series of phonological oddity tasks in kindergarten and first grade children. The phonological oddity tasks involved onset-rime sensitivity (e.g. deck, neck, fit or flow, sky, flea) and rime-phoneme analysis (e.g. jug, dog, log or bed, bit, bin). The results showed that only 10% of the first-graders performed at chance level or better on the phonemic structure (phoneme oddity) task indicating that pre-readers do not generally attend to the phonemic structure in spoken words. While 20% of the kindergarten children performed above chance level on the onset-rime sensitivity task, this score rose to 60% for the children who had had 6 months of reading instruction in

grade one. These results confirm that reading instruction stimulates both onset-rime sensitivity and phonemic analysis, Bowey and Francis (1991) suggest that alphabetic literacy instruction, involving (directly or indirectly) instruction in letter-sound correspondences, is probably the most efficient means of stimulating phonemic analysis.

Lundberg , Frost and Petersen, (1988) developed a training programme consisting of games and exercises to stimulate preschool children to attend to the phonological structure of language. The programme involved listening to verbal and non-verbal sounds, playing rhyming games, and completing simple sentence, word, syllable and phonemic segmentation tasks. Lundberg and colleagues found that although awareness of words, rhymes and syllables were less dependent on systematic instruction for their development, phonemic segmentation skill on the other hand, did not seem to develop without explicit instruction.

Research has also demonstrated that even after such training, the learning of words by segmenting individual graphemes was a particularly difficult skill for beginning readers to master (Wise, 1992). Using a "talking computer" system Wise (1992) compared grade one and two children's word learning rates when words were presented in one of four different conditions; whole words, syllables, sub-syllabic onset-rimes and single graphemes. The aim of the study was to find out for a given word, if there were advantages to short-term learning for breaking the word into units rather than presenting it as a whole. The results showed that all groups benefitted least from having the word presented as single graphemes. The older and better readers learned as many words when they were presented as subsyllabic onset-rime units as they did under either syllable or whole word presentation conditions. These findings and the findings of a strong predictive relationship between preliterate onset-rime sensitivity and later reading achievement (Bradley & Bryant, 1985) have led to the hypothesis that beginning readers may initially link elements of written and spoken language at the level of onsets and rimes (Goswami & Bryant, 1990, 1992; Treiman, 1992). Because preliterate children are generally incapable of fully analysing spoken words into phonemes, they may have trouble discovering correspondences between single letters or digraphs (e.g. sh, th, oa) and single phonemes in the beginning stages of learning to read. In support of these

suggestions is research by Goswami (1986, 1988, 1991) indicating that beginning readers can use multi-letter units corresponding to onsets and rimes when reading new words.

Rime Analogy Training Studies and Beginning Readers

There have been an increasing number of training studies investigating rime analogy processes with beginning readers (Bruck & Treiman, 1992; Ehri & Robbins, 1992; Goswami, 1986, 1988, 1990, 1991, 1994; Muter, Snowling & Taylor, 1994; Peterson & Haines, 1992; Pick, Unze, Brownell, Drozdal & Hopmawn, 1978; Treiman, Goswami & Bruck, 1990; Wise, Olson & Treiman, 1990). In one of her analogy training studies, Goswami (1988) investigated the level at which six and seven-year old children make analogies during regular story reading. The story they were required to read had a "clue" word in the title (e.g. Hark). The title word was selected to prime the reader to other words in the story containing the phonogram ar (e.g. h-ar-p, d-ar-k). The results showed that the children were generally able to successfully decode more of the analogy words than the control words. One problem with this study however, was that because the text was somewhat contrived (in that the target words were inserted specifically to encourage analogy activation) it was not really possible to measure the true extent to which young children were able to spontaneously use analogy strategies to decode unfamiliar words in regular reading situations.

Opponents of Goswami's view argue that, although beginning readers have the potential to use analogies, they will not be able to use this strategy until they have developed a sufficiently large sight vocabulary on which to base analogical inferences. In addition, a significant amount of letter-sound knowledge may be needed to store the base (analog) words in memory in sufficient detail to recognise identical orthographic units in known and new words. In support of these claims Muter, Snowling and Taylor (1994) found that for children not exposed to "clue" words at posttest, the size of the analogy effect was greatly reduced and correlated with reading ability. Muter et al. (1994) trained thirty six 6 year-old children to read a list of "clue" words. After mastery,

the children were then asked to read groups of analogy words and groups of non-analogy (control) words as a posttest. All children were told that the "clue" words may help them to read some of the new words, but only half the children had the clue words available to them during the posttests. The results indicated that more analogy than control words were read correctly when the clue words were visible than when they were not.

Although the Muter et al. findings are consistent with Goswami's (1986, 1991) results confirming analogy use among young readers, Muter et al. are rather more cautious on the question of whether young children use analogies spontaneously during reading. On the basis of their findings Muter et al. (1994) concluded that the extent to which young children can use analogies on a spontaneous basis depends upon their general reading level and basic sight vocabulary knowledge. They argue that "while young readers have the potential to use analogies, this strategy will only come into force after they have had the opportunity to develop a sight vocabulary on which to base their analogical inferences" (p. 300).

Even though it may be acceptable to have clue words remain in view during analogy training studies, the results may not necessarily reflect the true extent to which analogy activation processes are present. This point was made by Ehri and Robbins (1992) in relation to Goswami's findings as these authors maintained that in many of Goswami's previous studies, "analogs have remained in view as subjects read unfamiliar words. This contrasts with normal reading in which students do not have analogous words at hand and so must access their memories" (p.23).

Goswami (1986, 1988, 1990) found that when readers were taught clue words like beak they were then able to read unknown words like peak by making analogies between the ends (e.g., rimes) of the clue words and the unknown words. However, these chidren were unable to make use of analogies between the beginnings of clue words like beak and test words like bean. In contrast, somewhat older beginning readers were able to read unknown words by making analogies between the beginnings of the clue and test words. Their performance was also superior when the analogies involved the ends (rimes) of the clue and tests words. These findings suggest that children initially make

analogies on the basis of rimes and only later notice spelling patterns that cut across the onset-rime boundary. These findings were further confirmed in later studies (Goswami, 1991, 1994). On the basis of these findings Goswami (1994) concludes that "spelling sequences which correspond to onsets or rimes are more likely to be used as a basis for analogy than spelling units of equal size which require segmentation of the rime" (p.20).

Consistent with these findings are the results of several other studies using different tasks or procedures involving reading both real and nonwords. Wise, Olson and Treiman (1990) found that the short-term learning of new words by first-grade readers was better when the visual forms and corresponding pronunciations were segmented at the onset-rime boundary (e.g. d- ish) rather than after the vowel (e.g. di-sh). In a study investigating young children's ability to pronounce non-words, Treiman, Goswami and Bruck (1990) reported that beginning readers performed better on non-words that shared their rime units with several real words (e.g. "high" non-words such as tain) than on non-words that shared their rime units with few or no real words (e.g. "low" non-words, such as taich). While sight vocabulary seems to be necessary for analogies to take place, Ehri and Robbins (1992) suggest that a minimal level of phonological recoding skill may also be necessary. Ehri and Robbins trained two groups of young children to read different sets of words and then asked them to read a common set of five new words. For the first (analogy) group, the new words shared the rimes of the old words. For the second (control) group, the new words shared only individual letter-sound correspondences with the old words. Although there were no differences among children with little or no decoding skills, (i.e. children who could read no more than one of five CVC nonwords) and children with some decoding skills, the analogy group nevertheless read more new words than the control group.

Pick, Unze, Brownell, Drozdal and Hopmawn (1978) investigated six-year old children's ability to read groups of consonant-vowel-consonant (CVC) real words (e.g. bug, rat) followed by CVC nonsense words, some of which shared the first two letters with the real words (e.g. bup-bug, rad-rat). Pick and colleagues found that most of the children made correct analogies on the nonsense words that shared the same CVC patterns with real words.

Bruck and Treiman (1992) also found similar patterns of results with a group of grade one children and they noted that the analogies made using the initial consonant plus vowel (CV) took longer than did the analogies involving the rime units. Bruck and Treiman (1992) concluded that although children did learn new words when shown that the vowel or the initial CV of the new word was the same as those of known words, these methods resulted in slower learning than that shown by the rime method. Furthermore, Bruck and Treiman (1992) found that rime-trained first graders who were explicitly shown that the rime for each new word had the same sound and spelling as the rime of a known word, required fewer learning trials than two other groups of first-graders who were shown that the vowel or the initial CV of each new word was the same as that of a previously learned word. However, the children in the rime group pronounced fewer of these words on a retention test than the children in the other groups and they also performed less well than the vowel-trained children on a non-word generalisation test. It is possible however, that the poorer retention rates of the rime-trained group can be attributed to their having received less practice with the training words than the other two groups. Had a metacognitive component been added to their programme the results of the Bruck and Treiman study may have been more positive. Although the Bruck and Treiman (1992) study reported in favour of the vowel training (versus the rime training), it would be interesting to see how the vowel-trained children would perform on words in which the 'a' vowel is represented by a different sound in each, such as in saw, was, cake, cat, and far.

Peterson and Haines (1992) reported that children require minimal levels of segmentation ability to manipulate the onset-rime components, before they can profit from analogy training programmes. They instructed a group of 47 kindergarten children of average ability, to read some simple words by analogy to a list of clue words. Seven 15-minute training sessions took place over one month and during the sessions, ten different rime units were taught. The training sessions highlighted how new words could be made by changing only the onsets and retaining the rimes. Pretest and posttest measures included letter-sound knowledge, onset-rime segmentation skills and analogy transfer skill.

The results showed that the analogy training did not significantly improve the low segmenter group's ability to read words by analogy, but the analogy training did improve this group's onset-rime segmentation ability. Both the middle and high-segmenter groups however, showed significant improvement in their ability to read words by analogy. These groups also showed improvement in onset-rime segmentation ability and letter-sound knowledge but the training effects were less significant for the high segmenters which was possibly due to this group's ceiling scores for this measure.

A second significant finding from this study was that there appeared to be a developmental progression in the acquisition of segmentation ability. For the low segmenter group, the analogy training influenced onset-rime segmentation ability the most. Peterson and Haines (1992) noted that for those children who were unable to perform onset-rime segmentation, the training did not operate in a bilateral fashion, but rather as a symbolising system to facilitate the acquisition of onset-rime segmentation. Mutual facilitation between orthographic segments and corresponding speech segments then became evident in concurrent gains in segmentation and letter-sound knowledge. However, the middle and high-segmenter groups who were already proficient in onset-rime awareness showed greatest improvement in the sentences-to-words and words-to-sounds tasks. On the basis of these results Peterson and Haines (1992) suggest that onset-rime segmentation ability precedes normal segmentation ability which in turn is necessary before children can take full advantage of analogy training procedures. Peterson and Haines (1992) noted that "as children learn to detach the onset from the rime, progress in letter-sound knowledge was evidenced" (p.121).

Finally in a study investigating the phoneme blending and analogy abilities of first grade students, Moustafa (1995) found that the onset/rime analogy explanation accounted for correct recoding of pseudowords better than did the phoneme blending explanation. However, Moustafa was also concerned as to why some students failed to correctly recode any of the pseudowords even though they knew two of the underlying conventional words that collectively, contained the same onsets and rimes (e.g., *yig* from *pig* and *yellow*). Moustafa suggested that a possibility may have been that the students

were unable to differentiate the pseudowords from real words and therefore read the pseudowords as if they were real words.

Yet another possibility as to why the Moustafa's (1995) students often failed to read the pseudowords using analogy processes is that the students may not have had enough other (similarly spelled) print words in their mental lexicon for them to be able to decode by analogy. Common sense would suggest that the reader would certainly need to have knowledge of at least one word with a particular target spelling pattern from which to base future analogies. The problem seems to be that, even where such word knowledge is present, there is still a reluctance by disabled readers to transfer this knowledge on a spontaneous basis when they encounter unfamiliar words that contain identical spelling patterns to known words.

Phonological Recoding Ability, Sight Word Knowledge and Rime Unit Analogy Use: A Reciprocal Relationship

Two views of rime unit analogy development have been discussed. One view states that rime unit analogy processes do not develop before minimal levels of basic sight word knowledge (Muter, Snowling & Taylor, 1994), segmentation ability (Peterson & Haines, 1992), and phonological recoding skill are present. This view argues that minimal levels of both phoneme segmentation ability (Ehri & Robbins, 1992) and spelling-to-sound knowledge are also necessary before rime unit analogy processes are activated. Ehri and Robbins (1992) claim that there are two ways in which phonological recoding skill may assist readers to read new words by analogy. Firstly, it may enable them to segment the spellings into onsets and rimes and then blend these units to form new words. Secondly, it may enable them to store the words in lexical memory by forming connections between the graphemes in the spellings and the phonemes in pronunciation. This process further enables the reader to store letter details in memory in sufficient detail for them to be accessed when recognized across a number of words.

The second view of analogy use maintains that even very young beginning readers are generally able to link elements of written and spoken language at the onset-rime level

(Goswami, 1990, 1992, Treiman, 1992). In other words, phonological knowledge at the level of onset-rime awareness may be sufficient in itself to enable even very young developing readers to activate analogies when identifying unfamiliar words. Furthermore, a number of studies have demonstrated that young beginning readers can also be trained to use rime unit analogies in reading (Goswami, 1986, 1988, 1990).

An alternative view of onset-rime development proposes that there is a reciprocally facilitating relationship between the development of phonological recoding skill, sight word knowledge and the ability to make use of rime-unit orthographic analogies. While some phonological recoding skills may be necessary to use rime-based analogies, the process of dividing words at the onset-rime boundary may itself help to develop phoneme sensitivity (Treiman, 1992). This in turn would also enable children to develop an increased awareness of grapheme-phoneme correspondences within onsets and rimes. Consistent with these suggestions are results from a number of recent studies (Bowey & Hansen. 1994; Treiman, Goswami & Bruck, 1990; Patterson & Morton, 1985; Goswami, 1993, 1994).

Treiman, Goswami and Bruck (1990) examined both children's and adults' ability to pronounce consonant-vowel-consonant (CVC) nonsense words. However, while some of the nonsense words shared VC units with many real words (e.g., tain, goach) others shared their VC units with very few or no real words (e.g., goan, taich). The results showed that the children correctly read more of the high-frequency VC words than the less common VC units. The Treiman et al. study also showed that while children may initially rely on GPC rules to decode many unfamiliar words, the use of VC unit knowledge develops as the more dominant decoding strategy. In support of this claim Treiman and colleagues (1990) noted that by the end of first grade, students reading at the first grade level were already using VC units. Treiman and colleagues further argue that facility in using VC units to make analogies may improve with increasing reading skills.

This notion of a reciprocal relationship between GPC knowledge, sight word knowledge and rime unit (VCs) analogy use is also consistent with Patterson and Morton's (1985) reformulation of the rule-based view of reading. According to

Patterson and Morton, readers use two types of rules to assemble the pronunciations of letter strings. These include rules that involve graphemes and phonemes and rules that involve the "bodies" (i.e., VCs) of printed words and rimes of spoken words. Bowey and Hansen (1994) used the orthographic rime frequency effect to examine beginning readers' use of orthographic rimes in reading pseudowords as a function of word identification ability. They tested the hypothesis that pseudowords constructed from familiar (i.e., frequently-occurring) orthographic rimes can be read using large unit analogy rules and that such units should also be read more accurately than pseudowords constructed from less common orthographic rimes. Grade one children were tested on their ability to read 40 regular/consistent monosyllabic pseudowords The pseudowords, while containing both common and less common orthographic rimes, were nevertheless, exactly equivalent in length, and the rime units could all be consistently pronounced according to regular graphophonic correspondence (GPC) rules.

The results showed that pseudowords constructed from common orthographic rime units were read more accurately than those constructed from less common rime units, even though both sets of pseudowords could have been decoded using GPC rules. The results further suggest that the size of the orthographic rime frequency effect on word identification skills are influenced by two factors; the size of the children's sight vocabulary affecting the availability of orthographic rime correspondences and their ability to use GPC procedures to phonologically recode novel words. The results also indicated that onset-rime knowledge and knowledge of grapheme-phoneme correspondences develop simultaneously during the first year of reading instruction.

Although Bowey and Hansen (1994) like Treiman et al. (1990) differentiate between "high" (e.g., taich) and "low" (e.g., tain) frequency rime units in pseudowords, it could be argued that a sight knowledge of only one word containing the relevant rime unit should be sufficient for the reader to activate analogies to other words containing this unit. Furthermore, it may be difficult to ascertain whether the reader is using GPC knowledge or analogies when reading many pseudowords. The reality may be that possibly both processes operate in combination. Where a "low" frequency rime unit is encountered, it is possible that this rime unit itself may be further subdivided into two

"high" frequency units, ai and ch. Therefore, although the rime unit aich may well be categorized as "low" frequency (because very few words contain this spelling pattern), the two sub-units ai and ch occur in many words making the rime unit aich accessible via the two sub-units. Pseudoword reading tasks therefore may be viewed as a measure of both GPC and analogy use and rime unit analogy use may therefore also be viewed as a process that includes both strategies. As knowledge of the subcomponents become part of the reader's sight word knowledge, it is possible that these subcomponents are blended quickly and accurately, initially as separate units and later as part of larger unit knowledge.

In her interactive analogy model of reading development Goswami (1993) found that the use of vowel analogies emerges gradually as reading develops and follows an initial phase in which children's use of analogies is restricted to spelling patterns corresponding to onsets and rimes. Goswami's analogy model is interactive in that both phonological and orthographic knowledge are seen as influencing one another in a reciprocally facilitating way. In support of this claim Goswami (1993) suggests that phonological knowledge "initially constrains the development of orthographic knowledge with children focussing on spelling sequences corresponding to rimes. Developing orthographic knowledge then, in turn, refines phonological knowledge, with phonemic awareness emerging from a combination of factors, including learning about single-phoneme onsets and learning to spell" (p.21).

Goswami also found that as reading skills improve, pronunciations of vowel graphemes and onset-rime units were also transferred (e.g., beak-heap, beak-bean). The interactive analogy model makes the prediction that children with reading difficulties who have poor phonological processing skills are likely to have difficulty establishing orthographic recognition units for words. These children will also be unlikely to use phonological skills for analysing the orthography within words. A lack of onset-rime segmentation ability will inhibit the use of analogies in reading with the result that each unfamiliar word is likely to be read independently of its orthographic neighbours.

Finally, in a recent modified Reading Recovery (RR) training study Iverson and Tunmer (1993) included specific instruction in the use of orthographic analogies as a

basis for improving phonological recoding skills in beginning readers. They used magnetic letters to further demonstrate how orthographic spelling patterns may be used to assist with the recognition of unfamiliar words. The main aim of the instruction incorporated into the modified RR training programme was "to make the children more aware that words with common sounds often share the same spelling patterns" (p.16). The significant finding from this study was that the modified RR training group reached discontinuing level on average 16 lessons earlier than the standard RR trained group. The authors suggested that one possible reason for the faster progress of the modified RR training group was due to their superior phonological recoding skills which developed as a result of the explicit analogy training. This study, and a number of other recent training studies demonstrate that there are a number of advantages in teaching onset-rime unit awareness to children with severe reading difficulties. Some of these advantages will now be discussed.

Advantages in Teaching Onset-Rime Unit Awareness

Acquiring knowledge of orthographic units that correspond to onsets and rimes may be advantageous to both beginning and poor readers in three ways. First, because onsets and rimes are more accessible to young children and because onsets often comprise single phonemes, an initial focus on dividing words at the onset-rime boundary may greatly facilitate the process of learning to isolate and recognize individual phonemes (Treiman, 1992). This in turn would facilitate further progress in reading by enabling children to utilise one-to-one correspondences between graphemes and phonemes within onsets and rimes. Support for this claim comes from a longitudinal study by Bryant, Maclean, Bradley and Crossland (1990) who carried out a path analysis of their data and found that preliterate onset-rime sensitivity at age 4 influenced reading at age 6 indirectly through phonemic awareness (the ability to detect individual phonemes) at age 5. There was also a direct path from onset-rime sensitivity at age 4 to reading at age 6.

A second advantage in initially linking print and speech at the level of onsets and rimes is that the complexity of vowel generalisations is greatly reduced. Although vowels may represent a number of different sounds depending upon the particular word they appear in, they are generally quite stable when viewed as part of the rime unit (Adams, 1990; Treiman, 1992, Wylie & Durrell, 1970). Analyses of children's reading errors by Shankweiler and colleagues (Shankweiler & Liberman, 1972; Fowler, Liberman & Shankweiler, 1977) showed that vowels are particularly difficult for beginning readers to learn (and may even be more difficult for dyslexic children, given that vowel spelling patterns typically map on to single phonemes within rimes). However, because the complexity and variability of vowel spelling-to-sound correspondences is greatly reduced when the vowels are segmented as part of the rime unit (Wylie & Durrell, 1970), it follows that there may be advantages in designing interventions that encourage reading disabled children to focus on these particular units when reading unfamiliar words. The letter a for example, has a consistent pronunciation when it precedes ng (bang, hang, rang, sang) but has many different pronunciations when it follows c (cat, call, cake). Treiman, Goswami and Bruck (1992) also make the point that in English, "the consonant grapheme that follows a vowel grapheme sometimes influences the vowel's pronunciation. Only rarely does the preceding consonant systematically affect the pronunciation of the vowel. As children become aware of this characteristic of English, they may increasingly rely on VC units" (p. 560).

Because of the nature of English orthography, the vowel sounds are generally quite stable in the rime segments of words. Further evidence in support of this statement comes from the results of a statistical analysis of a large set of English words containing consonant-vowel-consonant phonological structures which was undertaken by Treiman, Mullenix, Bijeljac-Babic, and Richmond-Welty (1995). These researchers, like Wylie and Durrell (1970), found that orthographic rimes had more stable pronunciations than either individual vowels or initial consonant-plus-vowel units. In their study, Wylie and Durrell (1970) undertook an analysis of the utility value of exploiting vowel phonograms as a reading strategy for beginning readers. From a list of 286 rimes appearing in a selection of early reading texts, the authors reported that in 272 of these phonograms

the vowels represented the same pronunciation when they appeared as part of the same rime unit (e.g., vowel plus one or two consonants). Furthermore, the authors also reported that a knowledge of a further group of only 37 rime spelling units (phonograms) was sufficient for beginning readers to be able to read up to 500 of the most frequently occurring words in beginning reading materials. In the study involving 230 first-grade children, Wylie and Durrell also administered a multiple choice test that required the children to identify a specific rime spelling unit (phonogram) from within groups of five (e.g., *ack*, *eck*, *ick*, *ock*, *uck*). In one task the children were required to identify a particular target phonogram and in another task they were required to identify only a particular vowel. The results showed that the children were generally more successful on the phonogram identification task than they were on the vowel-only identification task.

Similarly, Stanback (1992) analyzed 17602 high-frequency words for syllable and rime patterns and found that 616 rime units provided the "building blocks" for 43000 syllables of words. Furthermore, a large number of these rimes (e.g., 436) were both regular and consistent in pronunciation, and 55 were consistent but not phonetically regular. However, provided the reader was able to activate a phonological set for diversity (Gaskins et al., 1988) even these consistent (but irregular) rime patterns offered sufficient phonological clues to the identity of many words.

A third possible advantage in initially focussing on teaching orthographic units corresponding to rimes is that it temporarily delays the need for acquiring the ability to blend individual phonemes within onset and rime spelling units (Ehri & Robbins, 1992). Blending is a particularly difficult operation to perform because of the large amount of processing required (Bowey & Francis, 1991; Perfetti, Beck, Bell & Hughes, 1987). In support of this claim is recent research by Wise (1992) indicating that blending onset and rime units into words is a much easier task for beginning readers than blending phonemic units into words.

The identification of rime units allows the reader a "phonological pathway" into the identity of many words. Ehri (1991) argues that developing such orthographic knowledge of word reading facilitates the decoding of unfamiliar multisyllabic words as

well. She also notes that the process helps the reader establish access routes in memory through the learning of particular spelling patterns. Sight word access is speeded up through the efficient recognition of familiar orthographic patterns. In support of this suggestion Ehri (1997) further argues that a knowledge of larger letter-sound units are valuable for sight word learning "because they reduce the number of connections that are needed to secure words in memory" (p. 178).

The role of letter-sound knowledge, onset-rime sensitivity and the implications for reading disabled students has become the subject of a growing number of training studies (Cunningham, 1988; Gittleman & Feingold, 1983; Lovett, Warren-Chaplin, Ransby & Borden, 1990; Lovett, Borden, Deluca, Lacerenza, Benson & Brackstone, 1994; Williams, 1980). While research evidence suggests that phonological processing deficits in reading disabled students are the most likely cause of their poor word recognition ability, Lovett et al. (1994) note that relatively little research effort has been directed to analysing dyslexic students' attempts to acquire word recognition skill or to evaluating the effectiveness of different instructional approaches.

Use of Rime-Unit Analogies by Disabled Readers

Although research evidence indicates that young normally developing readers are able to use orthographic analogies soon after they begin formal reading instruction, reading disabled older children seem to have more difficulty using this skill. A number of studies demonstrate that dyslexic students (when compared to younger reading age matched children) perform less well on tasks that measure analogy use (Ehri & Saltmarsh, 1995; Lovett et al. 1990; Lovett et al. 1994; Reitsma, 1983; White & Cunningham, 1990; Wolff, Desberg & Marsh, 1985). Furthermore, the findings from a number of these rime analogy training studies demonstrate positive outcomes for dyslexic children suggesting that these particular children can be taught to make use of rime unit analogies when decoding unfamiliar words (Baron, 1979; Manis, 1983; Marsh et al. 1981; Wolff, Desberg & Marsh, 1985). Some possible reasons why dyslexic children have difficulty with using rime unit analogies are also investigated.

Findings from a study by Lovett et al. (1990) suggest that dyslexic children have difficulty abstracting spelling-to-sound pattern invariance, irrespective of the size of the units and that this may be a reason why they do not make more use of orthographic analogies when reading. They gave two groups of dyslexic children systematic word identification training. One group received letter-sound training while the other group received whole word training. Although both groups made substantial gains on the instructed words, the children did not profit differentially from letter-sound over whole word training and neither group showed significant transfer to uninstructed vocabulary. Moreover, when presented with uninstructed words (e.g. cart, peak) that shared rime spelling units with the taught words (e.g. part, weak), the dyslexic children did not spontaneously use rime-based orthographic analogies to identify the unfamiliar words.

Lovett et al. (1990) speculated that the cause of this difficulty is most likely the dyslexics' inability to parse a syllable into smaller subsyllabic onset-rime units. The inclusion of a reading-level control group of normally developing readers (and appropriate measures of onset-rime segmentation ability in the design of the study) may have helped to clarify this point.

An alternative explanation as to why reading disabled children do not use rime unit analogies on a spontaneous basis when reading may be due to their lack of metacognitive awareness of the task requirements. Most disabled readers already possess the necessary minimal levels of phonological processing skills including onset-rime segmentation ability and basic sight word knowledge (Greaney & Tunmer, 1996) yet they still do not spontaneously use this knowledge to activate analogy processes. Instead, they tend to rely on ineffective or inappropriate learning strategies such as a reliance on partial letter-sound cues, (e.g., Ehri, 1985) or contextual guesswork (e.g. Goodman, 1967; Smith, 1978). Consistent with this possibility are the results of studies by Reitsma (1983) and Ehri and Saltmarsh (1995).

Reitsma (1983) conducted a series of experiments for the purpose of assessing the course of printed word learning by beginning readers. In one experiment Reitsma (1983) gave a group of normally developing first grade readers and a reading-level control group of older disabled readers, varying amounts of practice at recognising a set

of words containing both standard and homophonic (e.g., same sound/different spelling) spellings. These words were later tested along with a matched set of homophonic spellings of these words. The results showed that after as few as four learning trials, some of the young readers performed better on the standard spellings than on the homophonic spellings, whereas no differences were found for the disabled readers, even after six learning trials.

In extending this work, Ehri and Saltmarsh (1995) found that disabled readers were particularly deficient in remembering letter details in the middle of words. Ehri and Saltmarsh compared first-graders and reading disabled second, third and fourth graders' sensitivity levels to various types of letter alterations (e.g. letter additions, letter deletions) in words that they could read. Ehri and Saltmarsh further divided the first-graders into high and low decoders. The high decoders were able to identify (within a one-second time-frame for each word), between 41 and 126 words on the Boder and Jarrico (1982) word test, while the low decoders were able to identify between 2 and 40 words in the same time-frame. The research findings showed that even the low first grade readers were more sensitive to spelling alterations than were the older disabled readers. They were able to read the original spellings faster than spellings containing medial letter alterations and they also read the spellings faster than the disabled older readers. The disabled older readers took significantly more learning trials to learn the target words than both the high and low first grade readers, suggesting a deficit rather than a delay in sight word learning ability (see previous discussion).

On the basis of their research findings, Ehri and Saltmarsh (1995) suggest a number of possible reasons for the poor word learning abilities in reading disabled children. These include not being sufficiently analytic to notice all the letters in the words, using only partial alphabetic cues, a limited graphophonic (GP) knowledge and deficient phonemic segmentation ability. The lack of GP knowledge was a particular cause for concern because, as Ehri and Saltmarsh maintain, even in irregularly-spelled words such as sword the GP correspondences should normally be sufficient to enable the reader to bond most of the letters to sounds in such a way as to successfully identify the word. Ehri and Saltmarsh note that this process develops early in beginning readers.

> As soon as beginning readers gain even rudimentary knowledge about G-P relations. they become able to learn to read sight words by bonding spellings to pronunciations. For irregularly spelled words, G-P correspondences should help readers bond most of the letters to sounds for example, all but T in 'listen', all but W in 'sword' (p.6).

The problem with reading disabled children however, is that because their G-P knowledge and phonemic segmentation skills are limited, they form only partial rather than complete orthographic connections between word letters and sound units. The result is often that the decoding attempt includes only the salient (usually boundary) letters of the target word while ignoring the medial letters. This further explains the reason why the reading progress of older disabled readers plateaus in what Ehri (1991) describes as the phonetic cue reading stage of development. During this stage the reader relies primarily on initial and/or final consonant information to identify the word, rather than making full use of complete letter-sound information from throughout the whole word. A likely consequence of the continued use of partial letter-sound cues is the development of poorly specified lexical representations in semantic memory. If disabled readers are not sufficiently analytic in their word attack skills, they may need intensive strategy training in word decoding to get them into the habit of making greater use of letter-sound information available within unfamiliar words.

In a more recent intervention study, Lovett et al. (1994) tested both explanations, (i.e. deficits in phonological skills versus deficits in decoding strategies) of dyslexic children's difficulties in acquiring invariant spelling-to-sound patterns, and their limited transfer to uninstructed words. Lovett et al. (1994) used two experimental training programmes consisting of intensive word identification instruction. One programme (PHAB/DI) involved teaching phonological-based decoding skills while the second programme (WIST) used a strategy-based metacognitive decoding approach. A third alternative treatment control procedure was also used, in which a classroom survival skills programme (Lovett et al. 1990) was taught. This programme included training classroom etiquette, life skills, organisational strategies, academic problem solving and

self-help techniques. The phonological training programme included training in phonological analysis and blending as well as direct instruction in letter-sound and letter-sound cluster correspondences. The main focus of instruction in the phonological training programme was word segmentation and sound blending skills. The strategy-based word identification training programme trained the children in the acquisition, use and monitoring of effective word identification strategies.

Part of the metacognitive training programme was based on the Gaskins et al. (1988) study and involved the teaching of four specific decoding strategies; word identification by analogy, seeking the known part within words, attempting variable vowel pronunciations (set for diversity) and identifying prefixes and suffixes in multi-syllabic words. The main element to success for the metacognitive programme depended upon a knowledge of 120 high-frequency spelling patterns (e.g. *ack*, *ound*). Test measures of training effects included letter-sound identification accuracy of the 120 key words and a set of 67 isolated letter-sound combinations.

Transfer of training measures included the ability to read 71 words that contained letter-sound (phonograms) patterns identical to those in the key words. The key word bake for example, was represented in the transfer test as fake, babe, bike, and baker. Challenge words were also included in the transfer measure. These included 105 words in which the key spelling pattern was embedded in multi-syllabic words. Two final transfer measures included a pseudoword decoding task and a task that assessed each child's ability to decode a set of ten unknown low-frequency words (e.g. grouty, browbeat, limerick).

A set of standardised measures involving phonological analysis and blending skills, word identification, spelling, reading and arithmetic achievement were also used. Training measure results showed significant posttest gains for both the experimental training groups over the classroom survival skills group. Particularly large transfer effects were obtained on key words, letter-sound and sound combination measures. Transfer of training measures also showed highly significant posttest gains for both the experimental training groups on the test of transfer, challenge words and regular word list measures.

The phonological-based experimental group performed significantly better than the other two groups on the transfer to nonword reading measure. The strategy use measures also showed significant posttest gains for both the experimental groups over the classroom survival skills group (Lovett et al. 1994). On academic achievement measures including reading and spelling, it was revealed that the PHAB/DI subjects scored significantly higher than the other two groups on the WRAT-R Reading test. On the spelling measure posttest gains were higher for the WIST subjects. The phonological processing measures posttest scores revealed significant improvement for both the PHAB/DI and WIST subjects on both the sound analysis and sound blending measures. Lovett and colleagues concluded that, on the basis of their research, the most important finding was that the poor phonological processing skills characteristic of many older poor readers could be improved with appropriate and systematic training.

However, several questions remain unanswered. First, because no measures of phonological awareness were taken, it is unclear whether the success of the two programmes was due largely to increasing dyslexics' phonological awareness skills or to increasing their word decoding skills and strategies. Second, as Lovett and colleagues note, because both programmes were successful, it is possible that some combination of the two programmes would result in even greater benefits for dyslexic children. Finally, as Lovett and colleagues further note, the optimal level of spelling-to-sound unit knowledge for children with dyslexia is not known. As they put it, "the developmental sequence by which children use larger and smaller spelling-to-sound units is not obvious" (p. 819).

Regarding the latter issue, although the question of the developmental sequence by which normally developing readers use larger and smaller spelling-to-sound units is unresolved (see previous discussion) the situation may be more straight-forward for disabled readers. In learning to recognise words, normally developing readers make greater use of grapheme-phoneme correspondences to form sublexical connections between specific letters seen in words and the sounds detected in their pronunciations (Adams & Bruck, 1993; Ehri, 1991, 1992; Perfetti, 1992). In contrast, disabled readers rely more on partial word-level information (e.g. partial visual cues, partial letter-sound

cues) and contextual guessing to identify words, and as a consequence, have less fully developed sublexical connections between the orthographic and phonological representations of words in semantic memory.

There is less interaction between orthographic and phonological cues in the word processing of disabled readers, with these readers tending to rely instead on only partial word-level cues. A consequence of this is that the development of an awareness of individual phonemes and knowledge of correspondences between graphemes and phonemes may not be promoted to the same extent as in normally developing readers. Support for this suggestion comes from a study by Bruck (1992) who found that disabled readers showed deficits in phonemic awareness at all ages and reading levels but eventually acquired appropriate levels of onset-rime sensitivity.

Because rimes are more accessible phonological units than phonemes (see previous discussion) an initial focus on teaching orthographic units corresponding to rimes may be an effective intervention strategy for reading disabled children. Moreover, if the word recognition skills of dyslexic children are weak because of their continued use of ineffective or inappropriate learning strategies such as relying on sentence context and partial word-level cues to guess the words, then teaching these children to use rime-unit analogies may be a very useful first step in making them more aware of the sublexical relationships between written and spoken words. In particular, it may also help disabled readers to overcome their tendency to focus on the boundary letters at the expense of medial letter cues when they are attempting to decode unfamiliar words.

Although many English words may be decoded phonetically letter-by-letter (Venezky, 1974), Wolff et al. (1985) note that this process becomes ineffective when children are faced with multisyllabic words in which the spelling is more morphophonemic and lexical than based on letters and sounds. To overcome this particular reading problem it is suggested that the competent reader uses analogy strategies (Marsh et al. 1981). In their analogy training study, Wolff and colleagues (1985) used three different instructional approaches to ascertain which type of instruction would most likely encourage analogy strategy use in both normal and reading disabled children.

In the first approach subjects were shown a nonsense word and were then asked to think of a word that would look like the nonsense word if the initial letter was changed. They were then required to pronounce the nonsense word in the way they would pronounce the analogue word. In the second approach, the subjects were required to read the analogue word first (as a prime) then a corresponding nonsense word. The third approach combined the verbal instructions of the first group with the prompts of the second group. A control group was asked to read the nonsense words with no instructions or prompts. The subjects in this study included normal 2nd and 5th graders and learning disabled (LD) 5th graders.

The results showed that on a 5-word transfer task, the subjects who were trained on the first approach (where the subjects were required to generate the first analogue) performed significantly better than either of the other group conditions. Although substitution strategies were used by both the 2nd graders and LD 5th graders, they were seldom used by the normal 5th graders. Partial decoding, involving mainly the initial letter cues,was also frequently a strategy used by the LD 5th graders to guess the word.

Another significant finding from the study by Wolff and colleagues was that while the LD 5th graders were often able to pronounce the analogue word correctly, they were not able to generalize its pronunciation to the nonsense word, whereas very few of the normal 2nd and 5th graders had this problem. On the basis of this finding Wolff et al. (1985) suggested that "reading disabled students not only need to be taught how to use analogy strategies, but also how to generalise them" (p.415).

The third significant result from the Wolff et al. study showed evidence indicating that it was possible to speed up reading development by giving direct instruction in the use of analogy strategies to reading disabled children. This was particularly evident under the *instruction-only* condition which required the students to produce analogue words, which helped develop a better set towards transferring the skill to reading words by analogy.

In summary, some unresolved questions arising from the research on the use of rime-unit analogies by disabled readers relate to the issue of why this group of readers do not spontaneously use rime-based analogies to identify unfamiliar words. A second

question concerns the issue of whether procedures can be developed to help disabled readers make use of rime spelling units in regular (context) reading situations and on a spontaneous basis.

Transfer of Training Issues

The Role of Metacognitive Learning

One of the problems that many students with SLD have is activating their cognitive processes. Chapman and Tunmer (1996) argue that such students are often characterised as "being inactive learners, because they appear to have difficulty engaging in the cognitive requirements of the learning tasks" (p.3).

Wong (1991) also argues that an associated cognitive shortcoming for SLD students is that they often fail to employ appropriate strategies to help their learning. Evidence of this cognitive learning deficit can be found in the results of the first experiment in the current investigation in which the disabled readers frequently demonstrated satisfactory levels of phonological knowledge (e.g., onset-rime sensitivity, rime unit awareness), yet failed to transfer this knowledge to related tasks.

An effective approach to improving the academic performance of disabled learners is more likely to occur where the instructional approach involves attention to the elements of the "Triple Alliance for Learning" (Short & Weissberg-Benchell, 1989). These elements include the incorporation of cognitive skills, metacognitive skills and motivation. The influences of critical cognitive, metacognitive and motivational factors on learning disabled students' academic learning has been given increasing attention in the research literature (Cecci, 1986; McKinney, 1988; Torgesen & Wong, 1986). For the motivational component Chapman and Tunmer (1996) recommend including attribution retraining procedures as part of the remedial programme. The main purpose of attribution retraining is to alter students' perceptions of causes of success and failure on learning tasks by ensuring that they receive teacher feedback that links effortful

strategy use with success. Craven, Marsh & Debus (1991) suggest for example, that teacher responses to successful achievement outcomes should make reference to the correct use of a task strategy, the effort and perseverence required for completion of the task and a confirmation to the student that he/she does in fact have sufficient strategic knowledge to succeed.

Spelling programmes for disabled readers/spellers should include a metacognitive component. Metacognitive training encourages the student to see a purpose for learning a particular skill/strategy and to activate the skill/strategy independently of teacher assistance. Metacognitive training also encourages the student to know when and how to activate such a strategy independently of teacher interactions. This is in contrast to spelling programmes that focus on the teaching of lists of isolated and unrelated words. Metacognitive/phonological spelling programmes also allow opportunities for the student to recognise the link between spelling and decoding. This is best achieved when the student is encouraged to decode unfamiliar words by activating phonological strategies such as segmenting the word at the appropriate rime spelling unit boundary and isolating and blending the relevant rime unit phonograms. If the relevant rime unit phonograms are already known (via spelling) then there is a greater likelihood that these particular units will also be recognised within unfamiliar words during context reading.

The Reading-Spelling Link

Because disabled readers are generally unable or reluctant to activate subsyllabic segmentation processing strategies including the use of analogies, the spelling component in training programmes encourages the subjects to pay closer attention to the phonological characteristics of the words. Lovett et al. (1990) comment on the value of incorporating a spelling component into training programmes to improve the word recognition skills of disabled readers, suggesting that "spelling training forces the disabled reader to deal with individual letters and to segment sub-word units both orally and in writing" (p. 778).

In a small orthographic analogy training study using 66 kindergarten children, Walton (1995) also found that the students who were taught with words with the spelling segmented at the onset-rime boundary read more of the analogy test words than did the students who were taught to read words in the intact (e.g., whole word) spelling condition. Walton (1995) suggests that teaching students to identify words by segmenting the spelling at the onset-rime boundary helps to highlight the similarity between the rime ending and the common spelling which forms the basis of orthographic analogies.

Current spelling programmes in New Zealand primary schools are seldom based on phonological strategy training principles (Brann, 1996). Rather, the words that students are required to learn to spell are generally either based on misspellings that occurred in the student's writing or they may be from particular themes that the class may be studying. In either case, there is little attention given to the study of common spelling patterns that occur across groups of words. While this may not necessarily be a particular problem with students who are already proficient at spelling, it certainly does not address the phonological processing deficit of the poor speller/reader.

In a recent survey of spelling teaching practices of 110 teachers in Auckland primary schools, Brann (1996) found that while many junior (e.g., Year 1-3) teachers were aware of the importance of phonetic analysis skills for spelling development, the senior class teachers tended to base their spelling programmes almost entirely on interest word lists, with no regard for orthographic strategies. Brann (1996) noted that "the survey did not locate one senior class teacher operating a programme considered to be based on acquisition of knowledge of the orthographic system" (p.3).

The Appropriateness of Training Tasks to Regular Class Programmes

In a recent publication Blachman (1997) questioned the instructional feasibility of some training tasks that occurred outside the context of reading and spelling. In an analysis of some recent training studies Blachman (1997) was concerned that in some training tasks students spent "valuable hours becoming more competent at activities that had little real world value" (p.415).

Brown, Armbruster and Baker (1986) noted that while there were a small number of training studies that shared metacognitive strategies, they conceded that this number was not large. More importantly, Brown et al. (1986) also noted that "studies actually demonstrating instructional feasibility in the regular classroom are even scarcer" (p.75).

Transferring the training effects to uninstructed learning has also been a key issue for many training programmes (Gaskins, et al. 1988; Lovett et al. 1994; Torgesen et al. 1992). Lovett et al. (1994) suggest that transfer of learning failures may be attributed to a general problem with acquiring effective and flexible word identification strategies and to the reader's difficulty in maintaining metacognitive control over the decoding process. Metacognitive considerations (such as the spontaneous strategic behaviour characteristic of more skilled readers) were incorporated into the training programme in order that the disabled readers were better able to learn the reading behaviour patterns of better readers. A problem affecting the success rate of transfer of recently-learned skills to uninstructed learning situations relates to the amount of practice opportunities that are available during the training programme. Many training programmes under-estimate the amount of practice that is required before disabled readers are able or prepared to activate the recently-learned strategies in uninstructed situations. Lovett et al. (1994)

noted for example that even after repeated practice with letter-sound knowledge, later success for their disabled readers was not guaranteed and they concluded that "an intensive and focussed phonologically-based training programme appears essential and that segmentation training must be explicit, to the point of exaggeration" (p.820).

Various programmes aimed at training phonological awareness (and related skills) in young children have been generally successful (Moustafa, 1995; Wagner, Torgesen & Rashotte, 1994; Walton, 1995). However studies by Torgesen, Morgan and Davis (1992), Torgesen, Davis & Wagner (1993), Torgesen et al. (1994), and Lundberg et al. (1988) indicate that it is certainly not easy to significantly improve phonological skills of at-risk older readers. The Torgesen et al. (1992) study found that almost 30% of their "at-risk" sample showed almost no measurable growth in phonological awareness following an 8 week training programme. Because at-risk readers are so weak in phonological awareness and because it is so difficult to remediate such readers, Torgesen et al. (1994) recommend that training procedures "that are more explicit or more intense than those typically found in the research literature may be required in order to have a substantial impact on the phonological awareness of many children with severe reading difficulties" (p. 285).

Rime-Based Analogy Training for Disabled Readers in Context Reading

To investigate whether disabled readers could be trained to activate orthographic analogies in context reading Greaney and Tunmer (1996) employed a combination of a reading-level match design and a follow-up intervention study with a group of older poor readers. In the study 30 disabled readers were closely matched with 30 normal (younger) readers on a standardised measure of context free word recognition ability and on the Neale Reading Analysis prose test. The children in both groups were given four tests measuring onset-rime sensitivity including a rhyme knowledge questionnaire,

a rhyme oddity task and two rhyme detection tasks. A task that measured the disabled readers' ability to read groups of words by analogy was also presented. The rhyme knowledge questionnaire assessed children's understanding of the concept of rhyme; the rhyme oddity task measured children's ability to judge which word out of four orally presented words did not rhyme with the other three; the rhyme detection task measured children's ability to detect pairs of rhyming words in the context of a poem. The analogical transfer task measured children's ability to take spontaneous advantage of analogical units when reading two lists of words. In one list (e.g., Rhyme order grouping) 100 words were presented in groups of 5. Each group of 5 words was presented contiguously so that the target analogical unit was identical in each word. In 10 of the contiguously presented groups of words (i.e., 50 words) the target analogical unit formed the rime part of the words (e.g., *ball, tall, wall, hall, fall*). In the remaining 10 groups of contiguously presented words the target analogical unit was embedded within the rime (e.g., *farm, hard, card, start, part*). In the second list the same 100 words used in the Rhyme order condition were presented again but in scrambled order so that no two words with the same target analogical units appeared consecutively.

Results indicated that the younger, normal readers outperformed the older, disabled readers on the two rhyme detection tasks but not on the rhyme knowledge questionnaire or rhyme oddity task. Because the magnitudes of the differences on the two rhyme detection tasks were not great, the overall results seemed to suggest that, although the disabled readers were somewhat behind the reading-age controls in the development of onset-rime sensitivity, they appeared to have sufficient awareness of onsets and rimes in spoken words to be able to use rime-based analogies. On the analogical transfer task the reading age controls performed significantly better overall than the reading disabled students, which suggests that disabled readers are less likely than normal readers to take advantage of orthographic analogies when reading words containing common analogical units, large or small.

This finding is consistent with the results of Lovett et al. (1990) who found that dyslexic children do not spontaneously use rime-based analogies to identify unfamiliar words (see previous discussion). The students in both groups performed better when the

words containing a common rime unit were presented contiguously rather than noncontiguously. This result is similar to Muter et al's. (1994) finding in which the beginning readers were better able to use analogies when the clue word was exposed than when it was not exposed. The results from the analogical transfer task further indicated that the students performed better when the analogical unit constituted the rime portion of the word than when it was embedded within the rime portion of the word. This finding provides further support for the claim that beginning readers are better able to use multi-letter units corresponding to rimes than smaller units corresponding to sounds within rimes.

A follow-up intervention study was carried out to determine whether the poor readers could be taught to use analogies when they encountered unfamiliar words while reading connected text. The poor readers were divided into two carefully matched groups. The treatment group received instruction in the use of orthographic analogies, whereas the comparison groups received remedial instruction emphasising context cue usage. The students in both training groups were asked to read graded prose passages until a reading accuracy rate of 90% to 94% was achieved. The selected passage was read twice, once before and once after the training procedures. The first time the students read the passage their errors were underlined by the experimenter on a separate copy of the passage. The students were informed prior to the reading that any errors made would be underlined by the experimenter, but the experimenter provided no prompting or feedback during the reading.

The purpose of the analogy training was to encourage the reading disabled students to use, where applicable, relevant analogical unit knowledge to decode unfamiliar words in regular prose reading. The training focussed mainly on rime units, but occasionally included training on units embedded within rimes. The assumption underlying the procedure was that poor readers would be better able to identify unfamiliar words when they became metacognitively aware that unfamiliar words often contained units that were analogous to units in known words.

During the first reading the experimenter wrote down the words that were not read correctly by the student. These errors were printed in a column adjacent to the

word in the passage. In a second column the student was asked to write one, or two frequently occurring words (dictated by the experimenter) that contained an analogical unit identical to one that appeared in the misread word. If all spelling attempts were incorrect (which was rare) the experimenter wrote down the words for the student. From the correct spellings the student was then asked to locate the common analogical unit (that also appeared in the original reading error). After the unit was identified, the student was then asked to pronounce the sound, and to print the unit in a separate column on the worksheet.

One student for example, missed a total of 19 words in the target passage, including garden, stake and dew. For the word garden, the student was asked to spell (i.e., write) car and far, and then to identify, pronounce, and write down the common unit *ar*. For the word stake, the student was asked to spell the words make and take and to identify the common unit *ake*. For the word dew, the student was asked to spell the words new and few and to identify the common unit *ew*. This procedure was repeated for as many of the students' errors as possible. Some of the errors did not contain suitable analogical units from which spelling examples could be based. This occurred for example, when an error contained a completely irregular word such as *laugh*.

Although no explicit attempt was made to encourage the students to decode the reading errors during the spelling stage, many of the words were recognised as soon as the analogical unit was identified and pronounced. In other words, the processes of spelling and identifying the target analogical unit was often sufficient to prompt the student to identify the original reading error. However, the strategy became even more powerful when the spelling and analogical unit knowledge was used in conjunction with the sentence context during the subsequent reading. Following the completion of the spelling training procedure, the students were asked to read the passage a second time and to use their newly-learnt analogical unit knowledge to identify the original reading errors.

The experimenter also printed out the reading errors that the control group made during the first reading of the text. However, this group did not receive the spelling and analogical unit awareness training. In contrast, when reading the target

passage the second time, the students in the control group were encouraged to make use of the context cues to identify the misread words.

For each error the students were given prompts in accordance with the procedures of a commonly used remedial reading programme in New Zealand called "Pause, Prompt and Praise" (see Smith & Elley, 1994). If the students made an error that did not make sense, they were prompted with clues about the meaning of the story. If the students produced a word that made sense but was incorrect (a relatively rare kind of error) they were prompted to look at some of the letters in the word. This approach to remediation is based on the assumption that the meaning cues in the sentence and a minimal amount of word-level information are sufficient to enable beginning readers to recognise unfamiliar words in text

The results from this study indicated that there were no significant differences in mean number of pretreatment reading errors between the analogy training group ($\underline{M}$ = 20.20) and the context cue usage training ($\underline{M}$ = 21.00) and that both groups showed significant reductions in the mean number of posttreatment errors. However, the students in the analogy training group made considerably fewer posttreatment errors ($\underline{M}$ = 7.13) than did the students in the context cue usage training group ($\underline{M}$ = 13.20). This finding demonstrated that reading disabled students were able to be taught to use analogies to identify unfamiliar words in context reading. The findings also demonstrated that analogy training may be more effective in increasing the error correction rates of disabled readers than training that focusses primarily on context cue use. Although the results from this small-scale training study are promising, further research is needed to determine the amount of training that is required to ensure that these positive effects are maintained, and generalised to other uninstructed reading materials.

Summary

There is now considerable evidence in the research literature in support of the phonological processing deficit hypothesis as the possible main cause of reading disability among older poor readers. While there are a number of different ways that English written words may be read, the research literature suggests that the use of rime unit orthographic analogies features strongly as a decoding strategy among fluent readers. The research evidence also demonstrates that even very young beginning readers can be trained to use orthographic analogies to help them identify unfamiliar words (Bruck & Treiman, 1992; Ehri & Robbins, 1992; Goswami, 1986, 1988, 1990, 1994; Muter et al. 1994; Peterson & Haines, 1992; Pick, et al. 1978; Treiman et al. 1990; Wise et al. 1990).

The primary problem for children with severe reading disabilities is that because of their poor phonological processing abilities, they tend to rely on inefficient non-phonological decoding strategies (such as contextual guessing) to identify unfamiliar words. These students also lack the metacognitive strategies and phonological knowledge to activate rime unit orthographic analogy processes. However, research evidence is now beginning to demonstrate that children with severe reading difficulties can be trained to develop sufficient rime unit awareness to enable them to also use orthographic analogies. The challenge is to develop a training programme that encourages disabled readers to activate rime unit orthographic analogies on a spontaneous basis in uninstructed reading situations. The aims of the current study were formulated on the basis of this challenge.

Aims of the Present Study

The current research study aims to firstly, further investigate the phonological skills of a specifically-identified group of older poor readers. Secondly, the research aims to develop an analogy training programme for this particular group of readers, with an

emphasis on encouraging them to acquire and activate more specific phonological-based decoding strategies on a spontaneous basis during reading.

If the word recognition skills of very poor readers are weak because of their continued use of compensatory strategies at the expense of phonological information,. it may be necessary to provide them with explicit instruction in the use of more effective learning strategies, such as the use of onset-rime analogies. As noted earlier, the use of such an instructional strategy may be a very useful first step in making these students more aware of sublexical relationships between written and spoken words, and in helping them to overcome their tendency to focus on boundary letters at the expense of medial information. Learning to take advantage of rime-unit analogies may in turn facilitate further progress in reading by helping students to isolate and recognise individual phonemes and acquire one-to-one correspondences between graphemes and phonemes within onsets and rimes.

While a number of training studies have shown positive findings relating to the use of rime unit analogies by disabled readers, there still remains some major unresolved questions. These include the following: Why do disabled readers fail to spontaneously use rime-based analogies to identify unfamiliar words? Is it because they lack the phonological skills necessary for taking advantage of rime-unit analogies, such as onset-rime segmentation ability? Is it because they tend to rely instead on ineffective or inappropriate strategies, such as partial letter-sound cues and contextual guessing even though they may already possess requisite phonological knowledge? Or is it because these readers lack sufficient metacognitve awareness to make effective use of rime unit analogies when identifying unfamiliar words?

Given that there may be important advantages for disabled readers in initially linking print and speech at the level of onsets and rimes, a related set of questions is this: Can procedures be developed to help disabled readers make use of rime spelling units and if so, do the positive effects of such training generalize to other reading skills and materials? More specifically, would some combination of skills training and metacognitive strategy training in the use of rime spelling units (to encourage

orthographic analogy processes) provide the basis for an effective intervention programme for students with reading disability?

The Research Questions

(1) What level of phonological processing ability do older disabled readers possess compared to younger normally developing readers of the same reading level?

(2) To what extent can a programme involving both skills training and metacognitive strategy training in the use of rime-based orthographic analogies, encourage disabled readers to become more strategic decoders?

CHAPTER 3

RESOURCE TEACHERS OF READING

Introduction

Although there are a variety of school-based initiatives in place in New Zealand primary schools that cater for students with various learning difficulties, there are only two nationally-based and Ministry of Education (i.e., government) funded programmes catering specifically for students with severe reading difficulties. These two programmes are Reading Recovery and the Resource Teacher of Reading network. While the current research is concerned with students and teachers involved in the Resource Teacher of Reading (RTR) programme, the early intervention Reading Recovery programme will also be briefly discussed. This is because a significant number of students enter the RTR programme even though they may have already completed a Reading Recovery programme at some earlier time. Students enrolled in RTR programmes are generally older than those in Reading Recovery programmes because the RTR service is designed to cater specifically for "third wave" readers. These readers are students who have failed to respond adequately to both the first level or "first wave" of classroom reading instruction and to a "second wave" of instruction such as Reading Recovery.

Reading Recovery

Reading Recovery (RR) is an internationally recognised early reading intervention programme which according to Clay (1992) is designed to give students who have not made a successful transition into literacy learning, a second chance to become successful readers and writers. Reading Recovery is an intensive individualised literacy programme

for students who have failed to respond adequately to the "first wave" of reading instruction; that is, the reading instruction offered within the regular class programme during the first twelve months of schooling. In New Zealand therefore, the majority of students entering the RR programme are aged between 6 years and 6 years, 6 months. Reading Recovery teachers, who are usually also regular full-time junior class (i.e., years 1 and 2) teachers in their respective schools, are trained over a 12 month period by university-trained RR tutors. As well as teaching up to four RR students daily, the RR teachers also meet with their tutor and training colleagues on a regular (usually fortnightly) basis to observe colleague demonstration lessons and to discuss matters of concern to RR methodology.

Reading Recovery Programme Entry Criteria

Entry into the RR programme is based on the student's performance on a series of specifically designed tests known as the "Observation Survey". There are six separate components to the "Observation Survey". These include;

- a record of book reading level
- a letter identification task
- a Concepts about Print task
- the Burt Word Test or the Ready to Read Word List
- a test of writing vocabulary
- a dictation (sentence) writing task

The Reading Recovery Lesson Format

A typical RR lesson includes each of the following components, and usually in this order.

- The student re-reads one or more familiar (i.e., easy) books.
- The student reads an instructional-level text during which the teacher takes a running record, which is an observational recording of the student's oral reading responses.

- A letter identification task using plastic letters.
- The student writes a simple sentence which the teacher dictates. The teacher also prints this sentence on a card and cuts it up.
- The student re-assembles the cut-up sentence.
- The teacher introduces a new instructional level text.
- The student attempts the first reading of the new instructional text.

The Reading Recovery Students

The RR programme is designed to cater for those particular students who are deemed to be "most in need" of extra reading assistance after one year of schooling. Clay and Tuck (1991) note for example that entry to the RR programme is based only on being one of the group with the lowest achievement for their school. Although there is no strict limit to the amount of time a student stays in a particular RR programme, the recommended average duration is between 12 and 20 weeks. Reading Recovery may be summarised as a programme that includes the following:

- a relatively long training course for the teachers (i.e., one year)
- has a strict age criteria for entry (e.g., 6 years to 6.6 years)
- has a specifically designed set of entry and exit test measures
- has a regularised set of intervention procedures and includes regular (usually daily) intensive one-to-one tutor sessions.

The RR teachers are usually also regular full-time junior class teachers who are released daily from their classes to take individual students for Reading Recovery lessons in their own schools (see Iverson and Tunmer 1993, for a more detailed description of Reading Recovery).

Resource Teachers of Reading (RTRs)

While the Resource Teacher of Reading (RTR) programme, which is the focus of the current study, has some similarities to Reading Recovery (RR) there are nevertheless a number of important differences. Some of these will now be discussed.

National Distribution of Resource Teachers of Reading

Currently there are 68 full-time RTR positions nationwide in New Zealand, but unlike RR, the RTR positions are clustered within the cities and larger towns only. This means that there are many smaller areas that do not have access to RTR services. Indeed, even within the larger centres, there are schools that are unable to access the RTR service because there are not enough of these specialists to service every school in the area. The RTR network is therefore much smaller than RR which operates in 73% of all primary schools (Dewar, 1995). While both RR teachers and RTRs are based in regular primary schools, the RTRs travel between a group of schools teaching individual students on a regular (usually daily) basis. Table 1 presents data on the RTR distribution in New Zealand in 1994.

Table 1
National Distribution of Resource Teachers of Reading in New Zealand in 1994 [a]

Ministry of Education District	Number of RTR positions	Percentage of total positions
Northland	1	1.5
Auckland	16	23.5
Waikato	4	5.9
Bay of Plenty	7	10.3
Central West	9	13.2
Central East	6	8.8
Central South	7	10.3
Marlborough/Nelson/Westland	4	5.9
Canterbury	7	10.3
Otago	4	5.9
Southland	3	4.4
Total	68	100.0

[a] Dewar, 1995, p.34.

Training of Resource Teachers of Reading

Resource Teachers of Reading are full-time reading specialists who (unlike RR teachers) do not also teach regular class programmes. Resource Teachers of Reading are fully trained and certificated primary school teachers who specialise in teaching "third wave" readers. Table 2 illustrates the three "waves" of reading according to age and class level.

Table 2

Beginning Reading Cohort Subdivided According to Instructional Input

	Class Level					
Cohort subdivisions	1 (5 years)	2 (6 years)	3 (7 years)	4 (8 years)	5 (9 years)	6 (10 years+)
First Wave (100%)	Regular class reading programme ---------->					
Second Wave (25%)		(RR)				
Third Wave (2%)			RTR/RAT ---------->			

Note. RR= Reading Recovery

RTR= Resource Teacher of Reading

RAT= Reading Assistance Teacher

All students receive "first wave" reading instruction during their first year of schooling. A further 25% of second year students require the "second wave" of Reading Recovery instruction (Dewar, 1995). A small number (2%) of students who fail to respond adequately to the "second wave" of instruction enter a "third wave" programme such as the RTR/RAT network.

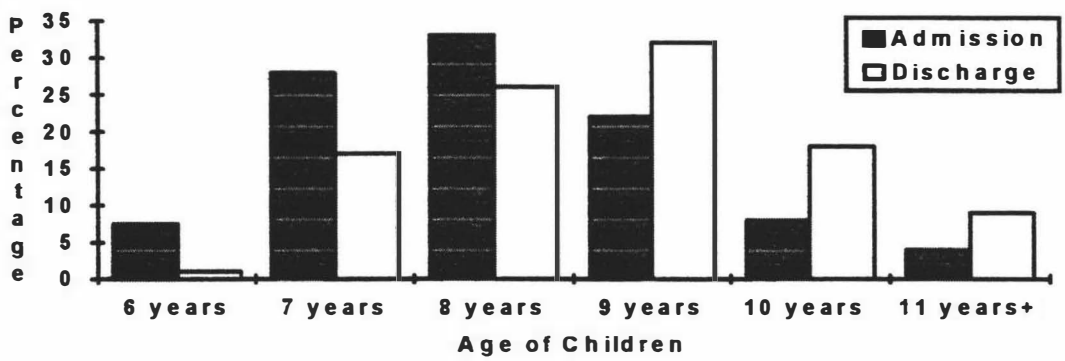
While most RTRs have completed the RR training at some time, and many have also undertaken various studies at university, no specific long-term training programmes are available to this group of remedial reading specialists. Most of the RTRs however, attend an annual professional RTR conference, and local groups of RTRs also meet regularly (usually 3-4 times per year) to discuss issues of common concern and to share teaching experiences and resources.

Resource Teacher of Reading Students

While there are a small number of students who are admitted to some RTR programmes who are only 6 years old (i.e., year 2) the majority of students admitted are 7 years of age and older. Figure 2 presents information on the ages of students that were admitted to (and discharged from) RTR programmes during 1994.

Figure 2

Age of Discharged Children at Time of Admission to (and Discharge From) RTR Programmes in 1994 [a]



[a] Dewar, 1995, p.38.

Frequently, the RTR rolls also include large numbers of students who may have completed (or have been exposed to) a RR programme at some earlier time in their schooling. Table 3 presents information on the number of students who were taught by RTRs in 1994 and includes a sub-total of students who had also participated in a RR programme. In 1994, this particular sub-total of "Ex Reading Recovery" students accounted for more than half (51.6%) of the total number of all RTR enrolments (Dewar, 1995).

Table 3

Reading Recovery Information on Children Admitted to RTR Programmes in 1994 [a]

Reading Recovery Information	N	%
Children who had not received a Reading Recovery Programme	502	48.4
Children referred on from Reading Recovery	160	15.4
Children discontinued from Reading Recovery	299	28.8
Children who had received a complete Reading Recovery programme	32	3.1
Children for whom there was no Reading Recovery information available/outcome unknown	44	4.2
Total number of children	1,037	100.0

[a] Dewar, 1995, p.36.

Some of these "ex Reading Recovery" students included a small group of "referred-on" pupils for whom the RR programme was not sufficient. These students were referred on to other specialists (including RTRs) for more remedial tuition.

Resource Teacher of Reading Pupil Selection Criteria

The criteria and method of selection of students for the RTR programme are also considerably different from that used by Reading Recovery. Because there is no formal test battery (e.g., Observation Survey) available for RTRs to use, entry criteria tend to be more subjective and based on a variety of diagnostic procedures specific to each RTR. Referral procedures usually begin with the class teacher requesting the RTR carry out a reading assessment of a particular student that may be causing concern. Most RTRs use a combination of test measures including a word test (e.g., Burt Word Test), an analysis of writing behaviour, a spelling test and an analysis of current instructional reading behaviour (i.e., a current running record of oral reading behaviour). However, while there is no formalised pre-entry reading test battery available to RTRs, the students

admitted to the RTR programmes tend to be reading at levels substantially below their chronological age. Table 4 shows for example, that for the older poor readers aged 8 years and over, more than 50% of each age cohort entered the RTR programme in 1994 with reading levels at least 18 months below their chronological age. For the oldest groups (aged 9 years and older) this reading level/age deficit was over 2 years for more than 50% of these cohorts.

Table 4

Reading Levels and Ages of Discharged Pupils at Admittance to RTR Programmes in 1994 [a]

Levels	Age											
Reading Recovery Book Levels	Reading Age Levels	6 years		7 years		8 years		9 years		10 years		11+ years	
		N	%	N	%	N	%	N	%	N	%	N	%
11 and less	Up to 6 years	61	85.9	179	68.3	90	31.8	33	15.7	7	7.9	4	8.3
12 to 18	6 to 7 years	10	14.1	77	29.4	144	50.9	88	41.9	36	40.4	11	22.9
19 to 22	7 to 8 years	-	-	6	2.3	46	16.3	72	34.3	28	31.5	6	12.5
-	8 to 9 years	-	-	-	-	3	1.1	17	8.1	16	18.0	12	25.0
	9+ years	-	-	-	-	-	-	-	-	2	2.2	15	31.3
Totals		71	100	262	100	283	100	210	100	89	100	48	100

[a] Dewar, 1995, p.39.

The students who have been referred on from Reading Recovery (which often include many of the RTR students) are frequently regarded as "the hardest to teach" group of students in the New Zealand reading education system (Clay & Tuck, 1991). This is because these pupils have already failed to respond adequately to the previous reading instructional programmes available in their schools (i.e., the "first two waves" of reading instruction).

The Resource Teacher of Reading Management Committee

Responsibility for acceptance into an individual RTR's programme rests with a local RTR Management Committee. This committee comprises the local Reading Advisor for the area, a representative from the local Ministry of Education Special Education branch (usually an educational psychologist), the RTR's base school principal, a principal from another school in the RTR's catchment area, and the RTR.

Pupil selection meetings are held two or three times each year and at each meeting new pupils are enrolled and successful pupils are discharged. Decisions on enrolments and discharged pupils are made in consultation with the RTR and the main basis for the decisions are made in accordance with the RTR's written report on each pupil. While students are admitted into and discharged from RTR programmes at these Management Committee meetings, it is not uncommon for a student to remain on an RTR programme for up to one year.

Resource Teacher of Reading Programme Format

Because there are no national training programmes for RTRs, this reading service operates in a more flexible manner than does the RR programme. Many RTRs have also undergone the RR training at some time in their teaching careers, and elements of their lessons often reflect RR methods. However, the RTR lesson format is generally more varied than that offered through RR because RTRs are not bound by the restrictions of one particular (e.g., Reading Recovery) methodology. It is also more varied than RR because older disabled readers tend to have learning needs that are different from those of a 6 year-old and therefore the teaching programmes should (and do) reflect these differences. Reading Recovery lessons involve seven specific teaching activities (see previous discussion) whereas RTR lessons reflect very diverse methodologies. However, there are nevertheless, a number of core constants (e.g., common elements) that every RTR would normally include in their lessons on a regular basis. As Table 5 illustrates, these core constants include lesson durations of 30-40 minutes daily, opportunities for

student reading of both instructional and independent texts and regular teacher observations and evaluations (i.e., running records) of student's oral reading. Additional activities that encourage the development of literacy-related skills are also usually included.

Table 5

Summary of a Typical RTR Lesson Format

I Core Constants		
Lessons	Student Reading	Observation-Evaluation
• 30-40 Minutes duration	• Familiar (easy) reading	
• 4-5 lessons/week	• Instructional reading	• Running Records
II Additional Teaching Activities		
Skill Domain	Related Activities	
Comprehension	Written questions, worksheets, reciprocal questions, sequence cards, cloze activities	
Reading	Reading student's own published stories, teacher reading to student, teacher reading with student, play reading, impress reading	
Spelling	Isolated word lists, sounds and blends	
Writing	Reciprocal writing, diary and story writing	
Language Games	Work with plastic letters, flashcard (word) games	

While the RTR network is much smaller than RR in terms of total numbers of teachers and although there are no national training courses for RTRs, Clay and Tuck (1991) conceded that RTRs were the most appropriate specialists qualified to teach the referred on pupils (e.g., the pupils who had not been successful in RR). When discussing alternative additional instructional options for these particular students Clay and Tuck

(1991) noted that "one kind of change over time that is entirely appropriate occurs in the services provided by Resource Teachers of Reading" (p.38).

The reasons that the authors regarded the RTR programmes as being appropriate for the referred on RR students were that, the students were able to continue receiving individual reading tuition, RTRs were still able to provide guidance to the student's class teacher and RTRs were able to monitor the student's reading/writing progress in the student's regular class setting. None of the other follow-on programmes discussed in the Clay and Tuck (1991) study offered these options for the students who had failed to respond adequately to Reading Recovery.

Reading Assistance Teachers (RAT's)

Reading Assistance Teachers (RATs) like RTRs, are fully qualified primary school teachers who work in co-operation with designated RTRs. This group of reading specialists also teach students on a one-to-one basis and the students for the RAT programmes are selected by the respective RTR Management Committees (see previous discussion) based on the same criteria as that used for RTR pupil selections. Because each RAT operates under the supervision of a "parent" RTR, the general lesson format is the same as that for RTRs. In the current research project, a group of 57 students enrolled on RTR/RAT reading programmes in 1994 were the focus of the investigation.

Summary

For many students who fail to respond adequately to the "first wave" of reading instruction in New Zealand primary schools, the early intervention Reading Recovery programme offers them a second opportunity to learn. This second chance is known as the "second wave" of reading instruction. Older students who continue to have difficulties learning to read (including some who fail to respond adequately to Reading Recovery) may enter a "third wave" of reading instruction. A nationally recognized "third wave" reading intervention in New Zealand primary schools is the Resource Teacher of Reading programme. Students may enter this "third wave" reading programme at any stage in their primary schooling after the age of 6.6 years. The

Resource Teacher of Reading programme therefore caters for students who are older than those who enter the Reading Recovery programme. Students who are enrolled into Resource Teacher of Reading programmes are also often frequently referred to as "the hardest to teach" students in the reading field (Clay & Tuck, 1991). This is because they have failed to respond adequately to the first "two waves" of reading instruction offered within the school. Many of these students have also developed negative self-concepts as a result of long term and continued literacy-related failure in school.

CHAPTER 4

EXPERIMENT 1 THE READING AGE MATCH

Introduction

While both normal and disabled readers depend on spelling-to-sound correspondence knowledge for word recognition, a major difference between these two groups of readers lies in the level of efficiency with which each group constructs, accesses and learns these correspondences. One method of comparing how disabled and normal readers operate when they are given the same reading-related tasks to perform is to employ a reading age match design study in which the disabled older readers are matched (for reading ability) with a younger group of normally developing readers. Goswami and Bryant (1990) note that the strength of this particular research design is that "if poor readers prove to be worse than their reading-level controls on phonological tasks for example, one cannot easily dismiss the difference as the possible product of a difference in reading level because there is no difference" (p. 83). Any performance differences in reading age match studies must therefore by definition, be attributed to variables other than differences in reading ability. Rack et al. (1992) further note that the advantage in using the reading age match design rather than a mental age match, is because the reading age match design can "begin to untangle questions about causality" (p. 32).

A reading age match study was undertaken to compare phonological processing and reading performances of two groups of students in the New Zealand education system. One group included 57 reading disabled older students who were concurrently enrolled on Resource Teacher of Reading programmes in 1994. The second (reading age match) group included an equal number of younger normally developing Year 2 readers who were reading at the same level as the disabled readers.

The reading age match study was used to test the hypothesis that children who are enrolled on the national Resource Teacher of Reading programmes have inefficient phonological processing skills and that these inefficient skills are due to a specific phonological deficit rather than to a general developmental delay in word processing abilities.

Method

Sample

The sample for the first experiment comprised 114 students: 57 disabled readers (39 boys and 18 girls) and 57 normally developing younger readers (28 boys and 29 girls). The students were selected from 36 primary schools in two central North Island (New Zealand) regions. All the students in both the samples were native speakers of English. No student who was receiving additional special educational assistance in his/her school, or was known to have a hearing, visual, language or intellectual handicap was included in the study. The 57 disabled readers ranged in age from 7.2 years to 10.9 years and were in Years 3 to 6 classes. Many students in this sample had also either participated in a Reading Recovery programme at some earlier point in their schooling, or had received some form of additional one-to-one or small group assistance with reading within their school. The poor readers in this study who, as noted earlier, are referred to as "third wave" readers in New Zealand, were selected for specialist reading assistance in the local Resource Teacher of Reading (RTR) programmes during the second term of the 1994 school year.

Selection of the Target Group

Students selected for the RTR programmes normally comprise the lowest 1-2% of a given cohort of beginning readers. A second criterion for the selection of the poor readers for the current research was that their respective RTRs were satisfied that their particular pupils did in fact have sufficient letter and word knowledge (i.e., alphabet knowledge and basic sight word knowledge) for them to be able to cope reasonably adequately with the requirements of the tasks in the analogy training intervention programme for the second experiment.

Design

Experiment 1 employed a reading age match design in which 57 young normally developing readers were matched for reading ability with the 57 disabled readers. The 57 disabled readers were exactly matched on context free word recognition ability (as measured by the Burt Word Reading Test, New Zealand Revision; Gilmore, Croft & Reid, 1981). The matchings were done on a pairwise basis with students selected from a larger pool of normally developing younger readers. The younger (i.e., Year 2) students were administered the Burt Word Test after the 57 disabled readers had completed their tests and the first student to obtain a score identical to one of the disabled readers was selected. This process was repeated until all 57 disabled readers had a matched younger reader. The Burt Word Test scores also resulted in a very close match on accuracy of recognizing words in connected text, as measured by the Neale Analysis of Reading Ability (Revised) Accuracy Subtest (Neale, 1988). The mean chronological age and mean reading ages of the two groups in the reading age match are presented in Table 6.

Table 6

Mean Reading Ages and Chronological Age of Disabled Readers and Reading Age Controls

Group	n	Burt Reading Age (years)		Neale Reading Age (years)		Chronological Age (years)	
		M	SD	M	SD	M	SD
Disabled Readers	57	6.35	0.56	6.13	0.57	8.52	1.02
Reading Age Controls	57	6.35	0.56	6.21	0.54	6.6	0.42

These means indicate that the younger students were average to slightly below average readers for their age. Bowey et al. (1992) drew attention to the risk of regression effects in reading-level match designs when the younger normal readers are selected from the upper end of the reading distribution of younger readers. Although no intelligence tests were administered to the students, Form M of the Peabody Picture Vocabulary Test Revised (Dunn & Dunn, 1981) was used to measure general verbal ability. The mean standard score on the PPVT for the reading-disabled students was 79.5 compared with 90.6 for the younger normal readers. However, Backman et al. (1984) do not recommend matching normal and poor readers on intelligence in reading level match designs (see also Bowey et al. 1992).

Tests

Eight tests were administered to all students: the Burt Word Reading Test, the Neale Analysis of Reading Ability (Accuracy Subtest), the Peabody Picture Vocabulary Test (PPVT), a Sound Matching Task, a Phoneme Segmentation Task, a Pseudoword

Reading Task, a Reading Words with Common Rime Units Task and a Rime Spelling Unit Identification Task.

Burt Word Reading Test.

The Burt Word Reading Test, New Zealand Revision (Gilmore et al. 1981) provided a measure of context free word recognition ability. The students were presented with a list of words of increasing difficulty and asked to look at each word carefully and to say it aloud. Testing continued until 10 successive words were read incorrectly or not attempted. Scoring was based on the number of words read correctly.

Neale Analysis of Reading Ability

The accuracy subtest of the Neale Analysis of Reading Ability, Revised (Neale, 1988) provided a measure of accuracy of recognising words in connected text. The students were asked to read aloud a series of short passages that were graded in difficulty. Standardised scoring and procedures were used to derive an age-related measure of reading accuracy.

Peabody Picture Vocabulary Test

The revised Form M of the PPVT (Dunn and Dunn, 1981) was used to provide an estimate of each student's general verbal ability by measuring receptive vocabulary. The student was asked to choose which one of four pictures corresponded to a test word spoken aloud by the experimenter. Standardised scoring procedures were used.

Sound Matching Task.

This task was used to assess onset-rime segmentation ability. It was an adaptation of a task developed by Bryant, Bradley, Maclean and Crossland (1989) and

comprises two parts, a rime matching task and an onset matching task (see Appendix A). In the rime matching task, the student was asked to indicate which two of three orally presented words "sounded the same at the end" (e.g., sail, nail, boot). Two practice items with corrective feedback were included, and throughout the test, picture support was provided to reduce the load on working memory.

In the onset matching task, the student was asked to indicate which two of three orally presented words "sounded the same at the beginning" (e.g., hair, pin, pig). Practice items and picture support were also provided in this task at the beginning to familiarise each student with the requirements of the task. Scoring was based on the number of correct responses to the rime matching task (9 items) and to the onset matching task (also 9 items) giving a total possible score of 18 for the sound matching task.

Phoneme Segmentation Task

A modified version of a test developed by Tunmer, Herriman and Nesdale (1988) was used to measure phonemic segmentation ability (see Appendix B). The students were required to use counters to represent the sounds in orally presented pseudowords of varying length. The task was presented in the form of a game in which the students were asked to identify the sounds in "funny sounding names of children who live in faraway lands". One demonstration item was given, followed by four practice items with corrective feedback. The test items were then presented with no corrective feedback. There were 24 test items altogether in this test: 4 single-phoneme sounds (short vowels), 8 two-phoneme syllables (4 VC syllables and 4 CV syllables; the latter were transposed versions of the former), 8 three-phoneme syllables (4 CVC syllables that were constructed by adding a different consonant to the beginning of each of the 4 VC syllables, and 4 CVC syllables that were constructed by adding the same consonants to the ends of the 4 CV syllables), and 4 four-phoneme syllables (2 CCVC syllables and 2 CVCC syllables). The items were randomly ordered and scoring was based on the number of items correctly segmented, giving a total possible score of 24.

Pseudoword Reading Task

Thirty monosyllabic pseudowords from Section 3 of the Decoding Skills Test (Richardson & Di Benedetto, 1985) were used to measure knowledge of letter-sound patterns (see Appendix C). The pseudowords were presented in order of increasing difficulty, ranging from simple consonant-vowel-consonant patterns (e.g., jit, med, dut) to blends, digraphs and vowel variations (e.g., prew, thrain, fruice).

The original instructions for the test were piloted with a separate sample of students who were told that the items were not real words and had no meaning but could be pronounced like real words. However, many of the students were initially rather resistant to reading "words" that had no meaning. The reason for this resistance may be due to the heavy emphasis that is placed on the construction of meaning within their class reading programme. The instructions to the pseudoword reading test were therefore modified as follows: "Today I'm going to show you some funny sounding names. They are the names of children who live in a faraway land. Let's pretend that we are going to visit these children and learn to say their names the way they do. You can read their names only if you sound them out. Remember, not to try to make them into real words. Let's try this one". Two practice items with corrective feedback were given, followed by the 30 test items with no corrective feedback. When the student incorrectly pronounced an item, the mispronunciation was recorded using the pronunciation key provided by Richardson and Di Benedetto (1985).

The items were scored in two ways: first, according to the total number of items pronounced correctly, and second, according to the total number of sounds that were correctly pronounced in each item, provided the sounds in each item were blended into a single syllable. For example, if jit was correctly pronounced, three points were given (one for each sound). However, if jit was pronounced jat or jid, only two points were given (one for each sound that was correctly identified). Likewise, if jit was pronounced jad, only one point was given. The maximum number of points in this task was 101.

Reading Words With Common Rime Units Task

This test was devised to measure the students' ability to take advantage of orthographic analogies when reading words containing common rime spelling units (see Appendix D). As noted previously, Lovett et al. (1990) found that dyslexic students do not spontaneously use rime-based orthographic analogies to identify unfamiliar words. Because the purpose of this task was to assess spontaneous analogy use, the students were not explicitly given a "clue" word first, nor were they told to use the strategy of reading unfamiliar words by detecting and pronouncing known words and word parts in the unfamiliar words. Rather, the students were simply asked to read the 72 monosyllabic words that were presented in 18 rows of 4 words each.

The 72 words comprised 18 groups of words, each of which contained a common rime spelling unit (e.g., at as in cat, hat, bat, fat). The words were presented in two forms. In Form I the words of half the groups were presented contiguously in 9 rows (e.g., tail, mail, sail, jail) whereas the other groups of words were presented noncontiguously throughout the remaining 9 rows such that no two words containing the common rime spelling unit appeared in the noncontiguous row (e.g., bank, side, may, meat). The 9 rows of contiguously presented words and 9 rows of noncontiguously presented words appeared alternately in the list of test items. In the second form (Form 2) of the test, the words that were presented contiguously in Form 1 were presented noncontiguously in Form 2, and the words that were presented noncontiguously in Form 1 were presented contiguously in Form 2. The two forms were rotated across the students.

To increase the likelihood that students would have a base word available from which they could make a rime-based analogy, the first word in each of the rows containing contiguously presented words was selected from the New Zealand Basic Word List (Elley, Croft, & Cowie, 1977). This is a list of the 300 most frequently-occurring words in the 195 most widely used beginning reading books in New Zealand schools. Example words selected include cat, sit, make, eat, will, and day. The remaining

words in each row were chosen to vary widely in frequency of occurrence in order to increase the likelihood that at least some of the words would not be immediately recognised by the students. Two word frequency counts were used in selecting the stimuli (Carroll, Davies, & Richman, 1971; Elley & Croft, 1989). Most of the words were chosen from Elley and Croft's (1989) norms, as this particular word count is regarded by Elley and Croft as more appropriate for use in New Zealand. Scoring was based on the number of words read correctly in the two presentation conditions (i.e., contiguous vs. noncontiguous).

Rime Spelling Unit Identification Task

In this task the students were asked to identify rime spelling units in words that were read aloud by the experimenter (see Appendix E). Each of 10 rime spelling units appeared twice in a list of 20 words, once as the final segment of the word (e.g., tr-ick) and once embedded within the word (e.g., t-ick-et). Five of the rime spelling units contained one each of the five short vowel sounds. For example, the five short vowel sounds were represented in the following rime units ack, est, ick, ot and ug. The remaining five rime spelling units contained one each of the long vowel sounds: ake, eat, ight, oke, and uit.The twenty words were arranged in quasi-random order such that, for each pair of words containing a given rime spelling unit, one word appeared in the first half of the list and the other word of the pair appeared in the second half of the list. The reason for this was to ensure that no two identical rime units appeared consecutively on the list thus encouraging an analogy effect. Also, half of the embedded rime units appeared in the first half of the list and half appeared in the second section.

After the student was presented with the list of words, the experimenter read aloud the first practice item and asked the student to draw a circle around the targeted rime spelling unit. For example, the experimenter read aloud the practice word plan and then asked the student to "circle the part that says an". The second practice item involved locating the targeted rime spelling unit that appeared in an embedded position (e.g., v-ill-age). Corrective feedback was provided for the two practice items but no

corrective feedback was given during the presentation of the 20 test items. Scores were recorded for the number of rime spelling units correctly identified in the two conditions (i.e., rime unit at the end of the word vs rime unit embedded within the word).

Procedure

The study, including the reading age match, was carried out during the middle term of a three-term school year in 1994. The 57 disabled readers were first pretested on all test measures discussed earlier. Each student was tested individually in a quiet withdrawal space in their respective school. The disabled readers were tested in the first two weeks of the middle school term (i.e., late May and early June). The students were administered the three standardized test measures (i.e., Burt Word Test, Neale Reading Test and the PPVT) followed by the five phonological processing measures. The total testing time for each student was approximate 50 minutes but on occasions, the time was extended over more than one sesssion.

The 57 young normal readers were tested after the disabled readers had been allocated to their respective intervention groups. When a young reader with an identical Burt Word Test score to a disabled reader was found, he/she was then administered the remaining test measures that had been previously given to the disabled readers. Table 7 presents the timeframe for the complete study and includes the test-points for each group.

Table 7

Summary Plan of the Research Showing Timeframe for Tests, Testpoints and the Analogy Training Intervention.

Test Measures	Experiment 1		Experiment 2						
	Pretests (May/June 1994)		Training Intervention (May to August 1994)	Posttests (Aug 1994)			Follow-up Tests (June 1995)	
	Disabled Readers (n = 57	Reading Age Controls (n = 57)		Rime Spelling (n = 18)	Item-Specific (n =18)	Standard Intervention (n = 21)	Disabled Readers (n = 52)	Reading Age Controls (n = 20)
Burt	✓	✓		✓	✓	✓	✓	✓
Neale	✓	✓		✓	✓	✓	✓	✓
PPVT	✓	✓		–	–	–	–	–
Sound Matching	✓	✓		✓	✓	✓	–	–
Phoneme Segmentation	✓	✓		✓	✓	✓	✓	✓
Pseudoword Reading	✓	✓		✓	✓	✓	✓	✓
Words/Common Rime Units	✓	✓		✓	✓	✓	✓	✓
Rime Unit Identification	✓	✓		✓	✓	✓	✓	✓

Results and Discussion

As expected, there were no significant differences on the standardised reading measures on which the students in the two groups were matched (i.e., the Burt Word Test and the Neale Reading test). Recall that the original reading level matchings were based initially on the Burt Word Test (raw scores). Each disabled reader's Burt Word Test score was matched exactly with a Burt score for each of the young normal readers to obtain the reading level matchings. However, the Neale mean reading age scores for both groups also matched very closely (refer Table 6) illustrating a relationship between isolated word reading ability and general context reading ability for these particular groups of students.

The older disabled readers performed better than the younger normal readers on the receptive vocabulary test (i.e., PPVT raw score). Although the mean standard score on the PPVT for the reading level controls was higher than that of the disabled readers (90.6 vs 70.5, see previous discussion) it would be expected that the older students would have a higher absolute receptive vocabulary than the younger students. On all other measures however, the disabled readers performed significantly less well than the normally developing reading age controls. The tests of differences between the means of the disabled readers and the reading controls on all the pretest measures are presented in Table 8.

Table 8

Tests of Differences Between Means of Disabled Readers and Reading Age Controls on all Measures

Variable	Maximum Score	Disabled Readers (n = 57) M	SD	Reading Age Controls (n = 57) M	SD	t (112)
Burt Raw Score	110	23.24	6.74	23.24	6.74	0.00
Neale Raw Score	100	14.35	6.68	15.29	6.25	0.78
PPVT Raw Score	175	77.88	11.16	69.70	11.39	3.87***
Sound Matching Total Score	18	14.00	2.55	15.28	2.20	2.87**
Onset Matching Subtest	9	7.53	1.56	8.12	1.23	2.27*
Rime Matching Subtest	9	6.47	1.55	7.16	1.41	2.47**
Phoneme Segmentation	24	10.63	4.35	13.46	4.70	3.33***
Pseudoword Reading Total Words	30	2.54	3.34	4.23	3.87	2.49**
Pseudoword Reading Total Points	101	44.93	16.11	56.98	16.99	3.89***
Words With Common Rime Units, Total Score	72	29.68	16.52	37.38	18.40	2.35*
Contiguous Presentation	36	17.09	9.80	20.26	9.93	1.72*
Noncontiguous Presentation	36	12.59	7.51	17.21	9.15	2.94**
Rime Unit Identification Total Score	20	8.63	3.24	11.05	3.33	3.94***
Not Embedded	10	6.34	2.21	7.45	2.09	2.87**
Embedded	10	2.28	1.69	3.61	2.23	3.60***

Note PPVT = Peabody Picture Vocabulary Test.

* $p < .05$ ** $p < .01$ *** $p < .001$

Particularly robust differences were obtained on the measures of phoneme segmentation ability, pseudoword reading, identification of words with common rime spelling units and the rime spelling unit identification task. The poorer performance of the disabled readers on the phoneme segmentation and pseudoword reading tasks is consistent with the findings of other researchers (for reviews of research, see Adams & Bruck, 1993; Rack, Snowling & Olson, 1992). As noted earlier, because disabled readers do not make full use of sound-symbol correspondences in identifying words (relying instead on partial word-level strategies) there is less interaction between orthographic and phonological representations in semantic memory. As a consequence, the development of awareness of individual phonemes and knowledge of grapheme-phoneme correspondences is not promoted to the same extent as it is in normally developing readers.

In the pseudoword reading task the younger readers again outperformed the disabled readers on both the total words and total points (for sounds) scores. For the total words scores on the pseudoword reading task, the young normal readers' mean score of 4.23 was superior to that of the disabled readers (2.54). The young normal readers' pseudoword total points scores (i.e., 56.98 v 44.93) were also superior to the disabled readers. These results demonstrated that the young normal readers were already developing superior analytic word recognition strategies compared to those of the disabled readers. Even though by definition, the pseudowords were not real words, the phonological strategies required to identify them were no different from those strategies required to decode any orthographically regular but unfamiliar real words and therefore, the pseudoword decoding task represented a measure of phonological processing. The results of the pseudoword decoding task revealed that the disabled readers' phonological processing abilities were clearly inferior to those of the normal younger readers.

The normal readers also performed significantly better than the disabled readers when asked to read monosyllabic words containing common rime spelling units. This finding is consistent with the results of Lovett et al. (1990) who found that dyslexic students do not spontaneously use rime-based analogies. A 2 (Group: Normal Readers

vs Disabled Readers) x 2 (Presentation: Contiguous vs Noncontiguous) analysis of variance revealed significant main effects for Group, F (1,112) =5.61, $p < .05$, MSe = 154.18 and Presentation, F (1, 112) = 61.02, $p < .001$, MSe = 13.24. Regarding the latter effect, the students in both groups performed better when the words containing a common rime unit were presented contiguously rather than noncontiguously. This result is similar to Muter et al.'s (1994) finding (discussed previously) showing that beginning readers were better able to use analogies when the clue word was exposed than when it was not. The interaction between Group and Presentation condition was nonsignificant.

To investigate further the level at which poor readers seem less prepared than normal readers to make spontaneous use of rime-based analogies to identify unfamiliar words, an analysis of response patterns for the contiguously presented words with common rime units was undertaken. Recall that each of the two forms (Forms 1 and 2) of the words with common rime units task contained 9 rows of 4 words in which the rime units were presented contiguously. The 18 rime units and the 72 words (i.e., 36 from Form I and 36 from Form 2) are presented in Table 9.

Table 9
Words With Common Rime Units Contiguous Presentation Condition

Rime Unit	Words			
at	cat	hat	bat	fat
ack	back	sack	pack	tack
ell	well	fell	bell	yell
uck	truck	duck	luck	suck
an	can	fan	pan	van
ail	tail	mail	sail	jail
ake	make	lake	cake	rake
it	sit	hit	bit	fit
ight	right	tight	fight	light
op	stop	top	hop	pop
ill	will	fill	bill	kill
ump	jump	bump	lump	dump
ide	ride	side	hide	slide
ay	day	may	hay	pay
eat	eat	meat	heat	seat
ick	pick	kick	sick	lick
ot	not	hot	lot	cot
ank	thank	bank	tank	sank

When reading each group of 4 contiguously presented words, the student could have completed one of five possible scenarios, ranging from all words correct to all words incorrect. An error analysis was completed for the response patterns made by each student for the contiguously presented words with common rime units. Table 10 summarises the total percentage of responses made for each of the 5 possible response scenarios for both the disabled readers and the younger normal readers.

Table 10

Words With Common Rime Units Showing Mean Percentage of Total Responses Made for Each Response Scenario.

Response Scenario	Disabled Readers (n =57)	Reading Age Controls (n =57)
0	35.6%	29.1%
1	14.0%	11.1%
2	8.7%	7.6%
3	9.2%	10.2%
4	32.5%	42.0%

The results show that while the highest single response scenario for the disabled readers was one where none of the four contiguously presented words was correctly identified (i.e., 35.6%), the reverse was the case for the younger readers. For this group, the highest response scenario was where all four of the words were correctly identified. This result accounted for 42% of this group's responses. This result further suggests a possibility that the younger readers were more prepared to use the rime units to make analogies than was the case with the disabled readers.

When the 18 rime units (that formed the basis of the contiguously presented words) were analysed separately for error response patterns, the younger normal readers

were shown to equal or outperform the disabled readers on all but one of the units (e.g., eat). These results are summarised in Table 11.

Table 11

Words With Common Rime Units (Contiguous Presentation) Mean Scores for Each Unit and Each Group

Rime Unit	Disabled Readers (n =57)	Reading Age Controls (n =57)
at	3.2	3.4
ack	1.9	2.2
ell	0.7	1.2
uck	0.9	1.4
an	2.2	2.4
ail	0.7	0.7
ake	1.7	2.2
it	1.2	1.7
ight	0.9	1.2
op	3.1	3.5
ill	2.3	2.5
ump	2.2	3.0
ide	1.2	1.3
ay	3.0	3.4
eat	2.4	2.3
ick	1.7	2.1
ock	3.2	3.5
ank	1.0	1.5

Note. Maximum cell score = 4

These results suggest that the younger normal readers already possess superior knowledge of rime unit spelling patterns and/or superior ability to make spontaneous use of orthographic analogies to identify words. It is likely that both these abilities are present among the younger readers.

A further analysis of the error responses on all the words that contained three sounds (from the words with common rime units list) was also undertaken to investigate the level at which different cues were used. There were 56 words from the common rime units word lists that were made up of three sounds. These words are presented in Table 12.

Table 12

The 56 Words With Three Sounds From The Words With Common Rime Units Task.

cat	hat	bat	fat	will	fill
bill	kill	back	tack	sack	pack
ride	hide	side	pick	kick	sick
lick	well	fell	bell	yell	not
hot	lot	cot	top	hop	pop
duck	luck	suck	meat	heat	seat
can	fan	pan	van	tail	mail
sail	jail	make	lake	cake	rake
sit	hit	bit	fit	right	tight
fight	light				

To investigate the possibility that disabled readers' word identification skills are characterised by an over-reliance on boundary letter awareness (i.e., initial and/or final letters) an analysis was undertaken of the error response patterns for the 56 three-sound words from the words with common rime units lists. Both the disabled readers and the young normal readers' responses were compared. There were seven possible error response scenarios for each of the words according to the number of individual phonemes correctly identified in each word. If the first (initial) letter only was correctly identified for example, the response was coded as S_ _. Where the first two letters were correctly identified, the coding was SS _ . If none of the letters corresponded to the

target phonemes, this response was coded thus _ _ _ . Table 13 summarises the mean percentage of the total errors for each of the seven error response categories for both groups.

Table 13

Mean Percentage of Total Error Response Scenarios For The 56 Words With Three Sounds.

Cue Used	Disabled Readers (n =57)	Reading Age Controls (n =57)
S _ _	24.0%	18.4%
_ S _	0.4%	0.3%
_ _ S	2.4%	0.7%
S S _	5.8%	7.1%
S _ S	41.5%	45.2%
_ S S	4.3%	3.8%
_ _ _	21.6%	24.5%

The results indicate that the most common error response pattern for both groups, was the one that used the initial and final (**S _ S**) letters. For both groups, this response pattern accounted for more than 40% of the total error responses (41.5% for the disabled readers vs 45.2% for the young normal readers). This result suggests that initial/final letter use may well be the norm for normally developing beginning readers.

Another common error response pattern for both groups involved correctly identifying the initial letter only (**S _ _**). This result accounted for 24% of the errors for the disabled readers and 18.4% for the young readers. The third error response pattern which accounted for a significant number of the total errors included non-responding. This pattern accounted for 24.5% of the younger readers' responses and 21.6% for the

disabled readers. Final letter (_ _ S) and medial letter (_ S _) responses collectively accounted for less than 3% of the total errors for either group.

While an analysis of boundary letter responses revealed that both groups appeared to make approximately equal use of these cues when decoding unfamiliar words, a question that was further investigated in experiment 2 examined the extent to which disabled readers were able to be trained to take greater advantage of rime unit (_ S S) knowledge when decoding unfamiliar words.

The basis for orthographic analogies is enhanced as rime unit knowledge increases and the results of the words with common rime units task (refer Tables 10 and 11) suggest that rime unit knowledge appears to develop early in young normally developing readers but not as well in older disabled readers. A prediction that follows from the finding that disabled readers are less likely than normal readers to make use of analogies, is that disabled readers will have had fewer opportunities to derive implicit orthographic rime correspondence rules (i.e., "large-unit" rules) for commonly occurring rime spelling units. Consistent with this suggestion, the poor readers also performed significantly less well than the normal readers on the rime spelling unit identification task. The results of this task suggest a deficit in rime unit knowledge among disabled readers. Where the target unit formed the rime part of the word (i.e., not embedded) the disabled readers scored a mean of 6.34 correct responses versus 7.45 for the reading age controls (refer Table 8). However, when the target unit was embedded within the word (e.g., t-ick-et), the mean score for the disabled readers was only 2.28 correct responses versus 3.61 for the young normal readers. This result supports Ehri & Saltmarsh's (1995) findings that disabled readers found difficulty attending to the medial letters in words (see previous discussion).

Although the young normal readers significantly outperformed the older poor readers on the measure of onset-rime segmentation ability, both groups performed reasonably well on this particular task. These results were similar to the findings reported in Greaney (1992) where both disabled readers and younger normal readers scored almost equally on both rhyme and nursery rhyme knowledge and on a rhyme detection task when the tasks were presented orally. In the current research, the onset-

rime segmentation (sound matching) task was again presented as an oral task. The disabled readers averaged 14.0 items correct (from a maximum score of 18) and the normal readers averaged 15.28 items correct. This finding would appear to conflict with the suggestion by Lovett et al. (1990) that the failure of dyslexic students to make spontaneous use of analogies can be attributed to their inability to parse syllables into onsets and rimes. An alternative explanation is that dyslexic students do have sufficient onset-rime segmentation ability to read words by analogy but generally do not make use of this ability when attempting to read unfamiliar words, preferring to rely instead on ineffective word identification strategies. In support of this suggestion are the partial correlations (holding age and PPVT constant) between onset-rime segmentation ability (as measured by the total score on the sound matching task) and the Burt raw score, the Neale raw score, the reading words with common rime units task, and the rime spelling unit identification task. For the disabled readers, onset-rime segmentation ability did not correlate significantly with the Burt test, the Neale test, or the rime spelling unit identification task, and was only weakly correlated with the reading words with common rime units task ($r = .31$, $p < .05$). In contrast, the normally developing readers' scores showed highly significant correlations between onset-rime segmentation ability and the Burt test ($r = .50$, $p < .001$), the Neale test ($r = .47$, $p < .001$), the reading words with common rime units task ($r = .52$, $p < .001$) and the rime spelling unit identification task ($r = .43$, $p < .001$). On the basis of these findings it appears that the normally developing younger readers were able to make greater use of their onset-rime segmentation ability in acquiring basic word recognition skills than were the disabled readers.

Why Disabled Readers Do Not Use Rime Unit Analogies

The results from the reading age match study further support previous findings suggesting phonological processing deficits to be a possible causal link to poor reading progress among disabled readers. The 57 disabled readers in the reading age study were matched for reading ability with an equal number of younger normally developing readers. Both groups were given 3 standardized test measures and 5 phonological processing tasks.

The results showed that there were a number of significant performance differences in favour of the younger readers. The younger readers outperformed the disabled readers on all the phonological processing measures and an analysis of the word identification responses from the words with common rime units task further demonstrated the superior rime unit knowledge that this group had compared to the disabled readers.

While the disabled readers did possess sufficient onset-rime segmentation ability to read words by analogy (as indicated by the results from the sound matching task), they seldom made use of this ability when they encountered unfamiliar words. Rather, these particular readers tended to rely on ineffective or inappropriate strategies such as attending to only boundary letters and guessing, suggesting that disabled readers seem to have difficulty acquiring effective flexible strategies for word identification, and also difficulty maintaining metacognitive control over the decoding process.

This suggestion was confirmed with the results from the words with common rime units task, and in particular, from the contiguously presented subgroup of words that contained identical rime spelling units. Even though in many instances, the disabled readers were able to read at least one of these contiguously presented words, this was no guarantee that the remaining words in the group would be read correctly. In the word group consisting of night, tight, fight and light one reader read night correctly but the remaining three responses were try, frog and log. The only correct part in each of the three errors being the initial letters. This pattern of responding was typical for the disabled reader groups for this task. This result indicated that disabled readers'

knowledge of sight words lacked conscious phonological representations in lexical memory resulting in poor levels of metacognitive control over the decoding process. The disabled readers seemed unwilling or unable to use known word knowledge to assist them to decode unfamiliar yet similarly spelled words, even when the words were presented contiguously. It would be expected that such a presentation condition should have acted as a phonological priming effect enabling the reader to see the repeating pattern in the words.

Summary

Results from the reading age match study confirmed the finding that disabled readers were not as proficient as the reading age controls in the spontaneous use of rime spelling units. A consequence of this phonological weakness was that these disabled readers had acquired fewer orthographic rime correspondence rules. However, the results also suggested that even though the disabled readers had sufficient levels of onset-rime segmentation ability they still failed to make use of this knowledge when confonted with unfamiliar (yet similarly spelled) words.

It was suggested that, because disabled readers rely less on sound-symbol correspondences and more on partial word-level cues to identify unfamiliar words, there is less interaction between orthographic and phonological representations in semantic memory. As a consequence, the development of an awareness of individual phonemes and knowledge of grapheme-phoneme correspondences is not promoted to the same extent as it is in normally developing readers. Poor readers need to become more analytic in their word identification strategies if they are to acquire appropriate levels of phonemic awareness and phonological recoding ability, including the ability to use analogies. Furthermore, the development of these skills is dependent upon them having a metacognitive awareness of orthographic (word) knowledge.

The challenge arising from the results of the reading age study was to develop a training programme that encouraged disabled readers to become metacognitively aware

of the advantages of developing rime spelling unit knowledge. The development of such an awareness would also more likely encourage disabled readers to activate rime unit orthographic analogy processes in uninstructed reading situations. The second (rime analogy training) study addressed this issue.

CHAPTER 5

EXPERIMENT 2
THE RIME ANALOGY TRAINING STUDY

> "Reading disabled children are commonly and repeatedly found to benefit most when given a reading programme that directly emphasises word recognition skills, rather than more general reading strategies" (Adams & Bruck, 1993, p.131).

Introduction

Two suggested reasons are given by Lovett et al. (1994) as to why disabled readers do not use analogies when they read. One reason is that these students are unable to parse a syllable into the sub-syllabic units of onsets and rimes. The second explanation offered is that disabled readers have difficulty acquiring efficient and flexible word identification strategies and that they also lack metacognitive control over the decoding process.

The results of the reading age match study demonstrated that the disabled readers were in fact able to parse syllables into onsets and rimes reasonably well when given this task in an oral presentation condition. In the sound matching task finding both the disabled reader group and the younger normal readers scored well above chance on this measure. An inability to parse syllables into onsets an rimes is therefore not a reason supported by the reading age match study for the disabled readers' reluctance to use orthographic analogies on a spontaneous basis in reading.

The results from the remaining phonological processing tasks however, support Lovett et al's. (1994) second explanation suggesting that disabled readers lacked efficient and flexible word identification strategies. These readers also lacked metacognitve control over the decoding process as was evident in their responding patterns on such "phonologically primed" tasks as reading the words with common rime units. Even where the common rime units appeared in the contiguous presentation

condition (e.g., ball, hall, fall, wall), the disabled readers' attention was seldom alerted to the phonological priming effect that these repeated patterns would normally offer to a "metacognitively aware" normal reader.

The main aim of the rime analogy training study was to address the question as to what extent a programme involving both skills training and metacognitve strategy training in the use of rime-based orthographic analogies, could encourage disabled readers to become more strategic decoders.

A follow-up intervention study was carried out to determine whether a combination of skills training and metacognitive strategy training in the use of rime spelling units would produce positive effects that generalised to other reading skills and materials. If the word recognition skills of very poor readers are weak because of their continued use of compensatory strategies at the expense of phonological information, it may be necessary to provide them with more explicit instruction in the use of more effective learning strategies, such as the use of rime unit analogies. As noted earlier, the use of such an instructional strategy may be a very useful first step in making these students more aware of sublexical relationships between written and spoken words, and in helping them to overcome their tendency to focus on the boundary letters at the expense of medial word information. Learning to take advantage of rime-unit analogies may in turn, facilitate further progress in reading by helping students to isolate and recognise individual phonemes and also to acquire one-to-one correspondences between graphemes and phonemes within onsets and rimes.

Method

Sample and Design

The 57 disabled readers in Experiment 1 served as the sample for the second experiment. As discussed previously, these "third-wave" students had been selected by the school system for intensive individualised remedial reading instruction by specialist reading teachers known as Resource Teachers of Reading (RTRs) and Reading Assistance Teachers (RATs).

The 36 disabled readers that comprised the sample for the two training intervention groups (i.e., rime analogy and item-specific) were assigned to these groups on a random basis. Random assignment for each student occurred immediately following the completion of the pretests. The remaining 21 students that comprised the standard intervention group were assigned predominantly on the basis of geographical location. This was because these students were geographically more isolated and were therefore unable to be included in both the pre-study training trials and the intervention phase due to time and travel constraints. These 21 standard intervention students formed the non-intervention control group.

The two training groups (i.e., rime analogy and item-specific) received their training as part of the daily 30 minute lesson from their respective reading specialist (RTR/RAT). The standard intervention group received only their regular daily instruction given them by their respective reading specialist.

Recall that the standard RTR/RAT lesson format is somewhat similar to the standard Reading Recovery lesson in that it is an intensive daily one-to-one remedial reading programme taken in the student's own school during school time. However, the RTR/RAT lesson format is also more flexible than Reading Recovery (see Table 5) because there is no regular national training programme available for RTRs and hence, no specific lesson format or guidelines to follow (see previous discussion).

The students in the rime analogy training group received instruction that focussed on systematic strategy training in the recognition and use of rime spelling units as a means

of decoding unfamiliar words. The main aim of this strategy training process was to encourage the students to become more aware of the rime unit spelling patterns so that eventually, they would use this knowledge spontaneously during their reading, and particularly, when they encounter unfamiliar words.

The students in the item-specific training group received instruction that focussed on the identification of words using sentence-level strategies as the main emphasis. These sentence-level strategies included, reading to the end of the sentence, re-reading the sentence and thinking of a word that "might make sense". These particular strategies form the basis of the whole language teaching methodology and they are emphasised in both regular reading programmes and in many tutor programmes designed for remedial readers.

For both experimental interventions (e.g., rime analogy training and the item-specific/sentence emphasis intervention) possible main effects that may have been due to differences in such factors as teacher experience or teacher competence were controlled for by having each specialist (where possible) teach at least one student from each of the two intervention groups. Allocating pupils to teachers in this way ensured that each specialist was able to teach both forms of intervention. Therefore any differences in performance on the posttest measures at the conclusion of the strategy training intervention were less likely to be due to teacher effects.

Before any particular student was accepted for the training programme, his/her respective reading teacher had to be satisfied that he/she had sufficient phonological knowledge (i.e., basic vocabulary/sight word knowledge, letter-sound knowledge and alphabetic knowledge) to be able to cope adequately with the demands of the training tasks. Recall that all the reading specialists were trained in both the rime analogy and item-specific training procedures prior to the research programme. This training included trialing the procedures with earlier current RTR/RAT pupils so that the specialists were familiar with the procedures before the training intervention proper was undertaken. The specialists therefore knew before the pretests were taken, the demands required of their pupils to undertake the training interventions and indeed, the final samples used for the two modified interventions were based on the numbers of pupils

that each of the specialists considered were likely to be able to cope adequately with the training tasks.

The reading specialists were all certificated New Zealand primary school teachers with many years of general classroom teaching experience. Table 14 summarises the teaching experience of the reading specialists from all groups.

Table 14

One-Way ANOVA of Teaching Experience of Reading Specialists For all Three Comparison Groups

Variable	Modified Intervention, Rime Analogy Training Group (n = 18) M	SD	Modified Intervention, Item-Specific Training Group (n = 18) M	SD	Standard Intervention Group (n = 21) M	SD	F (df=2,54)
Teaching Experience of Remedial Teachers (years)	21.17	9.73	21.67	10.59	28.33	7.21	3.77*
Specialist Teaching Experience of Remedial Teachers (years)	5.06	3.65	5.28	3.92	6.52	4.11	0.81

Note. *p <.05

The only variable for which there were significant differences between the means was the amount of experience as a certificated teacher. The RTRs from the region in which the standard intervention group was predominately located had significantly more years of general classroom teaching experience than the RTRs for the two modified intervention groups. The standard intervention teachers had an average of 28.33 years of general teaching experience compared with just over 21 years for each of the training group teachers. This was not particularly significant in the context of the study, because

the years of experience as a reading specialist was likely to be of greater significance. However, there were no differences between the specialists from all three groups in years as a remedial reading specialist, with the two training groups averaging just over 5 years each and the standard intervention specialists averaging just over 6 years of specialist reading teaching.

Five of the eight RTRs and one RAT had, at some earlier time, completed a Reading Recovery training programme and a number of specialists from both groups (RTRs/RATs) had also completed a variety of graduate-level reading papers such as those offered at tertiary institutions during their general teaching careers. However, as was discussed earlier, there was no specific training available for RTRs/RATs.

Training Materials and Procedures

The Rime Analogy Training

For the rime analogy training group, systematic training in the use of rime spelling units to identify words was incorporated into the regular 30-minute lesson format of the RTRs/RATs. The intervention procedures built upon the earlier work reported in Iverson and Tunmer (1993) and Greaney and Tunmer (1996). Three assumptions guided the instructional approach used with the rime analogy training group. First, because there are simply too many grapheme-phoneme correspondences to learn through direct instruction (Gough and Hillinger, 1980) reading disabled students must become active problem solvers with regard to graphic information. Considerable emphasis must therefore be placed on developing within these students a set of self-improving strategies for acquiring spelling-sound relationships rather than on just teaching individual spelling patterns per se. As the reading attempts of the disabled readers become more successful, they should begin making greater independent use of letter-sound information to identify words. Additional spelling-sound relationships should also be induced without further explicit instruction.

Second, reading disabled students must learn to use their newly acquired word decoding strategies to identify unfamiliar words while reading connected text. In other words, although reading disabled students should receive explicit and systematic instruction in word recognition strategies outside the context of reading connected text, they must also be taught how and when to use these strategies during text reading, which includes developing a phonological set for diversity (see previous discussion).

Third, reading disabled students must be made aware that successful attempts at decoding unfamiliar words are a direct consequence of the appropriate and effortful application of taught skills and strategies. For a considerable period of time, disabled readers have been using ineffective learning strategies that may be very difficult to "unlearn". Moreover, as a consequence of repeated learning failures, many poor readers develop negative reading-related self-perceptions of their own abilities and therefore do not exert as much effort as other students because of their low expectations of success (Chapman and Tunmer, 1995a, 1995b). Emphasis must therefore be placed on making these students aware that they can achieve success by using more effective learning strategies.

The Twelve Training Cycles

There were twelve training cycles with each cycle being completed over 3-4 days as part of the RTR/RAT lesson. Each daily lesson training component was developed to ensure minimal disruption to the reading specialists' regular lesson programmes. To this end, each daily component of the training cycle required no more than 5 minutes of lesson time to complete.

For each of the 3-4 day training cycles three pairs of target nouns were presented to each student to identify. For a full list of the 72 target nouns used in the training intervention (see Appendix F). The 72 target nouns used in the study were obtained from the Elley and Croft (1989) Graded Nouns Lists. These nouns were graded by Elley and Croft "on the basis of frequency of occurrence in the free writing of New Zealand primary school children" (p.10).

The words that formed each noun pair contained one of the 37 rime spelling units identified by Wylie and Durrell (1970) who reported that in a list of 286 rhyming (vowel) phonograms appearing in primary grade words, 95% of them represent stable vowel pronunciations. For this list of rhyming phonograms the authors listed a group of 37 phonograms in which the vowel sounds were particularly phonetically dependable. In other words, no matter what word these phonograms appear in, the vowel and following consonants usually represent the same pronunciation. Thirty-six of these 37 "dependable" phonograms are represented in the 72 nouns which formed the basis of the training intervention. The 36 dependable vowel phonograms used in the training programme included the following: *eat, an, op, in, ay, ell, ill, ap, ot, ing, ack, est, ank, ine, ail, at, ug, ip, it, ate, uck, ink, ash, ice, ake, ide, ock, ight, ore, ame, unk, ain, aw, ump, ick, ale.*

For one word of each pair of nouns, the rime unit constituted the final segment of the word (e.g., m-eat). For the other word in the pair, the rime unit was embedded in the word (e.g., h-eat-er). On Day 1 of each training cycle (which was sometimes extended to 2 days depending on the student) the students were asked to read aloud each of the 6 target words (i.e., the nouns) and were given feedback in the form of a tick or cross immediately after each word was attempted. The worksheet for the first training cycle is presented in Appendix G. No corrective feedback was given during this initial reading of the nouns.The students were then given three groups of words to spell, each group comprising three words (e.g., seat, beat, neat). The three spelling words (spell-primes) in each group contained the same common rime unit that also appeared in one of the three pairs of target words that were attempted previously. Corrective feedback was given according to the particular pattern of responses arising from the students's initial spelling attempts. There were four possible response scenarios for each group of three spell-primes. However, the main aim of this particular activity was to encourage the students to identify the common rime unit in the three spell-primes, to write the rime unit in an egg-shaped space above the words on the worksheet, and finally to pronounce the rime unit. The four possible response scenarios to the spelling activity are described below.

Four Response Scenarios in the Rime Analogy Training Procedures

1. When none of the three spell-primes was written correctly, the teacher wrote the common rime unit in the egg-shaped space above the words on the student's copy of the worksheet. The teacher then pronounced the rime unit for the student. The student was then instructed to make a second attempt at writing the three spell-primes but this time was told to "make sure that each attempt contained the piece in the egg". After completing the spelling task (with assistance from the teacher where necessary) the student was asked to pronounce the rime unit him/herself. Corrective feedback was again given if the pronunciation was incorrect.

2. When only one of the three spell-primes was correctly written, the teacher underlined the rime unit in the correctly spelled word and then asked the student to make a second attempt at writing the other two words. The student was also instructed to "make sure that each second attempt contained the underlined part". The student was then asked to write the common rime unit in the egg-shaped space above the words on the worksheet and then to pronounce the rime unit. Corrective feedback was given if the pronunciation was incorrect.

3 When two of the three spell-primes were correctly written, the student was asked to"look carefully at the two correctly spelled words and to find the part that was the same". The student was then asked to make a second attempt at spelling the remaining word, but this time "making sure that it too contained the same part that was in the other two correct words". The student was again asked to write the rime unit in the egg-shaped space above the words on the worksheet and to pronounce the unit. Corrective feedback was given where necessary.

4. When all three spell-primes were correctly written on the first attempt, the student was asked to "look carefully at the three words and to find the part that was the

same". The student was then instructed to write the common rime unit in the egg-shaped space above the words on the worksheet and then to pronounce this rime unit. Corrective feedback was given where necessary.

On Day 2 of the training cycle the students were asked to read the six target words that were attempted on Day 1, but in scrambled order. However, before this second reading attempt was made, the students were first asked to study the "eggs" (rime units) that were learned during the previous day's lesson (and entered on the worksheet). The students were then asked to circle these identical rime units in the Day 2 words before making the second decoding attempt. If they had problems recalling how the rime units should have been pronounced, the students were asked to re-read the three spell-primes (and the "egg") to remind them. Following each second reading attempt of the 6 words, corrective feedback was given where necessary. Because the students's responses to the target words on Day 1 were visible on the worksheet, it was possible to make the students directly aware that the use of the "eggs" was helpful in improving word identification.

On Day 3 the students were again asked to read the six target words which were presented in another scrambled order, but this time, no assistance was given. The words and the spell-primes tasks from Days 1 and 2 were not visible as the worksheet was folded along the dotted lines obscurring the words (see Appendix G). After the "test" was completed, corrective feedback and further instruction in the use of the "eggs" was provided. For each day of the 3-day training cycle, the number of target words correctly identified was recorded. The maximum number of training cycles that each student could complete during the full training intervention was 12.

The rime analogy training that was incorporated into each 30-minute RTR/RAT lesson did not generally exceed 5 minutes in duration. However, a standard feature of the RTR/RAT lesson is the introduction of unfamiliar reading material (i.e., instructional level texts) at the end of the lesson. While reading this new material, the students in the rime analogy training group were encouraged to, wherever possible, use their newly acquired strategic knowledge to help them identify unfamiliar words. Following Gaskins

et al. (1988) the students were also encouraged to develop a phonological set for diversity. For example, if the student was unable to read the final word of the sentence, "He drank a glass of cold water", he or she was asked to search for familiar "eggs" in the word (i.e., at and er) and then to generate a pronunciation for the word. In this instance, while an incorrect pronunciation may well be produced, it would be so close to an approximation to the actual word that the student would in all probability, self-correct the error, particularly if the word was already in the student's listening vocabulary. The student was therefore encouraged to generate alternative pronunciations of the word (based on rime unit phonology) until one was produced that matched a word in his/her listening vocabulary and was appropriate to the sentence context.

In summary, although the students were taught specific skills in the rime analogy training programme (i.e., knowledge of commonly occurring rime spelling units), considerable emphasis was also placed on the development of metacognitive strategies for knowing how and when to apply such strategies in regular reading situations.

The Item-specific Training

For the item-specific training group, systematic training in the use of sentence context cues to identify unfamiliar words was incorporated into the daily 30-minute lesson format of the RTRs/RATs. The students in this intervention group were presented with the same material (i.e., training cycle worksheets) that was used in the rime analogy training group, but with one exception. On Day 2 of the training cycle, the target words were presented in underdetermining sentence contexts (e.g., the heater made them warm). The worksheet for the first training cycle of the item-specific intervention is presented in Appendix H .

The main reason that both groups (viz., rime unit analogy and item-specific) received the same materials was to eliminate the effects of possible material bias on the final results. In a recent analysis of 37 experimental studies of reading comprehension

strategy instruction programmes, Lysynchuk, Pressley, d'Ailly, Smith and Cake (1989) noted that both the controls and the trained subjects were exposed to the same materials in only 70% of the studies. Lysynchuk et al. (1989) suggested that at least one control group should also be exposed to the same training materials that are given to the intervention subjects. They also suggested that a further control group that does not receive the training could be included. Lysynchuk et al. (1989) concluded that "by comparing the two control conditions, the researcher can determine the contribution of the materials to any treatment effect" (p.465). The current research design incorporated these recommendations.

On Day 1 of the item-specific training cycle (which was often extended to 2 days) the students were asked to read aloud each of the six target words and were given immediate feedback in the form of a tick or cross after each word was attempted. The students were then given the three groups of words to write (i.e., spell-primes). These were the same words that were used in the rime analogy training procedure, but this time the words containing the common rime units were not presented contiguously. Rather, they were given in scrambled order so that no two consecutively-presented spell-primes contained the same rime unit. In fact, spelling words given in scrambled order mirrors the regular classroom spelling situation.This presentation condition would therefore be more "normal" to the subjects because spelling tests given within the regular classroom seldom include words that are presented with any specific phonological-based intention (Brann, 1996).

Corrective feedback was given immediately after each word was attempted. If the first spelling attempt was correct, the next word was given. If the word was written incorrectly, the teacher orally spelled the correct spelling version of the word and the student was asked to spell it on the worksheet next to their initial response.

On Day 2 the students were asked to read aloud six sentences, each one containing one of the six target words that were presented in Day 1. The words were presented in underdetermining contexts in order that they were not completely predictable but could be identified within the context of the sentence itself. For each error the students were given prompts in accordance with the procedures of a commonly used remedial reading

programme in New Zealand referred to as "Pause, Praise, Prompt" (see Smith & Elley, 1994). If the students made an error that did not make sense, they were further prompted with clues about the meaning of the sentence. If the students could offer no response to an unfamiliar word, they were asked to read on to the end of the sentence and/or to start again and to put in a word that will "make sense". If the students produced a word that did make sense but was still incorrect (a relatively rare kind of error), they were prompted to look more carefully at some of the letters in the word, especially the initial/final letters. This approach to remediation is based on the assumption that the meaning cues in the sentence and a minimal amount of word-level information are usually sufficient to enable readers to recognise unfamiliar words in text (Smith & Elley, 1994).

On Day 3 of the item-specific training cycle each student was again asked to read the six target words presented in another scrambled order, but this time in isolation (i.e., without sentence context). No assistance was given during this re-testing occasion and the Day 1 and 2 material was not visible as the worksheet was folded over. After the Day 3 activity was completed, corrective feedback was given and further instruction in associating sentence meaning cues with the target words was provided.

The item-specific training was also incorporated into the daily 30-minute RTR/RAT lesson and generally did not exceed 5 minutes in duration. The students in the item-specific training group received additional instruction in the use of the "Pause, Praise, Prompt" procedures while reading the new instructional reading material at the end of the regular RTR/RAT lesson.

To ensure that both training groups received approximately the same number of training lessons, each teacher kept a record of all lessons completed. This was recorded on each training cycle worksheet. (For a summary of the number of lessons each training group received see Table 16).

The third (standard intervention) group of RTR/RAT students received only their regular remedial reading instruction according to their respective specialist's programme. However, this third group also received the same number of RTR/RAT lessons over the same period of time as both the training groups.

Following the 11 week training programme the students in the three intervention programmes, (i.e., the two modified intervention groups and the standard intervention control group) were given the same tests that were administered prior to the training (i.e., the tests used in Experiment 1). However, the PPVT was not included in the posttreatment test battery. One year follow-up data were also obtained from the students in the three intervention groups and from a randomly selected sample ($\underline{n}$ = 20) of the reading level controls. The reason for the follow-up data was to assess whether the effects of the rime analogy training transferred to other reading materials and whether the effects were sustained over time. Comparisons could also be made with the reading performance of each of the samples over the same period of time. The tester for the posttreatment and follow-up testing was blind to group assignment at the time of the testing and the students were again all tested individually in a quiet withdrawal room in their school.

Results

The means and standard deviations of the three comparison groups for all pre-treatment measures are presented in Table 15. One-way Analyses of Variance (ANOVA) show that the only variables for which there were significant differences between the means were age, and the PPVT scores.

Table 15

One-Way ANOVA of Three Comparison Groups for All Pre-treatment Measures

Variable	Modified Intervention, Rime Analogy Training Group (n = 18) M	SD	Modified Intervention, Item-Specific Training Group (n = 18) M	SD	Standard Intervention Group (n = 21) M	SD	F (df=2,54)
Age (months)	99.06	10.50	97.94	10.44	108.62	15.38	4.37*
Burt Raw Score	23.17	6.26	23.44	6.44	23.14	7.55	0.01
Neale Raw Score	14.00	6.75	13.89	6.17	15.05	7.28	0.18
PPVT Raw Score	73.89	12.12	74.89	10.55	83.86	8.33	5.60**
Onset-Rime Segmentation	13.50	2.33	14.56	2.62	13.95	2.69	0.77
Phoneme Segmentation	11.17	4.41	10.61	5.46	10.19	3.28	0.23
Pseudoword Naming, Total Words	1.39	1.58	3.17	4.13	3.00	3.56	1.62
Pseudoword Naming, Total Points	42.94	13.02	49.11	18.75	43.05	16.15	0.88
Words with Common Rime Units	28.23	15.95	28.94	17.31	31.52	16.97	0.21
Rime Unit Identification	8.67	3.60	8.67	3.34	8.05	3.29	0.01

Note. *p <.05 **p <.01

The differences in means for the age and the PPVT raw scores reflect policy differences in admission criteria between the various RTR Management Committees of the region in which the standard intervention group was located and the region in which the two modified intervention groups were located. The former region (i.e., standard intervention group) generally requires a longer period of time to have elapsed following participation in the Reading Recovery programme before being admitted to the RTR programme. Because the students from this region were on average, 10 to 11 months older than the students in the modified intervention groups, it would be expected that they would have a significantly larger receptive vocabulary as well. Overall, the data presented in Table 15 indicate that the two modified intervention groups were closely matched on all pre-treatment measures.

As was discussed previously, each RTR/RAT recorded the number of lessons each student received in their respective training cycles. Table 16 presents data on the tests of differences between the means of the modified intervention groups and the amount of strategy training received by each student in each group.

Table 16

Tests of Differences Between Means of Modified Intervention Groups on Amount of Training Received

	Modified Intervention, Rime Analogy Training Group (n = 18)		Modified Intervention, Item-Specific Training Group (n = 18)		
Variable	M	SD	M	SD	t (34)[a]
Number of Lessons Received	30.61	5.28	31.67	5.94	0.56
Number of Training Cycles Completed	9.83	1.79	10.22	1.80	0.65

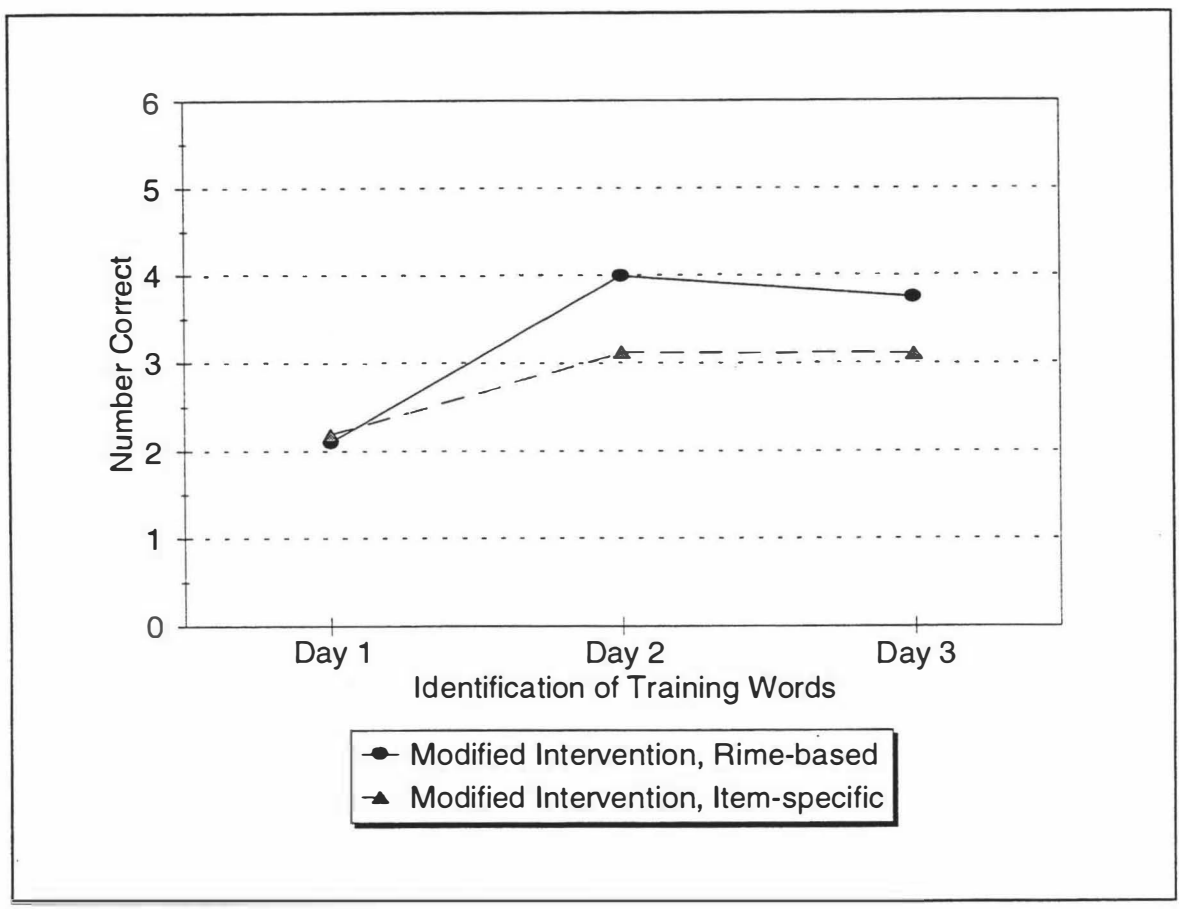
[a]Both t-tests were nonsignificant, p >.05.

The results indicate that there were no significant differences between the rime analogy and item-specific training groups in either the mean number of lessons received or the mean number of training cycles completed. The mean number of lessons given to the rime analogy training group for example, was 30.61 versus 31.67 for the item-specific training group. The mean number of training cycles (i.e., task sheets) completed was 9.83 for the analogy training group and 10.22 for the item-specific training group. The maximum number of training cycles available for the total intervention programme was 12 and a small number of students in each group did complete all twelve. Any differences between the two groups on posttest or follow-up measures cannot be attributed to differences in the amount of additional training in identifying unfamiliar words that was given to the students in a particular group, because these training differences were statistically non-significant.

The mean number of target words correctly identified at different points in each training cycle (averaging across the total number of training cycles completed) for the two modified intervention groups are represented in Figure 3. A 2 (Group: Rime-based vs Item-specific) x 3 (Day: 1, 2, or 3) analysis of variance was performed on the data.

Figure 3

Mean Number of Target Words Correctly Identified at Different Points in Training Cycle Averaging Across Training Cycles Completed



The main effect for Group was nonsignificant. However, there was a significant main effect for Day, F (2, 68) = 55.85, $p < .001$, MSe = .39, and a significant Group x Day interaction, F (2, 68) = 5.85, $p < .01$, MSe = .39. The training procedures introduced on Day 1 of the training cycle of the two intervention programmes resulted in significant improvement in the identification of the target words on Day 2, an improvement that was maintained on Day 3 of the training cycle. The significant Group x Day interaction indicated that, although there were no differences between the two groups on Day 1 of the training cycle, the rime analogy training group out-performed the item-specific

training group on Days 2 and 3 of the training cycle. Individual comparisons of cell means also revealed that both of these differences were significant (Newman-Keuls, $p < .05$). This finding suggests that the rime analogy training procedures were more effective than the item-specific training procedures in helping the disabled readers to identify the unfamiliar words.

The pretest and posttest means and standard deviations of the three comparison groups on all measures are shown in Table 17. A 3 (Group: Rime Analogy, Item-specific, Standard) x 2 (Time: Pretreatment vs Posttreatment) analysis of variance was performed on the data obtained for each measure. For the Burt raw score, there was a significant main effect for Time, $F(1,54) = 73.10$, $p < .001$, and a significant Group x Time interaction, $F(2,54) = 6.03$, $p < .01$. The main effect for Group was nonsignificant.

Table 17

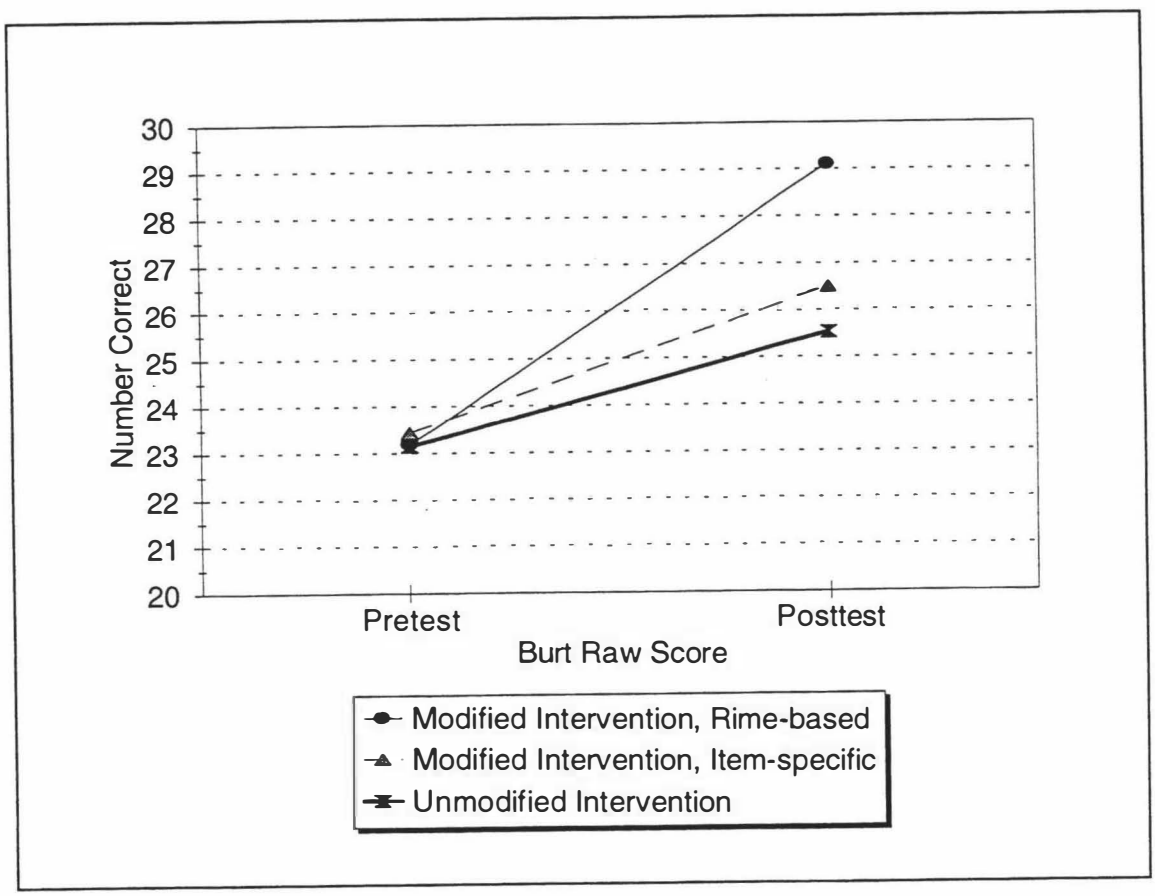
Pre- and Post-test Means and Standard Deviations of Three Comparison Groups on All Measures

Measure	Modified Intervention, Rime Analogy Training Group (n = 18)				Modified Intervention, Item-Specific Training Group (n = 18)				Standard Intervention Group (n = 21)			
	Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Burt Raw Score	23.17	6.26	29.11	6.69	23.44	6.44	26.50	6.48	23.14	7.55	25.52	7.74
Neale Raw Score	14.00	6.75	19.39	7.09	13.89	6.17	18.00	6.64	15.05	7.28	17.71	5.79
Onset-Rime Segmentation	13.50	2.33	15.28	1.90	14.56	2.62	15.61	2.03	13.95	2.69	14.33	3.06
Phoneme Segmentation	11.17	4.41	14.56	3.57	10.61	5.46	13.67	4.99	10.19	3.28	13.19	3.42
Pseudoword Naming, Total Words	1.39	1.58	5.94	4.30	3.17	4.13	4.44	4.26	3.00	3.56	2.86	3.54
Pseudoword Naming, Total Points	42.94	13.02	63.89	15.57	49.11	18.75	55.06	18.47	43.05	16.15	49.57	17.28
Words with Common Rime Units	28.23	15.95	47.28	12.46	28.94	17.31	40.06	16.90	31.52	16.97	37.76	16.31
Rime Unit Identification	8.67	3.60	15.50	3.54	8.67	3.34	11.44	3.38	8.05	3.29	10.90	3.53

While there were gains made by all three comparison groups for the Burt Word Test scores, the rime analogy training group made greater gains than either of the other two groups. Figure 4 shows that the rime analogy training group's pretest Burt raw score of 23.17 increased to 29.11 at posttest compared to much smaller gains by the other two intervention groups.

Figure 4

Mean Raw Scores on the Burt Word Test as a Function of Intervention Group and Time of Testing



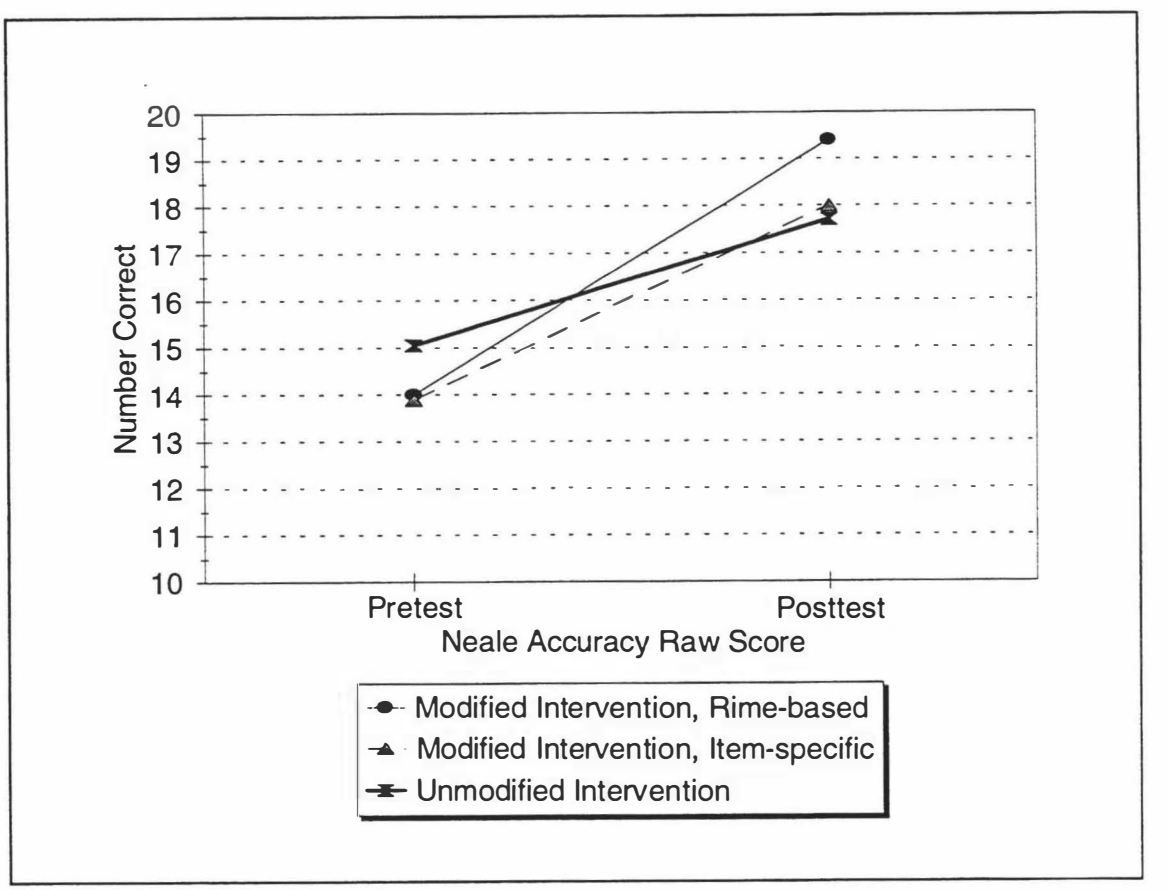
Individual comparisons of posttreatment cell means for the Burt word test indicated that each of these differences between means was significant (Newman-Keuls, $p < .01$). This is an important finding because not only is it consistent with the data obtained from the intervention phase of the study (which showed that the rime analogy training was more effective than the item-specific training; see Figure 3), but it also shows that the

positive effects of metacognitive strategy training in the use of rime spelling units generalised to performance on a standardised reading test.

For the Neale Reading (accuracy raw score) subtest, there was also a significant main effect for Time, F (1,54) = 87.32, $p < .001$, and a significant Group x Time interaction, F (2,54) = 3.38, $p < .05$. The main effect for Group was nonsignificant. Figure 5 shows that while all three training groups made gains for the Neale reading scores, the analogy training group again outperformed the other two groups.

Figure 5

Mean Number of Correct Responses on the Neale Reading Accuracy Subtest as a Function of Intervention Group and Time of Testing



However, the differences in the posttreatment means for the Neale reading test scores between the rime analogy group and each of the other two groups failed to reach

statistical significance (Newman-Keuls, $p > .05$). The most likely reason for this may be because the students in the comparison groups were able to use compensatory strategies when they were reading words in connected text. Consistent with this suggestion, the raw score gains achieved by the students in the rime analogy training group on both the Burt and Neale tests translated into 6 month increases in reading age, suggesting that the word identification strategies acquired by these students generalised to reading unfamiliar words in context as well as in isolation.

The analyses of variance for the two phonological awareness measures (i.e., onset-rime segmentation and phoneme segmentation) indicated that the main effects for Time were the only effects to reach significance: $F(1,54) = 13.36$, $p < .001$, for onset-rime segmentation, and $F(1,54) = 33.30$, $p < .001$, for phoneme segmentation. The main effects for Group and the Group x Time interactions were nonsignificant. All three training groups made moderate gains on both measures of phonological awareness, with the rime analogy training group making slightly larger gains. The lack of significant differences between the rime analogy training group and the other groups was not unexpected, however, as the rime analogy training did not specifically focus on the development of phonological awareness skills. Rather, the training was designed to encourage disabled readers to take advantage of existing phonological skills when learning to identify unfamiliar words. These skills included the ability to identify relevant rime spelling units in words and to use this knowledge to decode unfamiliar words by analogy. As the findings from Experiment 1 suggest, dyslexic students appear to have sufficient onset-rime segmentation ability to read words by analogy, but generally do not make use of this ability in a spontaneous way when attempting to read unfamiliar words.

Analyses of variance were carried out for both methods of scoring the pseudoword reading test, that is, by total words and by total points. For the total words scoring procedure there was a significant main effect for Time, $F(1,54) = 20.84$, $p < .001$, and a significant Group x Time interaction, $F(2,54) = 11.28$, p .001. The main effect for Group was nonsignificant. Only the two modified intervention groups showed gains in performance on the total pseudowords scores with the rime analogy training group making the largest gain. Even though the pretest mean of the item-specific group was

higher than that of the rime analogy group, the posttest mean of the rime analogy group was significantly higher than that of the item-specific group (Newman-Keuls, $p < .05$).

Figure 6

Mean Number of Total Points on the Pseudoword Reading Test as a Function of Intervention Group and Time of Testing

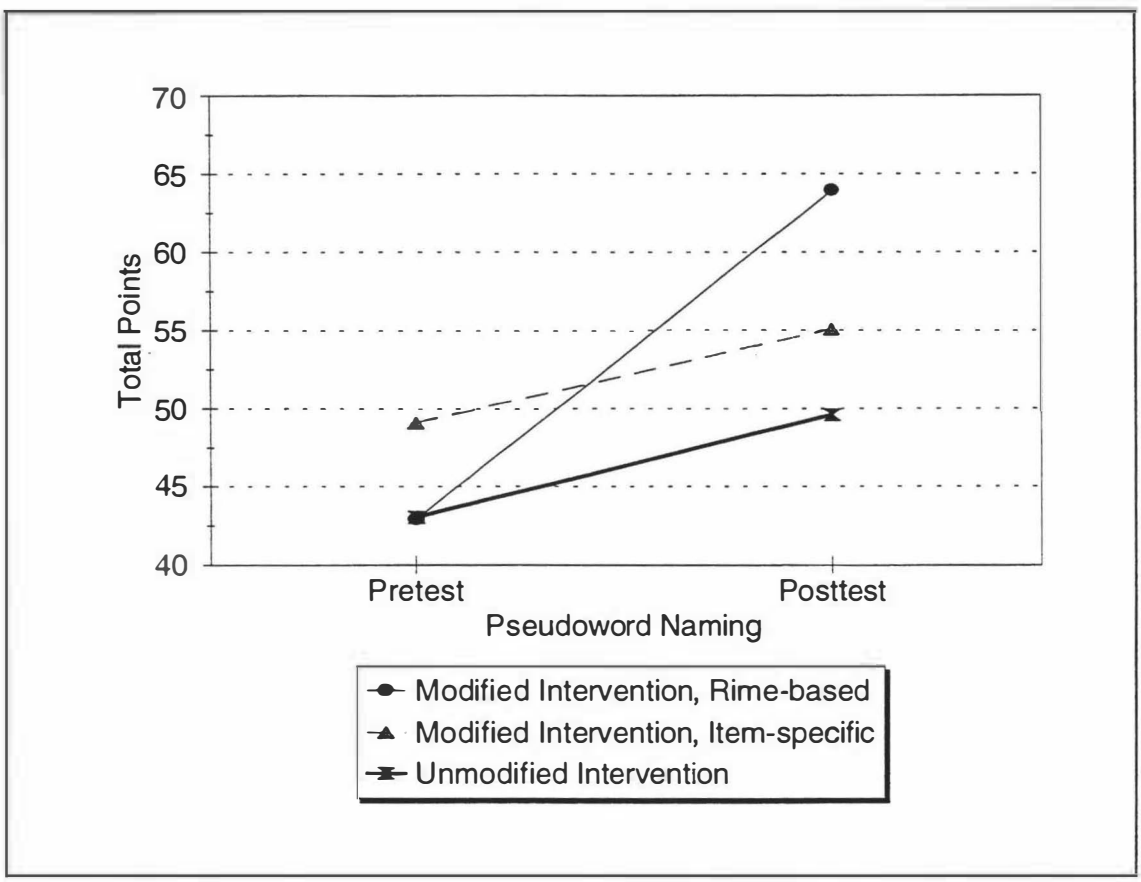


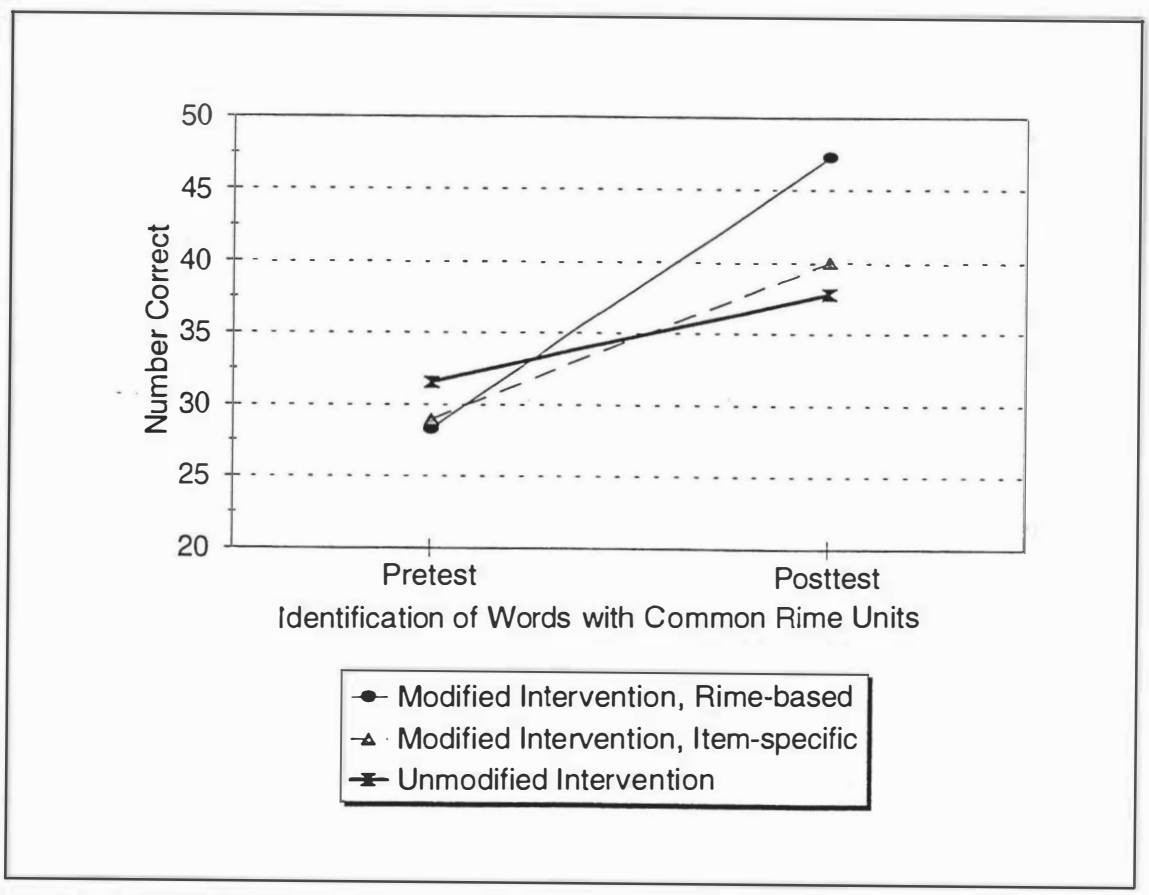
Figure 6 shows that a similar pattern of results was obtained for the second scoring procedure (i.e., total points) on the pseudoword reading task. The main effect for Time was significant, $F(1,54) = 55.79$, $p < .001$, as was the Group x Time interaction, $F(2,54) = 10.55$, $p < .001$. The main effect for Group was nonsignificant. Although gains in the total points performance were made by all three groups, the rime analogy training group again made the largest gain. Individual comparison of posttest cell means also indicated that the rime analogy training group significantly outperformed each of the

other training groups (Newman-Keuls, $p < .01$). Taken together, the findings of the two scoring procedures of the pseudoword reading test indicated that rime analogy training can have a strong positive effect on the development of letter-sound knowledge in reading disabled students.

For the reading words with common rime units task, there was a significant main effect for Time, $F(1,54) = 123.37$, $p < .001$, and a significant Group x Time interaction, $F(2,54) = 11.79$, $p < .001$. The main effect for Group was nonsignificant. While all three groups made gains in performance on the reading words with common rime units task, Figure 7 shows that, once again, the rime analogy training group made the largest gain.

Figure 7

Identification of Words With Common Rime Units Showing Total Words Correct as A Function of Group and Time of Testing

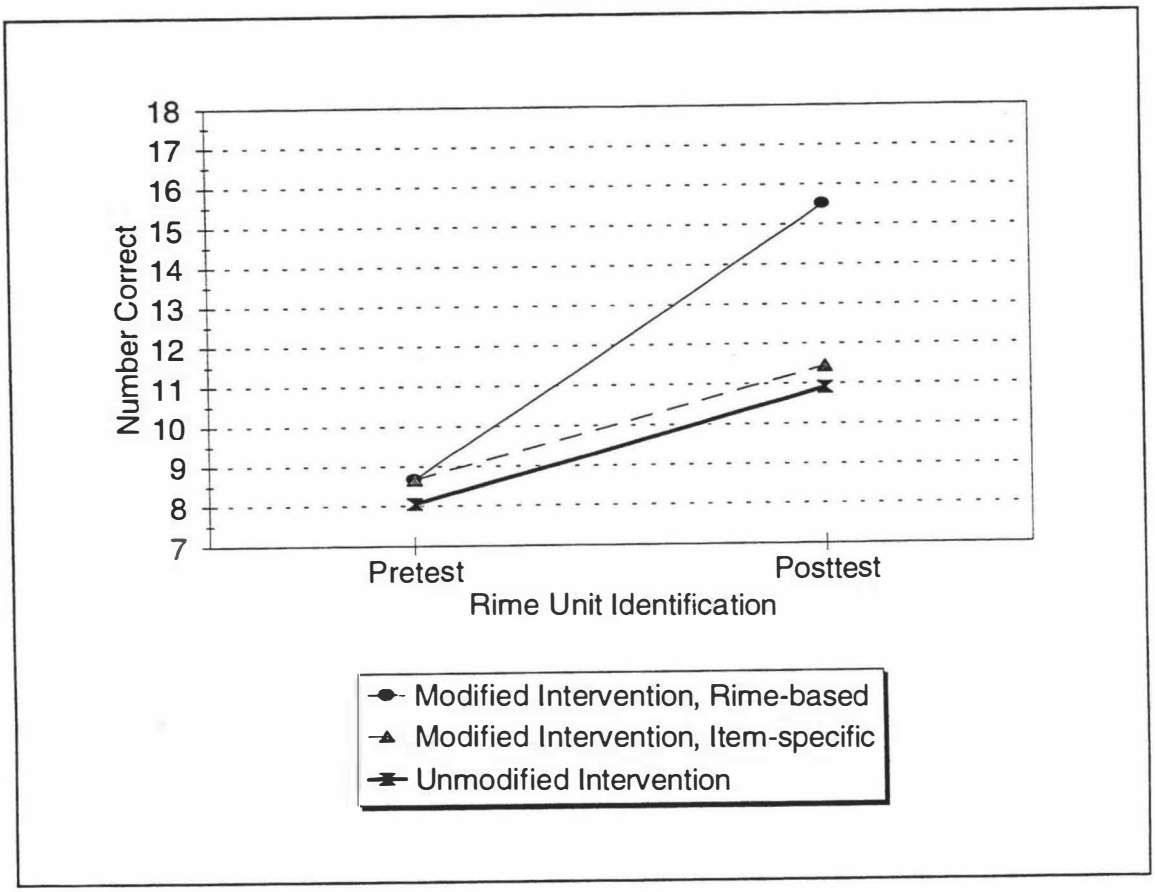


The differences in posttreatment mean scores between the rime analogy training group and each of the other training groups were significant (Newman-Keuls, $p < .01$). These results are consistent with the data obtained from the intervention phase of the study (see Figure 3) and further suggest that the analogy training was an effective procedure for improving reading disabled students's ability to take advantage of orthographic analogies when reading words containing common rime spelling units. Importantly, one third of the items on the words with common rime units test were not included in the training materials of the two modified intervention groups. A separate analysis of the scores of these words indicated that the superior post-treatment performance of the rime analogy training group over the item-specific training group was maintained. The mean percent difference between the modified intervention groups in post-treatment scores for the uninstructed words was 8.80%, which was only slightly less than the difference of 10.65% for the instructed words. This finding combined with the results from the pseudoword reading test and the standardised test of context free word recognition ability (i.e., the Burt test) provided convergent evidence that the training in recognising and using commonly occurring rime spelling units generalised to uninstructed words.

The analysis of variance for the rime unit identification task indicated that there were significant main effects for Group, $F(1, 54) = 3.44$, $p < .05$, and Time, $F(1, 54) = 82.51$, $p < .001$, and a significant Group x Time interaction, $F(2, 54) = 10.51$, $p < .001$. The improvement in performance of the rime analogy training group following the intervention phase (see Figure 8) was clearly much larger than either the item-specific or standard iintervention group.

Figure 8

Mean Number of Correct Responses on the Rime Unit Identification Task as a Function of Group and Time of Testing



The differences in the posttreatment means between the rime analogy training group and each of the other training groups for the rime unit identification task were significant (Newman-Keuls, $p < .01$). Eight of the ten rime spelling units appearing in the test items of the rime unit identification task were included in the training materials of the two intervention groups. However, the words in which the units appeared were uninstructed words. In other words, all the words in the rime unit identification task were new to the students and had not been seen before during the intervention phase. The findings therefore suggest that the rime analogy training facilitated the disabled readers' acquisition of orthographic rime correspondence rules.

Follow-up Results

The means and standard deviations of the four comparison groups (i.e., the two training intervention groups, the standard intervention group and the reading level group of younger readers) for all one-year follow-up measures are presented in Table 18. One-way analyses of variance revealed significant differences between the means of all measures except for the phoneme segmentation task. Because the means of the three intervention groups for the phoneme segmentation task did not differ significantly immediately after the training (see Table 17), it was not surprising that there were no differences between the groups one year later. Although the reading-age controls significantly outperformed the disabled readers on the phoneme segmentation task before the training (see Table 8) the disabled readers in all intervention groups performed at approximately the same level as the younger normal readers on this measure one year after the completion of their training.

Table 18

One-Way ANOVA of Four Comparison Groups For All Follow-Up Measures

	Normal Reader Group [a] (n = 20)		Rime Analogy Training Group (n = 17)		Item-Specific Training Group (n = 17)		Standard Intervention Group (n = 18)		
Measure	M	SD	M	SD	M	SD	M	SD	F (df = 3,68)
Burt Raw Score	37.90	10.24	33.59	8.73	29.53	8.16	28.61	5.90	4.77**
Neale Raw Score	30.55	12.99	26.76	9.46	22.47	9.5	20. 17	6.46	3.98*
Phoneme Segmentation	14.55	3.68	15.12	3.96	14.24	3.83	13.06	2.94	1.07
Pseudoword Reading, Total Points	74.40	15.01	71.47	12.38	59.06	19.39	53.78	18.03	6.63***
Words with Common Rime Units	59.05	15.89	55.29	12.84	44.35	16.73	43.33	14.36	5.02**
Rime Unit Identification	14.65	3.28	14.59	13.74	11.12	4.18	11.00	3.71	5.50**

[a] A randomly selected sample of the reading-age controls from Experiment 1.

*$p < .05$ ** $p < .01$ *** $p < .001$

A further examination of the follow-up mean scores for the four comparison groups reveal that only the rime analogy training group approached the rate of progress achieved by the normally developing younger readers. The results show that while the younger readers outperformed all the other groups at follow-up and on all the measures (except phoneme segmentation), the rime analogy training group scores were not far

below those of the younger readers. In addition, the rime analogy scores were superior to both the item-specific and standard intervention groups. Individual comparison of cell means indicated that for all variables except phoneme segmentation, the younger normal readers significantly outperformed both the item-specific and standard intervention groups (Newman-Keuls, $p < .05$). However, there were no significant differences between the means of the normal readers and the rime analogy training group on any of the follow-up measures. The analyses further revealed that the rime analogy group significantly outperformed both the item-specific and standard intervention groups on the pseudoword reading and rime unit identification tasks. The rime unit training group also significantly outperformed the item-specific training group on the reading words with common rime units task. The results therefore suggest that the students in the item-specific and standard intervention groups were clearly continuing to fall even further behind in their reading development.

Finally, a second analysis of the error response patterns at follow-up, for the 56 words with three sounds (in the common rime units task) showed that both the young normal readers and the rime analogy trained disabled readers significantly improved their rime (_ S S) unit responses. These improvements were not present in either of the other two disabled reader groups.

Recall that there were 56 words in the common rime units task that contained three sounds (see Table 12). An analysis of the error responses of the three-sound words was undertaken to investigate which parts (i.e., sounds) of the words were correctly identified. The results revealed that at pretest, all four comparison groups' three most significant responses included initial/final letters, (S _ S), initial letter only (S _ _), and no response (_ _ _). A similar pattern of responses occurred at both posttest and follow-up for the item-specific and standard intervention groups, except that at follow-up, the third most significant response pattern for the standard intervention group was the recognition of first two letters (S S _).

Table 19 presents the results of the error analysis for the words with three sounds (from the words with common rime units task). Although there were seven error possible response scenarios Table 19 summarises only the three most significant

response types for each group at each of the three test-points. Because the remaining four response categories accounted for less than 20% of the total responses, they were not considered in the analysis.

Table 19

Mean Percentage of Error Response Patterns For the 56 Words With Three Sounds as a Function of Group and Time of Testing

	Normal Reader Group [a]		Rime Analogy Training Group			Item-Specific Training Group			Standard Intervention Group		
Cues Used	Pretest	Follow-up	Pretest	Posttest	Follow-up	Pretest	Posttest	Follow-up	Pretest	Posttest	Follow-up
S _ S	45.2%	42.3%	44.9%	52.8%	58.4%	41.0%	51.9%	49.6%	38.6%	49.2%	50.8%
S _ _	18.4%	8.7%	29.1%	18.0%	11.2%	20.0%	19.3%	24.6%	23.0%	20.4%	17.9%
_ _ _	24.5%		12.8%			26.2%	14.6%	10.5%	25.8%	16.9%	
S S _											9.3%
_ S S		35.5%		13.2%	10.6%						

[a] The Normal Reader Group did not take part in the training programme and therefore were not posttested.

The results showed that the rime analogy trained group's third most significant response pattern at posttest for the words with three sounds was the rime unit (_ S S) response. This response pattern accounted for 13.2% of this group's total error responses. This pattern of responding is significant because it is not repeated for either of the other two disabled reader groups. The young normal readers' rime (_ S S) response patterns at follow-up accounted for a significant 35.5% of this group's total error responding. The rime unit response pattern did not feature in the top three response categories for the other disabled reader groups, showing that these groups were still not using rime unit knowledge at a significant level when decoding unfamiliar words. The younger normal readers' error responses reflected a strong shift towards rime unit usage at follow-up further suggesting justification for including interventions that encourage disabled readers to take greater advantage of rime spelling patterns when attempting to identify unfamiliar words. The young readers increasing use of rime unit knowledge at follow-up suggests that this is a natural progression in their reading development.

General Discussion

The main aim of the rime analogy training study was to determine whether a combination of skills training and metacognitive strategy training in the use of rime spelling would produce positive word identification effects, and whether such training effects would generalize (i.e., transfer) to other reading materials. In their analogy training study for example, Ehri and Robbins (1992) established that the "decoder" group included those students who could read between 2 and 5 pseudowords. The current study indicated that most of the disabled readers would therefore be classed as "decoders" using the Ehri and Robbins' (1992) criteria as the pseudoword reading mean (pretest) score for this group was 2.54. It must also be recalled that the subjects in the current study were somewhat older than those in the Ehri and Robbins

study and would therefore be expected to already have a "satisfactory" decoding ability. The mean Burt Word Test score (23.24) and the Neale Reading Accuracy subtest score (14.35) also further suggested that the disabled readers in the current study could be classed as "decoders". The challenge therefore, was to incorporate a training intervention that encouraged the disabled readers to develop an increased level of awareness of rime spelling units in words and to further encourage this group of readers to make use of such knowledge to identify similarly spelled words by analogy

Rime Analogy Training and Metacognitive Learning

The rime analogy strategy training procedure emphasised the link between the cognitive skill involving the identification of rime spelling patterns in familiar words, and the metacognitive knowledge of being aware of how the strategy may be useful when decoding unfamiliar words. Teacher feedback also emphasised the link between effortful strategy use and the resulting success where the identification of the appropriate rime spelling pattern resulted in a correct word identification.

Teacher reinforcement for the student emphasising the fact that he/she did in fact have the necessary phonological skills to succeed in the learning task (e.g., word identification) was also present in the strategy training procedures. The link between target rime spelling pattern knowledge and target word knowledge was also continually highlighted to the student, as was the effectiveness of activating orthographic analogies as a strategy for assisting with the identification of unfamiliar words. This was particularly evident when successful phonogram identification resulted in successful target word identification during the rime training cycles.

While one level of metacognitive awareness (e.g., rime spelling patterns in isolated words) was emphasised in the strategy training procedures, there was also a second level of metacognitive awareness which included the ability to transfer the

newly learned skill to uninstructed reading situations. This was fostered through instructions that encouraged the students to identify rime phonograms in unfamiliar words as the initial decoding strategy when reading regular texts, and to use context cues as a source of confirmation. Where successful word identifications resulted from this strategy, the student was given praise and the teacher made it clear that the success was a direct result of effortful and appropriate application of the learned analogy strategy.

The main aim of the analogy training programme was to foster metacognitive learning strategies within a specifically-identified group of disabled readers. The training was based on three learning assumptions: that learning may be enhanced through teacher modeling, that encouragement be given to student self-monitoring, and that students develop a sense of purpose in relation to the tasks.

Teacher Modeling.

To clarify learning tasks, research suggests that teacher modeling of the steps required for fostering strategic processing encourages students to imitate such strategies (Davey & Porter, 1982; Short, Evans, Dellick & Cuddy, 1988). Throughout the analogy training programme the teacher encouraged the development of rime unit awareness through the modeling of the phonogram isolation/identification procedures, and how such strategies could help with the identification of unfamiliar words. Modeling was particularly evident on Day 2 of the analogy training cycles, whereby the student was first required to isolate the relevant rime spelling units in the target words and to re-check the relevant pronunciations by re-reading the previous day's spell-primes. These strategies were undertaken as "think-aloud" strategies where the student was encouraged to verbalize what he/she

was doing and to appreciate how the strategy would be helpful in the word identification process.

Encouragement of Student Self-monitoring

One of the problems associated with learning disabled students is that they frequently show an inability to evaluate (self-monitor) their own learning on a regular basis. It is important for this particular group of learners that task feedback should be aimed at the learning process rather than the product. Where feedback is used to show process learning, both successes and failures will be instructive forms of information to the learner. Successful experiences provide information regarding task-appropriate strategies and failure experiences provide feedback regarding task-inappropriate strategies. Encouraging reading disabled students to activate a phonological set for diversity allows opportunities for both positive and negative learning trials. The activation of the phonological set for diversity also allows for process-oriented feedback which enables the student to engage actively in the learning and self-monitoring strategies. Many positive learning trials were encouraged when pronunciation attempts were made during the analogy training intervention.

The Development of a Sense of Task Purpose

Many learning disabled students fail to achieve success at tasks because task definitions are unclear or confused (Canney & Winograd, 1978). Giving students a clear sense of purpose/reason for learning a particular task/strategy allows them to see the relevance of the exercise and it is therefore, more likely to be meaningful to them. Throughout the analogy training procedures, the students were given a clear purpose for being able to segment words into relevant rime spelling units and how

such a strategy could assist them to identify unfamiliar words by analogy processes. The students were also continually encouraged to use this strategy to decode unfamiliar words during regular reading in the classroom, and to help them to spell many words during spelling/writing.

Why The Rime Analogy Training was Successful

There were two rationale that guided the analogy activation strategies in the training programme. These were: that the presentation of the spell-primes in the contiguous presentation condition (e.g., neat, beat, seat) would help to highlight the phonological consistency of rime units in different words, and secondly, that by following an explicit and systematic instructional spelling programme (which highlighted common rime unit spelling patterns) the students would better understand how rime unit awareness can be used to make orthographic analogies.

The main purpose in presenting the spell-primes in the contiguous presentation condition was to make the students more aware of the target rime spelling units. This systematic and explicit method of presentation allowed the students to build up a "knowledge bank" of common rime spelling units which could then be used as the basis for identifying the target words via orthographic analogies. Furthermore, the main objective in the rime analogy training programme was not to learn groups of words in isolation in some form of "skill and drill' procedure. Rather, the objective was to train the students to use the rime spelling unit knowledge as a metacognitive decoding strategy by encouraging them to transfer such knowledge from a known word to another (unknown) word through the process of orthographic analogy use. This was reinforced by ensuring that the students were explicitly taught how and why knowledge of rime spelling units can assist them to decode unfamiliar words in their general reading as well.

Although the rime analogy training programme contained elements of skill instruction, it was presented with a metacognitive emphasis, therefore ensuring that the students were able to understand the relevance of the exercise to the overall decoding process. The metacognitive orientation was further enhanced when the rime analogy trained students were encouraged to use their newly-learned rime analogy knowledge to help them decode unfamiliar words in general reading outside the context of the training programme.

The active encouragement in the use of rime unit analogies in reading helps to overcome the problem of isolated "skilling and drilling" which is often associated with phonics-based reading programmes. Spear-Swerling and Sternberg (1996) argue for example, that code-emphasis programmes "often contain too much isolated skill instruction, yet not enough of the kinds of activities that will enable students to see what the point of the skill instruction is or that will engage them and motivate them to keep reading" (p.179).

Using spelling procedures for the purpose of enhancing orthographic analogy use in decoding however, is certainly not the prime objective of regular classroom spelling programmes in New Zealand schools (Brann 1996). However, for students who have not developed knowledge of the orthography of English spelling, including rime unit awareness, the learning of lists of orthographically unrelated words is often a meaningless and confusing exercise. These particular students require a more structured, systematic and explicit phonological-based spelling programme such as the analogy training programme, to ensure that they understand the purpose for which such learning is undertaken.

The item-specific training on the other hand (in which the spell-primes were presented in scrambled order) reflected what generally happens in regular class spelling programmes. This is because such spelling programmes usually involve the presentation of spelling words in any particular order. The sentence/context cue

emphasis used in the presentation of the target words in the undetermining sentence contexts also reflected the dominant tutor procedure used in most class and remedial reading programmes. Therefore, the item-specific training rationale may be viewed as representative of general classroom procedures and would not be foreign to the students who participated in the item-specific training programme.

Both the word learning patterns in the training programmes (Figure 3) and the posttest results demonstrated that students with severe reading difficulties can be taught to use rime unit analogies. Furthermore, the results also demonstrated that decoding processes based on rime unit analogy activation procedures were more successful for these students than were decoding processes that continued to emphasise sentence/context cues.

The follow-up results one year after the completion of the training programmes, further revealed that the superior gains made by the rime analogy group were maintained. The results therefore suggest that it would make sense for students with severe reading difficulties, to receive explicit and systematic training in the identification and use of rime spelling units for the purpose of becoming more strategic decoders.

Teaching disabled readers to focus on rime spelling units for the purpose of making orthographic analogies was a particularly effective strategy because the rime units are (by definition) located beyond the initial letter (i.e, onset) in the words and therefore, the identification of this unit forces the reader to attend to units other than the boundary letters. As discussed earlier, students with severe reading difficulties have a tendency to focus only on the boundary letters in unfamiliar words while ignoring the medial ones. It is these medial letter groups that constitute the rime units and it is also understandable that if these letter groups are ignored, then there is little likelihood of the student developing sufficient phonological knowledge to activate orthographic analogy processes. A continued reliance on sentence/context

cues at the expense of phonological information, does very little to enhance disabled readers' ability to decode unfamiliar words because context cue reliance does not encourage the readers to attend to letters beyond the boundary ones. The rime analogy training procedure is one way of encouraging disabled readers to focus on the phonological information within the words.

Summary

Proficiency in reading is dependent upon students understanding the link between words and their sounds and the syllables. The inability to read words rapidly in context-free situations has been shown to be the most reliable indicator of reading disability (Lovett et al. 1990). Therefore it makes sense to include interventions that encourage the development of phonological recoding skills for children with severe reading disabilities. The results from the rime analogy training study demonstrated that disabled readers can be taught to use rime-based orthographic knowledge as a basis for decoding many unfamiliar words by analogy. The rime analogy training study incorporated a combination of skills training and metacognitive strategy training in the use of rime unit analogies.

The skills training involved teaching rime unit orthographic knowledge through spelling. The metacognitive strategy training component involved teaching the students to transfer the newly learned rime unit spelling knowledge to assist them to read uninstructed words by analogy. The rime analogy training intervention was compared to an item-specific training programme in which the students were trained to read the target words using standard context cue reliance methods of decoding. On both Days 2 and 3 of the training cycles the rime analogy trained students out-performed the item-specific group on the number of words identified. The results from the test measures also indicated superior posttest performances for the rime analogy trained students compared to both the item-specific training group and the standard (non-intervention) control group. The superior posttest performances of the rime analogy training group on the Burt Word test and, to a lesser extent, the Neale Reading Accuracy subtest, were particularly significant as these results indicated that the rime analogy training effects generalized to standardized achievement measures.

CHAPTER 6

CONCLUSIONS

Two separate but related issues were the motivation for the current study. The major aim was to determine whether metacognitive strategy training in the use of rime spelling units (for improving word identification skills) would be an effective intervention strategy for students with severe reading disabilities. A secondary aim was to examine the question of why disabled readers do not spontaneously use rime-based analogies to identify unfamiliar words. To investigate this second question a reading age match study was undertaken which compared performances on reading-related and phonological tasks by two different reader groups. A group of disabled older readers were compared to a similar number of younger normally developing readers who were reading at the same level as the disabled readers.

Key Findings

Results from the reading age match study revealed three significant findings. First, the data confirmed that the disabled readers were not as proficient as the normally developing younger readers in spontaneously using rime spelling units to help identify unfamiliar words. A consequence of this weakness was that the disabled readers acquired fewer orthographic rime correspondence rules. The younger readers however were already beginning to regard word spellings, including rime units, as "phonemic maps" which helped them to access the relevant pronunciations. Ehri (1997) argues that readers need to become skilled at "computing these mapping relations spontaneously when they see unfamiliar words and pronounce them" (p. 171). An analysis of the disabled readers' error responses however revealed that these students were frequently oblivious to the

spelling patterns in unfamiliar words even when these spelling patterns were repeated in groups, as happened in the words with common rime units task.

A second significant finding from the reading age match study was that, although the disabled readers appeared to possess a sufficient level of onset-rime segmentation ability for them to take advantage of rime-based analogies, they failed to make full use of this ability when confronted with unfamiliar words. Rather, these readers read each word as if it were a completely "phonologically unrelated" unit. This finding was evident in the words with common rime units task where frequently at least one of the words in the contiguously presented condition was correctly read but others in the group misread or not attempted. This finding therefore suggests that while disabled readers possess sufficient onset-rime awareness and general sight word knowledge for them to make use of rime unit analogies, they appear to lack metacognitive control over the decoding process and are reluctant or unable to activate analogy strategies on a spontaneous basis.

A third finding from the reading age match study further confirmed the phonological processing deficit hypothesis as a possible main cause for reading disability. This finding is in contrast to the developmental delay hypothesis which suggests that disabled readers are disabled because of a developmental delay in the phonological processing domain. However, if the developmental delay hypothesis was correct, it would be difficult to explain why the younger (and presumably developmentally less mature) normal readers outperformed the disabled readers on all the phonological processing measures. One possibility is that the disabled readers lack metacognitive control of strategic decoding processes because they had not received sufficient explicit training in phonological processing skills at an earlier age. The second (rime analogy training) study was carried out to investigate this issue.

Because rimes appear to be more accessible phonological units than individual phonemes (Bruck, 1992: Fawcett & Nicolson, 1995), an initial focus on teaching disabled readers to become more aware of rime spelling units as a means of helping them to become more strategic decoders, may be worthwhile. By developing such knowledge, disabled readers should become more aware of the sublexical relationships between written and spoken words, thus helping them to overcome their tendency to focus on only

the boundary letters in unfamiliar words. Results from the rime analogy training study support this suggestion in which it was demonstrated that training in the use of rime spelling units was more effective as a strategy for developing decoding abilities than was training that focussed on item-specific learning and sentence-level reliance. The data obtained from the intervention phase of the training study indicated that, although there were no differences between the two modified intervention groups (i.e., rime analogy and item-specific) on Day 1 of the training cycles, the rime analogy group outperformed the item-specific group on both Days 2 and 3. The results from the posttreatment measures provided further evidence that the rime analogy training procedures were more effective than the item-specific training procedures in helping disabled readers become more strategic decoders.

A second major finding from the training study was that the posttreatment results for the Burt Word test suggested that the training in recognizing and using commonly occurring rime spelling units as a basis for making orthographic analogies, generalized to uninstructed words. This finding is particularly significant considering the severity of the reading disabilities and the ages of the disabled readers in the study. Such students would almost certainly have entered what Spear-Swerling and Sternberg (1994) have termed the "swamp of negative expectations, lowered motivation and limited practice" (p.101). For this reason, any instructional programme that produces positive reading effects within such students should be developed further.

Finally, results from the one year follow-up measures for the training study indicated that the superior posttreatment performances of the rime analogy trained group were maintained. This finding further supports the positive transfer of training effects shown by the rime analogy trained group.

Summary

Given the rather limited amount of training provided in this study (i.e., 5 minutes per day for 11 weeks), and the fact that the disabled readers were taken from the bottom 2% of the reading disabled population, (e.g., "third wave" readers), the results from this training study are very encouraging. The results also suggest that the newly-learnt word recognition strategies acquired as a result of the rime analogy training may have enabled the disabled readers to derive greater benefits from the other reading activities included in the regular RTR lessons. If older disabled readers do indeed possess sufficient onset-rime segmentation ability to make use of rime-unit analogies, the question arises as to why these students continue to attend to only partial letter-sound information and to contextual guessing when confonted with many unfamiliar words. Regardless of the source of the reading difficulty, students with deficiencies in phonological processing skills at the outset of learning to read may eventually overcome such deficiencies and develop along normal lines. However, a more likely possibility is that most of these students will not await phonological development. Rather, they will rely increasingly on ineffective word recognition strategies and that these ineffective strategies will become more difficult to "unlearn" the longer they persist. The continued use of such strategies at the expense of phonological information will result in progressive deterioration in the rate of reading development. The identification and remediation of students with weaknesses in the phonological domain may therefore be the key to reducing the incidence of severe reading difficulties.

Research Design Issues

A criticism of the current research design may be that the teachers used in the training intervention were all experienced reading specialists. It could therefore be assumed that had regular class teachers been used instead, the training effects may not have been so positive. However, although the teachers used were generally experienced class teachers (before they were appointed to RTR positions), they had nevertheless only had on average, 5 years of reading specialist experience. Secondly, the reading specialists had not received any specific training in reading methodologies, although a small number had previously trained as Reading Recovery teachers. Therefore, the teachers used could more accurately be classed as experienced regular class teachers with a few years of reading teaching experience rather than true reading specialists.

A second criticism of the study may relate to the "pygmalion effect" accompanying students receiving one-to-one tuition and that such individualized tuition may in itself, be seen to account for the positive training effects. While it is acknowledged that any "pull-out" and individualized programme may be more successful than small-group or whole-class programmes, the students in the current study were severely reading disabled and had already failed to develop satisfactory reading skills in both regular class programmes and, in some cases, Reading Recovery. The students in the current training study were therefore, not the regular reading failures, but the hardest-to-teach group that constitute the lowest 2% of reading disabled students in the education system. This group of severely disabled readers present reading researchers with the greatest challenge. Furthermore, the students did not perceive the training programme as "special" because it was incorporated as just part of the regular RTR lesson. In fact, Wasik and Slavin (1993) argue in favour of using the tutor setting for research purposes because it "provides an ideal laboratory in which the process of learning to read can be observed as it unfolds" (p.198).

It could also be argued that the disabled reader group was not randomly selected from a wide pool of disabled readers. The students used in the training study had all been

selected both by their regular class teachers and by RTR Management Committees as being sufficiently reading disabled to warrant admittance into national RTR programmes. Because the RTR programme is nationally funded, it is recognised that students admitted to this programme are the most severely disabled reader group in the education system. Selection was also based on both geographic and time constraints.

A further problem associated with using reading age match designs for comparing two different age group performances is that because one group is (by definition) older than the other, the older readers may have additional skills and strategies that they are able to bring to the reading tasks. Their superior results on posttests may therefore, according to Rack et al. (1992) be due to these additional age-related variables. However, in the current study the disabled reader groups' follow-up test results revealed that while they were still functioning below the young normal readers (even though the young readers did not participate in any training programme), it was the rime analogy-trained subgroup of disabled readers that performed closest to the normal readers on the follow-up test measures. This finding demonstrated that the rime analogy training was more successful in closing the reading-related performance gap than were either the standard intervention or item-specific intervention.

One further related criticism of the reading age match design is be that because the disabled readers were older they would most likely have also developed more negative experiences related to persistent reading failure than the younger readers. However, all three disabled reader subgroups would have been equally affected by such accumulated negative learning experiences. Furthermore, the main aim of the intervention study was to compare the posttest performances of these three groups and their intervention effects rather than with those of the younger readers. The rime analogy-trained subgroup's posttest and follow-up scores were superior to both of the other disabled groups' scores adding further support to the efficacy of the rime analogy strategy training programme. The success of the rime analogy training may also be attributed to the metacognitive attributes associated with the training which included making the learner aware of how and why such training can help with specific decoding tasks. The training may also have helped to overcome some of the negative performance variables of these disabled readers.

Finally, it could be argued that the training time involved in each lesson (i.e., 5 minutes) may have been too short, and that had the time been extended, even greater positive effects could have been gained. While this may be true, teachers are more likely to take research findings "on board" if such findings are based on practical classroom applications. Because such positive findings were obtained from such a small amount of training input, the strategies taught in the rime analogy training study may transfer to general classroom applications without the teacher needing to make many adjustments to class organization.

Suggestions For Future Research

- Although a significant factor associated with the development of reading skills is the child's evolving self-system (Chapman, Tunmer & Ryan, 1997), these factors were not included in the current research design. Measures of self-system factors such as sel-concept, self-efficacy, self-worth, attributions and expectations (Borkowski, Carr, Rellinger & Pressley, 1990) could be included as part of a future replication study.

- The teachers used in the current study were full-time reading teachers. Future research designs could involve regular class teachers, or teachers' aides.

- Emphasis in the current study was on developing rime unit awareness as a strategy for increasing decoding ability using orthographic analogies. Future research could investigate the level at which rime unit awareness may be used to develop spelling skills.

- The training study was incorporated into the regular RTR (individualized) reading lessons. Future replication studies could investigate whether the training strategies can be taught as part of a small-group intervention within the regular class setting.

- The students used in the study were "third wave" readers. Future studies may involve less severely-disabled but low progress readers who lack full metacognitive control over the decoding process.

- The target group of disabled readers in the current study were somewhat older than the younger normal readers. Future replication studies could investigate whether younger reading disabled students could be trained to activate rime-unit analogies as a decoding strategy.

Implications For Educational Practice

Although the current training study involved students who were enrolled on Resource Teacher of Reading programmes, the findings nevertheless have relevance for both general class teachers with reading disabled students, and other remedial reading specialists. This is because disabled readers in any setting (i.e., class or individualized tuition) may benefit from a teaching programme that emphasises rime-unit awareness as a basis for decoding unfamiliar words by analogy. There are several advantages in encouraging disabled readers to use rime-unit knowledge for decoding. First, the reader is encouraged to focus on the phonological properties in words beyond the initial letter. By definition, the rime spelling units in words constitute the part beyond the onset, and research findings have demonstrated that disabled readers are particularly deficient in remembering letter details in the middle of words (Ehri & Saltmarsh, 1995). Ehri (1991) argues that if readers process letters "only partially, as in phonetic cue reading, or not at all, as in logographic reading, they will not learn what they need to know about letter sequences for orthographic-phase reading" (p. 405).

A second advantage in teaching disabled readers to use rime unit knowledge as a basis for decoding by analogy is that the process of dividing words into onsets and rimes encourages the reader to segment the words into "phonologically manageable" bits. Onset-rime segmentation processes help the reader to establish access routes in memory through the learning of relevant spelling patterns. Adams (1990) also notes that knowledge of spelling patterns "provides a means of introducing and exercising many printed words with relative efficiency" (p.324).

An advantage in requiring the reader to show the relevant "eggs" (i.e., rime spelling units) in unfamiliar words during context reading is that the teacher is able to see immediately whether the student is focussing on the correct segment in the target word. The process of identifying relevant rime spelling units also encourages the reader to take metacognitive control over the decoding process and at the same time, enforces active phonological processing. This is in contrast to allowing the reader to supply guesses or to attend only to minimal word information.

Finally, when combined with a phonological set for diversity (Gaskins et al. 1988) whereby the student is encouraged to generate multiple pronunciations for unknown spelling patterns, decoding strategies based on rime unit analogies can be particularly effective for developing decoding abilities. The process of rime unit orthographic analogy use is even more effective when it is activated in combination with sentence-level (i.e., context) cues. However, it is important that the student is encouraged to use context cues to confirm an initial decoding attempt rather than as the initial and often, only cue. This "reversal of cue order" is the basis of the current research investigation. It is also the foundation on which remediation programmes for the "phonologically deprived" older disabled readers (such as those in this study) should be based if these readers are to become efficient decoders.

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APPENDICES

Sound Matching Task

Student's Name: _____ **Student Number:** ____

School: _____ **Rime Matching Score:** ____

Date Tested: _____ **Onset Matching Score:** ____

Tester: _____ **Total Score:** ____

I. Rime Matching Task

sail	nail	**boot**
cat	**bell**	hat

1.	**sock**	tray	hay
2.	peg	**cot**	leg
3.	fish	dish	**book**
4.	**bus**	arm	farm
5.	sand	hand	**cup**
6.	hen	**car**	pen
7.	gun	sun	**tap**
8.	wall	**dog**	ball
9.	**paw**	boat	goat

Score: _____

II. Onset Matching Task

cat	car	**hen**
hair	pin	pig

1.	bed	**tree**	bell
2.	**box**	tray	train
3.	coach	**farm**	coat
4.	dog	doll	**sun**
5.	hand	hat	**book**
6.	man	**fish**	mat
7.	**nail**	peg	pen
8.	toad	toast	**girl**
9.	**rain**	bag	bat

Score: _____

Instructions for Sound Matching Task

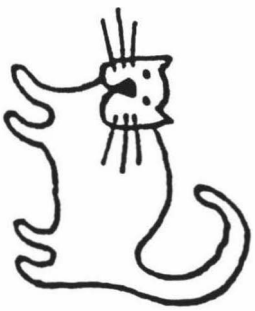
I. Rime Matching Task

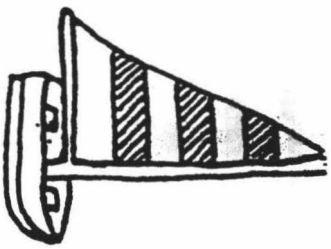
Before the trials begin, ask the child if they know the nursery rhyme **Jack and Jill** and recite the first two lines. "Do you know the nursery rhyme **Jack and Jill**? Jack and Jill went up the _____? Yes, **hill**. **Jill, hill**, they sound the same. **They** rhyme. Can you tell me another word that sounds like **hill**? Yes, good." If the child fails to respond, give them an example (e.g., **fill**). "Does **pill** sound like **hill**? Yes, **hill, pill**. Does **boat** sound like **hill**? No, they don't, do they? **Boat, hill** do not sound the same." Use additional examples until it is established that the child knows that rhyming words sound the same and that non-rhyming words sound different. "Now we're going to play a game about words that sound the same, about words that rhyme. I'm going to say three words. I want you to listen carefully and tell me which two words sound the same." The tester gives the first practice item (**sail, nail, boot**) and points to the corresponding picture as s/he says each word clearly. When the child responds, make sure s/he says the two words when pointing to the corresponding pictures. If the child hesitates, repeat the item. If the child still does not respond, encourage them to have a guess. Praise the child for a correct response. "Yes, **sail** and **nail** sound the same." Provide corrective feedback if the child responds incorrectly. "No, **sail** does not sound like **boot**. **Sail** sounds like **nail**. **Sail, nail**, they sound the same. They rhyme. **Sail, boot**, they don't sound the same. They don't rhyme." Give the second practice item (**cat, bell, hat**) and corrective feedback, if necessary. Then proceed to the test items, but do not give corrective feedback, only general encouragement. Repeat items if the child hesitates. When recording the child's response on the answer sheet, circle the item that they do not select. A point is given for each correct response.

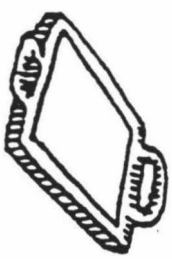
II. Onset Matching Task

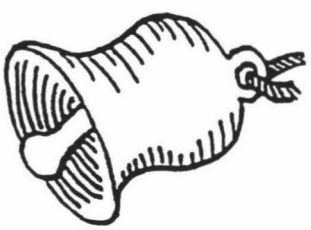
"The next game is a bit different. Some words sound the same at the beginning. Can you say the first sound of your name?" Provide help, if necessary. And then say, "Can you think of any other words that begin with the same sound as your name?" Provide prompts, if necessary. "Here are some other words that sound the same at the beginning, **fun, fish, face**. Each word starts with a **fff** sound. Can you think of any other words that have a **fff** sound at the beginning like **fffun, fffish** and **fffface**?" The tester draws the initial sound out a bit for emphasis. "How about **fun** and **fast**? Do these words sound the same at the beginning?" The tester asks the child about other word pairs with identical onsets (e.g., **fuss, feet; sit, song**) and also about word pairs with different onsets (e.g., **sad, fuss; sit, night**). "Do **fuss** and **feel** start with the same sound? How about **sad** and **fuss**?" Give corrective feedback if necessary. "No, **sssad** and **fffuss** do not start with the same sound. **Sad** starts with a **sss** sound and **fuss** starts with a **fff** sound." Use additional examples until it is established that the child knows that some word pairs start with the same sound but other pairs do not. "Now we're going to play a game about words that sound the same at the beginning. I'm going to say three words. I want you to listen carefully and tell me which two words sound the same at the beginning." The tester gives the first practice item (**cat, car, hen**) and points to the corresponding picture as s/he says each word clearly. When the child responds, make sure s/he says the two words when pointing to the corresponding pictures. If the child hesitates, repeat the item. If the child still does not respond, encourage them to have a guess. Praise the child for a correct response.

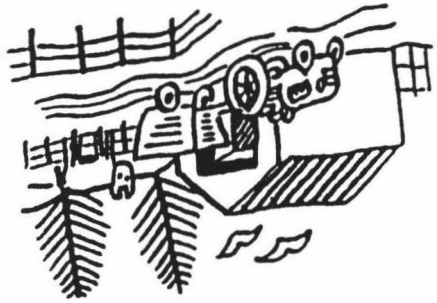
"Yes, **cat** and **car** have the same sound at the beginning." Provide corrective feedback if the child responds incorrectly. "No, **cat** and **hen** do not sound the same at the beginning. **Cat** and **car** sound the same. **Cat, car**, they both start with /k/." Give the second practice item (**hair, pin, pig**) and corrective feedback, if necessary. Then proceed to the test items, but do not give corrective feedback, only general encouragement. Repeat items if the child hesitates. When recording the child's response on the answer sheet, circle the item that they do not select. A point is given for each correct response.

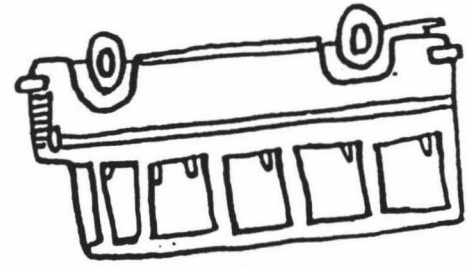


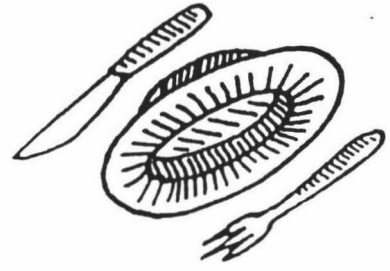


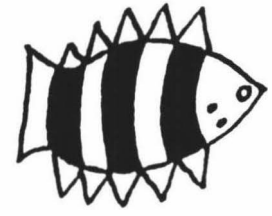


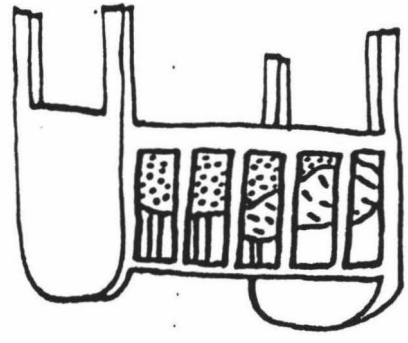


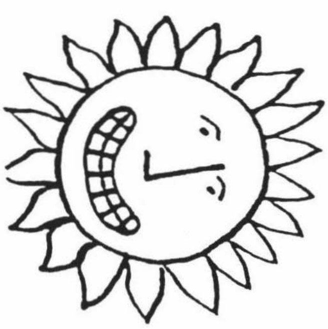


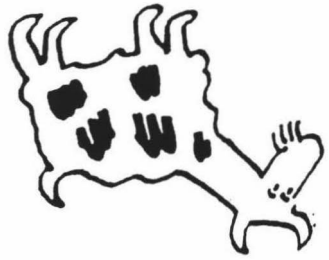


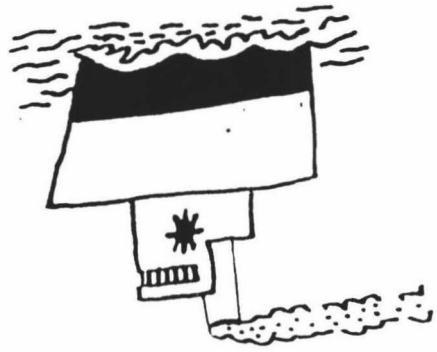


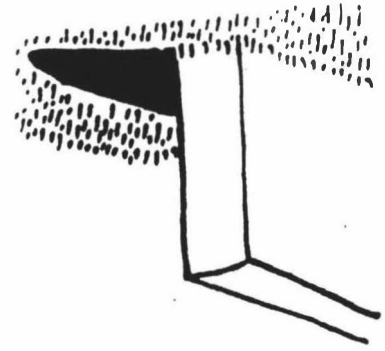


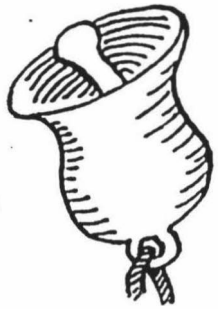


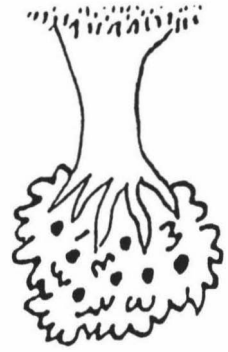


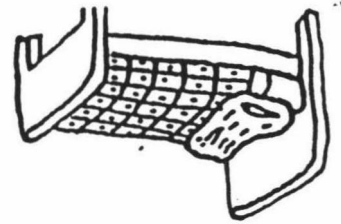


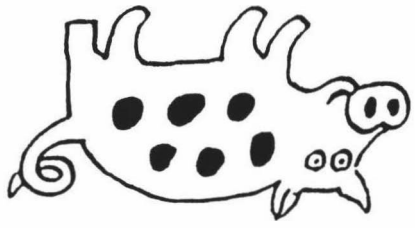


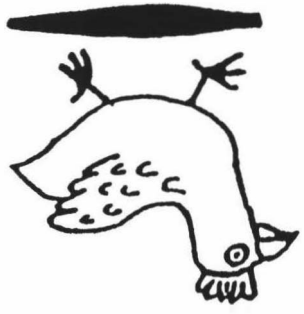


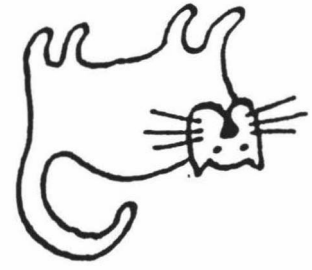


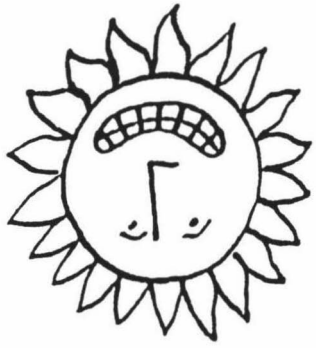


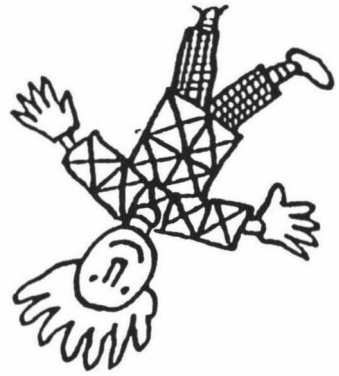


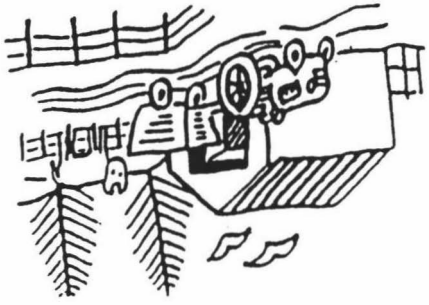


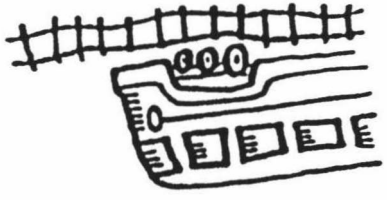


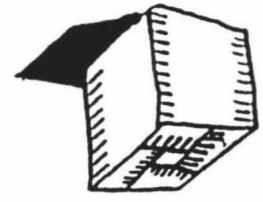




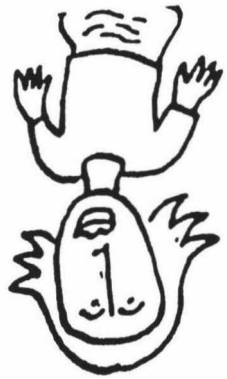


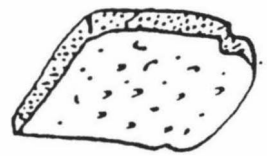


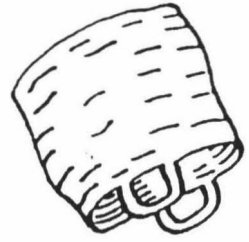


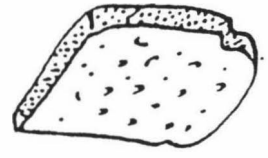


WELCOME









Phoneme Segmentation Task

Student's Name: _____ Student Number: _____

School: _____ v (4,9,16,21): _____

Date Tested: _____ vc (1,8,15,22): _____

Tester: _____ cv (3,11,13,20): _____

Start at item no: _____ cvc (2,7,17,19): _____

cvc (5,10,14,23): _____

ccvc, cvcc (6,12,18,24): _____

Total: _____

Demonstration item: sĭf
Practice items (with corrective feed back): ŭ, ĭv, vĭ, slĭf

Test Items

		Response	Score			Response	Score
1.	ĕk (2)			13.	kĕ (2)		
2.	fĭp (3)			14.	pĭf (3)		
3.	zŏ (2)			15.	ŏz (2)		
4.	ĭ (1)			16.	ĕ (1)		
5.	jăd (3)			17.	bĕk (3)		
6.	zĕlk (4)			18.	prăd (4)		
7.	tŏz (3)			19.	dăj (3)		
8.	ĭp (2)			20.	pĭ (2)		
9.	ă (1)			21.	ŏ (1)		
10.	kĕb (3)			22.	ăj (2)		
11.	jă (2)			23.	zŏt (3)		
12.	krŏb (4)			24.	dĭlt (4)		

Note: ĭ as in sit
ĕ as in set
ŏ as in pot
ă as in sat
ŭ as in nut

Instructions for Phoneme Segmentation Task

"Today we're going to see how many sounds are in some funny sounding names. These are names of children who live in a far away land. I'm going to say a name and then use these counters to break it up into separate sounds. Listen carefully, so that you can learn how to play the game. The first name is **sif**." After saying **sif** the tester pronounces the sounds /s/-/i/-/f/ and **simultaneously** with **each** sound pushes a counter forward. The tester then says, "Did you see how I broke up the name **sif** into sounds? I used one counter for each sound in **sif**, one for /s/, one for /i/ and one for /f/. Now I want you to say the name **sif** and to break it up into separate sounds just like I did. Use the counters and leave a gap between each sound". If necessary, the task is demonstrated again and the child is asked to copy what he/she was shown. The tester then moves on to the four practice items. "I'm going to say some more names and I want you to say them and then break them up into sounds using the counters. Some of these words may have more sounds than others." It is important to have the child repeat the name first to make sure s/he has heard it correctly. If the child does not pronounce a name correctly, the tester should immediately correct the pronunciation before the child attempts to break the word into sounds. If the child makes a mistake on any practice item, corrective feedback is given by repeating the instructions and procedures.

The tester introduces the test items by saying "Now I am going to say some more funny names. Use the counters to break them up into separate sounds. Only say the sounds that you hear. Leave a gap between each sound". The tester asks the child to repeat each item before attempting to segment it. The child's pronunciation is corrected if necessary. No corrective feedback is given for the child's segmentation attempts during the test, only general encouragement. Order of presentation of test items should be rotated across subjects; that is, the first subject starts on item 1, the second on item 2 etc.

Scoring

When scoring the children's responses, record what the child actually says (e.g., /t/-/oz/, or /t/-/o/-/z/) and the **number** of sound segments produced for each item. A point is given for each item correctly segmented.

Pseudoword Reading Task

Student's Name: _____ **Student number:** ____

School: _____ **Total correct:** ____

Date tested: _____ **Total points:** ____

Tester: _____

		Response	Points			Response	Points
1.	jit (3)			16.	clave (4)		
2.	med (3)			17.	chove (3)		
3.	dut (3)			18.	grake (4)		
4.	wob (3)			19.	trobe (4)		
5.	pag (3)			20.	drime (4)		
6.	thut (3)			21.	roud (3)		
7.	sath (3)			22.	zoin (3)		
8.	glick (4)			23.	taw (2)		
9.	blesh (4)			24.	woaf (3)		
10.	brop (4)			25.	dail (3)		
11.	mide (3)			26.	prew (3)		
12.	fute (3)			27.	thrain (4)		
13.	voze (3)			28.	froice (4)		
14.	pake (3)			29.	spound (5)		
15.	sone (3)			30.	fleach (4)		

Instructions for Pseudoword Naming Task

"Today I'm going to show you some funny sounding names. These are the names of children who live in a far away land. Let's pretend that we are going to visit these children and want to learn to say their names the way they do. You can read their names only if you sound them out. Remember, do not try to make them into real words. Let's try this one." The tester presents the first practice item and encourages the child to sound it out. If the child fails to respond correctly, or fails to respond after 5 to 10 seconds, the tester demonstrates how to sound out the item. "This letter makes an e sound and this letter makes a z sound, so the name is e - z, ez." The tester presents the second practice item and, if necessary, demonstrates how to sound out the item. "OK, now let's see if you can play the game. I'm going to show you some names and I want to see if you can tell me how to say them." The tester encourages the child to sound out each name. If the child makes a real word response, the tester reminds him/her that the right answer cannot be a real word. If the child reads a name in syllables (e.g., *juh-i-tuh*), the tester says to the child: "OK, what name does that make?" Throughout the test session the tester gives positive feedback of a nonspecific nature when appropriate - "nice", "good job", etc. However, corrective feedback should not be given. If the child fails to attempt any item on two consecutive word lists, the session can be terminated. All remaining items are scored as incorrect.

When an item is incorrectly pronounced, the tester records the child's mispronunciation according to the following code:

PRONUNCIATION KEY

Sound Symbol	Example	Sound Symbol	Example	Sound Symbol	Example
a	lag	ô	tone	ŕr	tow'ŕ
e	fleah	o	cute	k	cute
i	hit	öö	threw	z	vig'it
o	log	o͝o	foot	ə	pen'əl
u	nut	oi	choice	j	sau'sage
ā	take	ou	loud	th	thin
ē	preach	ô	raw	th	then
ī	hide	ə	a woké	ks	ek plode'

NOTE: Common consonant sounds are represented by the letters themselves (e.g., n as in nut; f as in fed).

The correct pronunciation(s) and common errors for each of the items of the pseudoword naming task are given below:

Word	Correct Pronunciation(s)	Common Errors
jit	jit	jit, jet
med	med	mid, met
dut	dut	dōōt
wob	wob	wub, wod
pag	pag	peg, pāj
thut	thut, thut	thōōt, thrut
sath	sath, sath	sāth, sat
glick	glik	klik
blesh	blesh	blish, bles
brop	brop	brōp, prop
mide	mid	mid
fute	fut, fōōt	fut, fōōt
voze	vōz	vō zē
pake	pāk	pa kē
sone	sōn	swun, zōn, sō nē
clave	klāv	krāv
chove	chōv	chōōv, shuv
grake	grāk	krāk
trobe	trōb	throb, trōōb
drime	drim	drem, dim
roud	roud	round, rōōd
zoin	zoin	zōn, zo in
law	tò	tou, thō
woaf	wōf	wōōf
dail	dāl	dil
prew	prōō	pōōt, prou
thrain	thrān	trān
froice	frois	frōd, foi sē
spound	spound	spoud
fleach	fletch, fletch	flesh, flēs

Two scoring procedures are used. The first is simply the total number of correct pronunciations. In the second procedure, each item is scored according to the number of sounds in the items that are correctly pronounced (the number in parentheses next to each item on the scoring sheet indicates the maximum possible points for each item). For example, if the child correctly pronounces the first item, s/he receives 3 points. However, if *jit* is pronounced *jet* or *jut* or *jid*, only 2 points are given. If *jit* is pronounced *jab*, *hid*, or *bat*, only 1 point is given.

Practise words:	ez	saf

Test words:

jit	med	dut	wob	pag
thut	sath	glick	blesh	brop
mide	fute	voze	pake	sone
clave	chove	grake	trobe	drime
roud	zoin	taw	woaf	dail
prew	thrain	froice	spound	fleach

Appendix D

Words With Common Rime Units Task

(Form 1)

Student's Name: _____ **Student Number:** _____

School: _____ **Form Number:** 1

Date Tested: _____ **Grouped Presentation Score:** _____

Tester: _____ **Random Presentation Score:** _____

Total Score: _____

cat _____	**hat** _____	**bat** _____	**fat** _____
will _____	jump _____	stop _____	thank _____
back _____	**sack** _____	**pack** _____	**tack** _____
ride _____	day _____	eat _____	pick _____
well _____	**fell** _____	**bell** _____	**yell** _____
not _____	fill _____	bump _____	top _____
truck _____	**duck** _____	**luck** _____	**suck** _____
bank _____	side _____	may _____	meat _____
can _____	**fan** _____	**pan** _____	**van** _____
kick _____	hot _____	bill _____	lump _____
tail _____	**mail** _____	**sail** _____	**jail** _____
hop _____	tank _____	hide _____	hay _____
make _____	**lake** _____	**cake** _____	**rake** _____
heat _____	sick _____	lot _____	kill _____
sit _____	**hit** _____	**bit** _____	**fit** _____
dump _____	pop _____	sank _____	slide _____
right _____	**tight** _____	**fight** _____	**light** _____
pay _____	seat _____	lick _____	cot _____

Instructions for Words With Common Rime Units Task

There are two forms (and corresponding stimulus sheets) for the Words with Common Rime Units Task. The forms will be rotated across children. That is, you should use Form 1 with the first child tested, Form 2 with the second child tested, Form 1 with the third child tested, and so on.

Introduce the task by saying to the child, "Here are some words I'd like to see if you can read". Expose each of the 18 rows one at a time by placing a sheet of paper over the remaining words and moving the sheet downward to expose each new row of words. Pointing to each word in the row, ask the child, "Can you read this word?" The test is untimed and the child should not be hurried into making a response.. However, do not help the child with any of the words and do not give corrective feedback. Give only general encouragement. Guessing may be encouraged where a particular word may not be known. Give the child opportunity to attempt all the words. Where the response is correct, record with a tick.Record all the actual incorrect responses the child makes.

Scoring

A point is given for each word correctly read. Self-corrections are counted as correct. Compute separate scores for the words presented in rime groups (rows 1, 3, 5, 7, 9, 11, 13, 15, 17) and for words presented in random (non-contiguous) order (rows 2, 4, 6, 8, 10, 12, 14, 16, 18). Then compute the total words score. When a non-word or partial word response is given, record the child's pronunciation according to the following code:

Pronunciation Key

Sound Symbol	Example	Sound Symbol	Example	Sound Symbol	Example
a	lag	ô	tone	ẽr	tow'ẽr
e	flesh	û	cute	k	cute
i	hit	o͞o	threw	z	viz'it
o	jog	o͝o	foot	ə	pen'səl
u	nut	oi	choice	j	sau'əge
ā	fake	ou	loud	th	thin
ē	preach	ô	raw	th	then
ī	hide	ə	ə woke	ks	ek splode'

NOTE: Common consonant sounds are represented by the letters themselves (e.g., n as in nut; f as in fed).

Words With Common Rime Units Task

F1

cat	hat	bat	fat
will	jump	stop	thank
back	sack	pack	tack
ride	day	eat	pick
well	fell	bell	yell
not	fill	bump	top
truck	duck	luck	suck
bank	side	may	meat
can	fan	pan	van
kick	hot	bill	lump
tail	mail	sail	jail
hop	tank	hide	hay
make	lake	cake	rake
heat	sick	lot	kill
sit	hit	bit	fit
dump	pop	sank	slide
right	tight	fight	light
pay	seat	lick	cot

Words With Common Rime Units Task

(Form 2)

Student's Name: _____ **Student Number:** _____

School: _____ **Form Number:** 2

Date Tested: _____ **Grouped Presentation Score:** _____

Tester: _____ **Random Presentation Score:** _____

Total Score: _____

stop	_____	**top**	_____	**hop**	_____	**pop**	_____
cat	_____	back	_____	well	_____	can	_____
will	_____	**fill**	_____	**bill**	_____	**kill**	_____
truck	_____	tail	_____	sit	_____	make	_____
jump	_____	**bump**	_____	**lump**	_____	**dump**	_____
right	_____	hat	_____	sack	_____	fell	_____
ride	_____	**side**	_____	**hide**	_____	**slide**	_____
fan	_____	duck	_____	mail	_____	hit	_____
day	_____	**may**	_____	**hay**	_____	**pay**	_____
lake	_____	tight	_____	bat	_____	pack	_____
eat	_____	**meat**	_____	**heat**	_____	**seat**	_____
bell	_____	pan	_____	luck	_____	sail	_____
pick	_____	**kick**	_____	**sick**	_____	**lick**	_____
bit	_____	cake	_____	fight	_____	fat	_____
not	_____	**hot**	_____	**lot**	_____	**cot**	_____
tack	_____	yell	_____	van	_____	suck	_____
thank	_____	**bank**	_____	**tank**	_____	**sank**	_____
jail	_____	fit	_____	rake	_____	light	_____

Words With Common Rime Units Task

F2

stop	top	hop	pop
cat	back	well	can
will	fill	bill	kill
truck	tail	sit	make
jump	bump	lump	dump
right	hat	sack	fell
ride	side	hide	slide
fan	duck	mail	hit
day	may	hay	pay
lake	tight	bat	pack
eat	meat	heat	seat
bell	pan	luck	sail
pick	kick	sick	lick
bit	cake	fight	fat
not	hot	lot	cot
tack	yell	van	suck
thank	bank	tank	sank
jail	fit	rake	light

Rime Spelling Unit Identification Task

Student's name: _____ **Rime correct** _____

School _____ **Embed correct** _____

Date: _____ **Total correct** _____

---

plan village

---

crack	___	sight	___
suitable	____	ticket	____
shake	___	pot	___
luggage	___	creature	___
chest	___	coke	___
smokes	___	question	___
wheat	___	hug	___
cotton	___	brakes	___
trick	___	fruit	___
frighten	___	package	___

Instructions for Rime Spelling Unit Identification Task

"I'm going to read you some words and then say one part of each word. When I say the part, I want you to draw a circle around this part with your pencil". The tester reads the first practice word **plan** then says "Now circle the part that says **an**". If the child circles the wrong part the tester corrects this by circling the correct part. The tester then pronounces the second practice word **village** and says "Now circle the part that says **ill**". Again, if the child circles the wrong part the tester corrects this by circling the correct part. The tester then pronounces each word slowly and clearly pausing to then pronounce the target unit for the child to circle. No corrective feedback is given during the actual testing procedures. Words are read going down the left column first then down the right one so that target units' positions are alternated between rimes and embedded.

Scoring

Scoring is based on the total number of target units correctly identified. Two scores will be computed: one for the number of rime units correctly identified and one for the number of embedded units identified. The correct target units are as follows:

cr **ack**	s **ight**
s **uit** able	t **ick** et
sh **ake**	p **ot**
l **ug** gage	cr **eat** ure
ch **est**	c **oke**
sm **oke** s	qu **est** ion
wh **eat**	h **ug**
c **ot** ton	br **ake** s
tr **ick**	fr **uit**
fr **ight** en	p **ack** age

Training Materials For Rime Analogy And m-specific Training Groups

Training Cycle Number	Rime Spelling Units (Wylie & Durrell, 1970)	Target Words (Elley & Croft, 1989) Rime	Embedded	Spell Primes
1	eat	meat	heater	seat, beat, neat
	an	pan	lantern	can, ran, man
	op	top	property	hop, shop, stop
2	in	tin	finish	win, bin, pin
	ay	hay	crayon	play, day, say
	ell	bell	fellow	well, tell, shell
3	ill	pill	willow	hill, fill, mill
	ap	trap	chapter	tap, map, lap
	ot	lot	pottery	cot, got, not
4	ing	ring	finger	wing, sing, thing
	ack	pack	jacket	back, sack, black
	est	rest	forests	nest, test, best
5	ank	tank	blanket	bank, thank, sank
	ine	pine	vines	fine, wine, line
	ail	rail	sailor	nail, tail, sail
6	at	hat	battery	cat, bat, fat
	ug	jug	buggy	rug, bug, dug
	ip	tip	lipstick	lip, rip, nip
7	it	pit	mitten	bit, hit, sit
	ate	mate	dates	gate, late, hate
	uck	luck	bucket	duck, suck, truck
8	ink	drink	sinks	sink, pink, think
	ash	cash	flashes	dash, gash, bash
	ice	price	slices	mice, rice, ice
9	ake	lake	flakes	cake, bake, make
	ide	tide	rides	side, hide, wide
	ock	clock	rocket	sock, lock, frock
10	ight	night	lightning	fight, right, might
	ore	store	forehead	shore, sore, more
	ame	name	flames	dame, came, game
11	unk	bunk	trunks	junk, sunk, drunk
	ain	rain	painter	train, again, main
	aw	jaw	dawn	paw, claw, saw
12	ump	bump	pumpkin	jump, lump, dump
	ick	chick	cricket	pick, sick, lick
	ale	gale	males	tale, sale, pale

Appendix G

Rime Unit Analogy Training Work-sheet Number 1

SHEET 1 Name_____ School_____ Date started _____ FORM A

meat	**pan**	**top**	No. correct
heater	**lantern**	**property**	

1	2	3

DAY 1

pan	**top**	**meat**	No. correct.
property	**heater**	**lantern**	

DAY 2

heater	**pan**	**lantern**	No. correct
top	**property**	**meat**	

DAY 3

Spell Primes (Cut out) Date Finished_____ No. of lessons (circle): 3, 4, 5

1	2	3
seat	can	hop
beat	ran	shop
neat	man	stop

Appendix H

Item-specific Training Work-sheet Number 1

SHEET 1 Name_____ School_____ Date started _____ FORM B

	meat	**pan**	**top**	No. correct
	heater	**lantern**	**property**	

DAY 1

1		2		3	

The **meat** pie was hot. Cook it in the **pan**. The **top** spun fast. The **heater** made them warm. The **lantern** was bright. The sock was in the lost **property** box.	No. correct

DAY 2

	heater	**pan**	**lantern**
	top	**property**	**meat**

No. correct

DAY 3

Spell Primes (Cut out)

Date Finished_____

No. of lessons (circle): 3, 4, 5

1	2	3
seat	beat	stop
can	shop	neat
hop	ran	man