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Word reading strategies: A replication and follow up intervention

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**WORD READING STRATEGIES:
A REPLICATION AND FOLLOW UP INTERVENTION**

by

Andrew Davoll

B.A. (Education)

A Thesis Submitted in Partial Fulfilment of the
Requirements for the Award of
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USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

ABSTRACT

The first stage of this study involved a replication of the cluster analysis procedures used by Freebody and Byrne (1988) to classify Year 2 readers according to their word reading strategies based on lists of irregular and pseudowords. A four-cluster-solution produced three groups similar to those reported by Freebody and Byrne (1988), and a fourth group which could not be classified using their criteria. A three-cluster-solution produced a more parsimonious interpretation, with these groups meeting the criteria for "LB" (low on both irregular and pseudowords), "HB" (high on both), and "Phoenician" readers (average or above on pseudoword, low on irregular words). There was no evidence of a discrete group of "Chinese" readers (low on pseudowords, average or above average on irregular words). These results were interpreted in the context of stage models of reading development.

A replication was carried out of Freebody and Byrne's (1988) examination of differences in the phonemic awareness abilities of the subjects grouped on the basis of the four-cluster-solution. Subjects were tested using the initial-consonant-ellipsis and the final-consonant-matching tasks. Three additional phonemic awareness tasks were also used: telescoping, segmenting and rhyming. Results showed unacceptable reliability of the telescoping, segmenting and final consonant-matching tasks, coupled with ceiling effects for telescoping and segmenting. Consequently, only the results from the combined initial-consonant-ellipsis and final-consonant-matching tasks, and the rhyming tasks were used. Consistent with the findings of Freebody and Byrne (1988), the LB group showed significantly lower phonemic awareness than the other groups combined, the HB group

showed the reverse outcome. This finding is consistent with previous research that has shown a relationship between phonemic awareness and reading achievement. There was a significant difference for the remaining two groups, but only on the rhyming task in favour of the Phoenician readers, reflecting their ability to recognise sound patterns within words.

The second stage of the study consisted of a single subject design investigation in which baseline data was collected for six (LB) subjects. As the requirement of stable and level baselines was not met for five of the six subjects, the decision was made to implement a changing criterion design with the other subject. He was given explicit instruction in which he was taught to discriminate between the letters he previously confused, and the strategy of sounding out regular word types without stopping between sounds. His daily data showed that by the end of the intervention phase, consisting of 16 half-hour teaching sessions, he had reached criteria in reading mixed regular word types. In addition, his post-test score on the pseudoword list indicated that he would now qualify as a Phoenician reader. Further research is required to investigate the extent to which changes in word reading strategy can be brought about by instruction.

DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due reference is made in the text.

Signature

Date 29/12/93

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CHAPTER 1

INTRODUCTION

1.1 Background

The significance of differences in word reading strategies used by beginning readers has become increasingly evident in recent years. Some recent research has focused on the classification of students according to the predominant word strategies they use. Freebody and Byrne (1988) and Byrne, Freebody and Gates (1992) found evidence of four distinct sub-groups of readers in Grades 2, 3, and 4. Some children (called "Chinese" readers) had average or above average scores on irregular words but substantially below average scores on nonsense or "pseudowords" which required phonic decoding skills. Others (called "Phoenician" readers) showed average, or slightly above average, pseudoword scores but poor irregular word reading. A third group, called "High on Both" (HB) performed above average on irregular and pseudowords. The fourth group, called "Low on Both" (LB) performed below average on both types of words. A central focus of this study was to investigate whether a replication of the word classification procedures carried out by Freebody and Byrne (1988) would produce the same groups of readers in a primary school in Western Australia.

Byrne et al (1992) carried out a longitudinal study to follow up the children from the 1988 study. They reported that, between Grades 2 and 4, when compared to Phoenician readers, Chinese readers showed a progressive deterioration in word attack skills (reading pseudowords), in word specific associations (reading irregular words) and in reading comprehension. In

contrast, Phoenician readers maintained their superiority in word attack skills and improved in their reading of irregular words relative to Chinese readers. They also showed improvement in reading comprehension that appeared to be sustained into 4th grade. Overall, the LB group achieved the poorest word reading and reading comprehension achievement scores, while the HB readers attained the best results in both measures.

These authors also found that measures of phonemic awareness (the ability to reflect on and manipulate phonemes) were stable for all groups over the two year period of their study. The HB readers' phonemic awareness was superior to that of the other groups. The LB group displayed the lowest performance on each of these measures. Freebody and Byrne (1988) had predicted that Phoenician readers would be significantly better than Chinese readers on measures of phonemic awareness. In fact, Byrne et al (1992) failed to find a significant difference in phonemic awareness between Phoenician and Chinese readers. They argued that this may indicate that phonemic awareness, while a necessary prerequisite, may not be a sufficient condition for reading acquisition, citing evidence from Byrne and Fielding-Barnsley (1989) and Tunmer, Herriman and Nesdale (1988).

An alternative explanation for the failure to find significant differences between the phonemic awareness scores of Phoenician and Chinese readers, may be attributable to the actual measures used by Freebody and Byrne (1988) and Byrne et al (1992). They used an initial-consonant-elision task which required the student to say a word minus its initial-consonant. In addition, a final-consonant-matching measure was employed which required the student to listen to a word and then choose from three spoken words, the one that had the same end-sound as the

target word.

Carnine, Silbert and Kameenui (1990) identified three phonemic awareness skills that they recommended teaching to beginning readers as a basis for later reading strategies, including sounding out words. The phonemic awareness skills (which they call auditory skills) on which they focused are segmenting words into phonemes, telescoping sounds into words said at normal speaking rate, and rhyming words.

Stanovich, Cunningham, and Cramer (1984) compared ten tests of phonemic awareness, representing five task types, in terms of their difficulty for young children. The telescoping and segmenting tasks recommended by Carnine et al (1990) were not included in their comparison. They did, however, include the three rhyming tests: a rhyme production, rhyme selection and rhyme substitution task. It was found that these were the easiest for children to complete, which may account for them not correlating highly with other phonemic awareness measures examined. Both Carnine et al (1990) and Adams (1990) considered that auditory telescoping (blending of sounds together) and segmenting tasks are simple and powerful tests of a child's understanding of the nature and function of phonemes. These tasks are justified by Carnine et al (1990) on the grounds that they are component skills required for learning the strategy of sounding out words and not on the grounds that they necessarily predict future reading achievement as such. Rhyming is recommended by Carnine et al (1990) as it is a valuable procedure for helping students learning to blend stop sounds, e.g. c-at. (The distinction between stop sounds and continuous sounds is made on the basis of whether or not the sound can be said continuously without changing its

pronunciation).

Yopp (1988) also investigated a variety of phonemic awareness tasks, including a phoneme blending test similar to the telescoping task of Carnine et al (1990), and a phoneme segmentation test which also resembled closely the one presented by Carnine et al (1990). Yopp (1988) concluded that there seem to be two levels of phonemic awareness which she called "simple" and "compound" phonemic awareness. On the basis of a factor analysis, she found that the segmentation test had the highest loading of the simple phonemic awareness tasks. She also found that phoneme deletion tasks, which were similar to the initial-consonant-elision task used by Freebody and Byrne (1988), were the most useful of the compound tasks. She concluded that use of a combination of simple and compound tasks was the best way of assessing phonemic awareness. Yopp (1988) also felt that the rhyming task tapped a different type of underlying ability than other tests of phonemic awareness. This interpretation is consistent with the position put forward by Carnine et al (1990) that rhyming should be taught as a means of assisting the beginning reader to telescope stop sounds to continuous sounds because rhyming demonstrates similarity in sound patterns contained in words.

Given the claims concerning these three auditory skills in terms of early reading instruction (Carnine et al, 1990), it was decided to include measures of these skills in this study in order to undertake an analysis of their relationship to groups of readers classified by their word reading strategy. In addition, a replication of the analysis of the phonemic awareness of different groups, using the same tests as Freebody and Byrne (1988) was undertaken.

The issue of whether the type of reading instruction offered to these students could influence their preferred reading style, is also a potential confounding variable. Byrne et al (1992) acknowledge that the Phoenician and Chinese readers exhibited selected deficiencies, while the LB readers were considered as having the most need of remediation. The question of which remediation strategies would be most appropriate to these readers, was addressed in their conclusion, (Byrne et al, 1992, p.150) where they stated:

because the study included no experimental intervention, we are not in a position to recommend remedial strategies for these groups (assuming they are needed), but from the point of view of both theory and practice, we should be alert to the possibility that the problems of children who begin to fall behind their class mates in core word identification skills, may be magnified in later school years (Stanovich, 1986).

Following on from Freebody and Byrne (1988) and the Byrne et al (1992) studies, it was planned that a small number of individual LB readers would receive explicit decoding instruction since this group of readers are most clearly in need of remedial help.

1.2 Research questions

The following research questions were investigated in this study:

- 1. Does a replication of the word reading measures and cluster analysis used by Freebody and Byrne (1988) with Grade 2 (Year 2) students result in their classification into the following groups: HB, LB, Chinese, and Phoenician?**
- 2. Is there a statistically significant difference between the phonemic awareness skills (measured by initial-consonant elision and final-consonant matching; and segmenting, telescoping and rhyming) of groups of students classified by word reading strategy?**
- 3. Is there evidence that the reading of regular words by individual students, classified as LB readers, improves with systematic decoding instruction?**
- 4. Is there evidence of increased ability to read pseudowords by individual students classified as LB readers who receive systematic decoding instruction?**

1.3 Definitton of key terms

In this thesis the terms listed below will be defined as follows:

- "Decoding": The act of converting a printed word into spoken language, either spoken aloud or subvocalized. Synonymous with "phonological recoding".
- "Irregular word": Any word in which one or more letters does not represent its most common sound (e.g. *was*), or any word in which two or more consecutive letters do not represent their most common sound (e.g. *flood*). Synonymous with "exception" words.
- "Phonemic Awareness": The ability to perceive a spoken word as a sequence of sounds and manipulate individual sounds in the speech stream.
- "Pseudoword": A sequence of letters which can be pronounced as a word using the most common sound of each letter or letter combination, but which has no meaning. (E.g. *morut*). Synonyms include: "nonword", "nonsense" word, and "synthetic" word.
- "Regular word": Any word that can be pronounced using the most common sound of each letter, or the most common sound of a sequence of letters (e.g. *went*).
- "Segmenting" The procedure by which a child says each of the component sounds in a word in sequence. (E.g. *mmm/ aaa/ nnn*).

- **"Sight word":** A word that is identified instantly.
- **"Sounding out":** The procedure by which a child says the letter-sounds for each letter in a word in sequence, which may not result in the child pronouncing the word in its usual spoken form. (E.g. child may sound out "cuh-a-tah" but fail to say "cat").
- **"Telescoping":** The procedure whereby the child says the sound for each successive letter of a word without stopping between sounds. (E.g. mmmmaannn). Synonymous with "blending".
- **"Word reading strategy":** The typical procedure or procedures that the child uses to recognise a word, operationally defined by the child's score on irregular word lists and pseudoword lists. Four types of word reading strategy have been defined by Freebody and Byrne (1988) as:
 - **LB (low on both):** Readers who score well below average on both irregular and pseudoword lists.
 - **HB (high on both):** Readers who perform well above average on both irregular and pseudoword lists.
 - **Phoenician:** Readers who perform average or better on pseudoword, but below average on irregular words.
 - **Chinese:** Readers who perform average or better on irregular

words, but below average on pseudoword lists.

- **"Word recognition":** The identification of a printed word, generally evidenced by saying the word aloud. Synonymous with "word identification".

CHAPTER 2

MODELS OF READING DEVELOPMENT

This study was developed and conceptualised within a theoretical framework based on stage models of reading development such as those proposed by Chall (1983), Frith (1985, 1986) and Ehri (1991). These models place initial emphasis on word recognition as the first step in the process of learning to read, that is the ability to pronounce printed words that are presented in isolation, without the support of context or picture cues. Research continues to indicate that word recognition is vital to the whole reading process. According to Groff and Seymour (1987) "as understanding constitutes the foundation for successful comprehension, so is word recognition the key element for understanding written material" (p. viii). They cited Gough (1984) who argued that word recognition is the foundation of the reading process. This emphasis on word recognition should not be seen as detracting from the ultimate goal of reading, namely, deriving meaning from print. Word recognition is considered by Stanovich (1991) as a necessary but not sufficient condition for comprehension. He noted that "a lack of skill at recognizing words is always a reasonable predictor of difficulties in developing reading comprehension ability" (p. 418).

Early reading acquisition has been found to be highly correlated with skill in word recognition (Biemiller, 1977-1978; Gough and Hillinger, 1980; Juel, 1991; Juel, Griffith and Gough, 1986; Perfetti, 1985; Stanovich, 1982, 1985, 1986; Stanovich, Cunningham and Feeman, 1984). Furthermore, some view this relationship as being causal, in that a child who develops word recognition skills is able to develop corresponding

reading comprehension ability (Chall 1989; Herman, 1985; Lesgold, Resnick, and Hammond, 1985; Stanovich, 1985). Stanovich (1986) saw this relationship as a case of reciprocal causation: while word recognition facilitates comprehension, so too does understanding what is read assist with word recognition. This relationship is especially important for the novice reader as the proportion of variance accounted for by word recognition decreases as reading ability increases (Chall, 1983; Stanovich, Cunningham and Feeman, 1984). Nonetheless, word recognition in adults is still considered vitally important for comprehension (Perfetti, 1985).

What follows is a discussion of stage models of reading acquisition all of which assign importance to children learning to decode words. Throughout this thesis the term "decode" will be used to refer to "the act of converting a printed word into spoken language, either spoken aloud or subvocalized" (Gross and Seymour, 1987). "Word recognition" is similar in meaning but not identical since context cues or other strategies may also be employed when identifying a printed word.

A common assumption of these models of reading development is that there are qualitatively different stages through which a beginning reader passes (Chall, 1979, 1983; Ehri and Wilce, 1985, 1987a; Ehri, 1991; Frith, 1985, 1986; Gough and Hillinger, 1980; Marsh, Friedman, Desberg, and Saterdahl 1981; Mason 1980). These stage models view the development of literacy not as a single process, as do the Goodmans (1979) but one in which, "qualitative differences emerge over time as the reader gains new and more efficient ways to identify printed words" (Juel, 1991, p. 762). For example, in Ehri's (1991) model of reading acquisition, the process is not seen as a smooth and gradual development, but as a series

of qualitative changes, with possible temporary regression at the start of transition between stages. Each phase of development is seen as building upon and refining earlier skills that have been acquired in previous stages. Chall (1983) warned that her reading stages should not be seen as fixed or static, noting that readers can begin to make a transition to the following stage from any point of a preceding stage.

The beginning reader's increasing knowledge about orthography is viewed as being more important for word identification, than improved syntactic or semantic ability (Chall, 1983, 1989). Each stage reveals differences in the processes used to identify printed words as well as the reader's control of these processes (Chall, 1989; Ehri, 1991, 1992). In each stage it is thought that children use a dominant strategy in order to identify words (Frith, 1986). Changes in the reader's strategies for word identification are seen as reflecting advances in their reading development.

The major stage models of reading development proposed by Chall, Ehri and Frith share significant similarities in the way that beginning readers are thought to develop literacy skills. There is general agreement that initially there is some sort of prereading phase, followed by a stage in which the child learns to break the alphabetic code. This knowledge is then assimilated into more sophisticated strategies for word identification. These general stages are described below, with particular reference to commonalities in the models of Chall (1983), Frith (1985, 1986), and Ehri (1991).

2.1 Initial prereading stage

Frith (1985, 1986) named this the "logographic" stage. It has also been called "code reading" by Gough and Hillinger (1980) and "visual cue reading" by Ehri (1987). This phase begins with the realisation that a printed word carries meaning for the reader. The logographic reader uses strictly visual stimuli found in the written word in order to identify and discriminate between words. They do not process words as visual Gestalts, instead, they select a restricted portion of the word's orthography, a salient graphic cue, and connect this with the word in memory (Gough, Juel and Griffith, 1992). Examples of this include the shape of a letter contained in a word, the visual configuration of a word, the length of a word, the logo or other environmental features that accompany a word, and a word's first letter. It is possible to select and remember a visual cue that is related to a word's meaning, e.g. two "eyes" in the word *look*. The limitation associated with a logographic strategy for identifying words is that it is difficult for the reader to find meaning-based clues in the majority of English words. Also, as more words are encountered it becomes extremely difficult for the reader to find enough visual cues to distinguish between words as many words have similar spellings. For example, using the "tail" in the word *monkey* to identify the word as "monkey" will no longer work when the child meets the word *money* in print. Ehri (1991) viewed the approach of the early visual reader in attempting to read words as being naturally unanalytical, unsystematic and arbitrary.

Gough and Hillinger (1980) considered this process of using visual cues in order to read words an example of paired-associate learning. In this case the reader associates a written word and its identity in lexical memory with

a salient visual feature of the word.

Mason (1980) described children at this stage as being "context dependent" readers. Through the use of environmental stimuli, context clues, or by "reading" a book's illustrations these children may be able to guess a word although reading the same word out of context is very difficult. McGee, Lomax and Head's (1988) research has shown that logographic readers do notice letters in environmentally printed language. "What they lack is the ability to use letters they recognise in remembering how to read words" (Ehri, 1991, p. 389). Poor performance on a spelling memory task by logographic readers confirmed that letter cues were not utilised in memory to read words (Ehri and Wilce, 1985). They concluded that visual associations are less powerful mnemonically than letter-sound associations.

Ehri (1991) argued that one reason why logographic readers do not remember letters in words is that they have not mastered letter names or sounds. Byrne (1992) confirmed that logographic readers have an intrinsic inclination to construct associations between the printed word and speech at word level but not at the level of phonemes. It is when these initial visual readers begin to read and spell words by processing letter-sound relations that they are able to move into the next stage of early reading development.

2.2 Alphabetic reading stage

The phonemic awareness skills of sequential sound ordering, sound segmentation and blending are seen as the evidence of the alphabetic

strategy by Frith (1986):

By ALPHABETIC I mean letter-sound by letter-sound analysis, a strictly sequential putting together of sounds to evoke a word. Each letter is important and the order it is in. A much quoted example is "cuh-a-tuh" which, remarkable as it is, reminds the child of "cat". More straightforwardly one can say that a child blends together the sounds into a word (p. 72).

Whereas Chall (1983) and Frith (1985, 1986) described a single alphabetic stage, Ehri (1987, 1989a, 1991) and Ehri and Wilce (1985, 1987a, 1987b) preferred to view readers, in this stage, moving from transitional or rudimentary alphabetic readers to true alphabetic readers. Readers who have just begun to use phonological skills and letter-sound correspondences, called phonetic cue readers by Ehri (1991), were characterised as children who "associated only some of the letters seen in spellings to sounds detected in pronunciations" (p. 391). Typically, the use of initial or final sounds detected in a word assisted readers to access routes in memory that were more systematic, due to the nature of letter-sound correspondences that they knew. Although these rudimentary alphabetic readers still read words by sight, they show evidence of a strategy of using letter identity knowledge as cues for remembering how to read sight words. To quote Juel (1991) "children appear to read by reaching into mental storage for words they know are likely candidates for a printed word and retrieving one that contains some of the letters of the unrecognizable word" (p. 767). The ability to master some letter sounds and read a few words in isolation is thought by Ehri and Wilce (1985) to signify the transition from logographic to rudimentary alphabetic reading.

The true alphabetic reader has the ability to translate spellings into sounds by application of letter-sound rules and then recognise the identities of words from their pronunciations (a process that is described by Ehri, 1991 as phonological recoding). Gough and Hillinger (1980), using the term "cipher reader", characterised the child at this stage, as a reader who is able to master a system of rules by which letters and letter sequences map onto speech sounds, known as phonological forms. Marsh et al (1981) differentiated two types of phonological recoding skill. Sequential decoding is evident when a child uses a simple sequential strategy to map one-to-one correspondences. This occurs before what they describe as hierarchical decoding, in which readers are able to accommodate conditional rules (e.g. the letter *c* is pronounced /k/ when it follows an *a*, *o* or *u*, but is pronounced /s/ when it follows an *e* or *i*) and more complex orthographic structure rules (e.g. the silent-*e* or **VCe** rule) while phonologically recoding.

The phonemic awareness skills of segmenting and blending coupled with knowledge of letter-sound relationships, are seen as being essential for the acquisition of phonological recoding abilities (Carnine, 1977; Fox and Routh, 1976, 1984;). Monaghan (1983, cited in Ehri 1991), noted that phonological recoding developed in stages beginning with a slow, deliberate and obvious process and progressed finally to the rapid and automatic recoding of spellings into pronunciations according to grapheme-phoneme information.

Acquisition of the alphabetic stage is thought by Frith (1986) to be the "necessary precondition to attaining literacy" (p. 79). Gough and Tunmer (1986) supported this argument, stating that children who fail to become

proficient at phonological recoding do not become good readers in the long run. Ehri (1991) underlined the importance of phonological recoding skill, considering it "the key ingredient for learning to read words" (p. 401).

There have been numerous studies undertaken that provide support for the proposition that the major qualitative difference (in phonological recoding) between good and poor readers can be attributed to the rapid use of letter-sound knowledge used in word identification (Barron, 1981; Juel, 1988; Liberman and Shankweiler, 1985; Perfetti, 1985; Rozin and Gleitman, 1977; Stanovich, 1980; Stanovich, Cunningham and Feeman, 1984). This evidence supports the notion that breaking the alphabetic code, which is seen as the crucial feature of this stage, is an essential step in learning to read successfully.

2.3 Orthographic reading stage

In the orthographic stage, the reader learns to instantly analyse a word into morphemic parts without going through the process of explicit letter-by-letter phonological recoding. Letter order is important, but not necessarily the processing of individual letter sounds, "rather, if any sound at all, it is the sound of morphemes or of whole words" that is the feature of this stage (Frith, 1986, p. 72).

Frith (1985, 1986) argued strongly that to move into the orthographic reading stage, without first mastering the alphabetic stage is extremely difficult. An alternative view of the sequential nature of the stage reading models was presented by Stuart and Coltheart (1988). They suggested that a child who is phonologically skilled may miss out the logographic stage of

reading altogether, but a child who lacks phonemic awareness may be forced to adopt a logographic reading strategy. Chall (1983) also observed that a reader who has broken the alphabetic code could move to more complicated and varied text without first going through the fluency stage.

The proposal that the alphabetic stage of reading is a prerequisite to orthographic reading is supported by Ehri (1991). She viewed the transition to this stage of reading as beginning when knowledge of recurring spelling patterns are used by the reader in word identification and in recalling how to read words. This knowledge is acquired by becoming familiar with similar spelling patterns in words through the process of phonological recoding. As these letter patterns are practised repeatedly, their recognition becomes rapid and automatic (Gough and Hillinger, 1980; Samuels, 1988). The benefit to the reader is that similarly spelled words are read quickly by utilising this stored information in memory (Juel, 1983). This enables the reader to decode unfamiliar and multi-syllabic words as spelling patterns symbolising multi-phoneme segments in pronunciation. It is hypothesised that these orthographic-speech units are then used as access routes in memory (Ehri, 1986; Groff and Seymour, 1987).

2.4 Implications of stage models of reading acquisition

The classification of beginning readers, according to their word reading strategies, is of central importance to this study. It is argued that the stage of reading development at which children are currently functioning will have direct relevance to the word reading strategies that they typically employ. In particular, Freebody and Byrne (1988), and Byrne et al (1992),

using cluster analysis techniques, reported four sub-groups of readers. The use of stage reading models may clarify the nature of such groupings, and even lead to different interpretations of their results. Casting the question of word reading strategies in a stage model framework, permits one to make predictions about likely groupings and has implications for teaching beginning readers based on their placement within the stage model of reading development.

In addition, the importance of phonemic awareness to word reading abilities, as noted in the stage models, is of critical interest to this study. Stage models may also be used to predict the relationships between different word reading strategies and phonemic awareness for beginning readers.

The LB group, identified by Freebody and Byrne (1988) and Byrne et al (1992), could be interpreted as exhibiting prereading characteristics typical of the prereading stage. The use of salient visual features to recognise words and extreme difficulty in reading words out of context, leading to either guessing or refusal to read a word, are characteristics of children who have not entered initial stages of alphabetic reading. Some of the LB group could be described as rudimentary alphabetic readers if they make use of a few letter-sound correspondences in trying to identify words, particularly, the beginning letter sounds of unknown words.

A study carried out by Ehri and Wilce (1983) indicated that beginning readers may differ in their skill at forming visual-phonological connections to recognise words by sight. Ehri (1992) explained the difference between skilled and less skilled readers' ability to recognise words instantly in

terms of their level of phonological recoding ability. She maintained that skilled readers are able to form complete connections between spellings and pronunciations in memory, whereas less skilled readers formed only partial connections and hence were not able to specify the whole word's pronunciation (Ehri, 1989b). She considered this to be due to an insufficient grapheme-phoneme knowledge base. According to Ehri (1992) complete visual-phonological connections are formed when readers use their acquired phonemic segmentation and phonological recoding skills to analyse the entire sequence of a word's spelling as "visual symbols for phonemic constituents in pronunciations" (p. 133). These conclusions tend to support the inclusion of explicit teaching in beginning reading instruction of phonological awareness skills, and letter-sound correspondences, as well as strategies for applying this knowledge to word reading.

Frith (1986) discussed the possibility of "discontinuity in development" (p. 73). This may occur when a new strategy is being learnt or amalgamated with existing strategies. At this time, readers may assimilate the new strategy into their repertoire of skills, or they may struggle to achieve this new acquisition so that their performance may suffer temporarily. If the latter scenario is the case, then the reader's earlier strategies may be further developed and refined. Bryant and Impey (1986) advised against viewing a reader as only using one strategy to the exclusion of all others. Instead they argued that a child can develop a "specialisation in one strategy at the expense of the other" (p. 136). Frith (1986) warned that if a reader becomes developmentally stuck in a stage then there is the real possibility that they may fall back on compensatory strategies.

The Chinese reader's dependence on whole word reading could be seen as inadequate development of any other strategy or the predominant use of a compensatory strategy. A Chinese reader may be able to memorise many words, but in doing this the child "does not use the alphabetic nature of our language to its best advantage" (Stahl, 1992, p. 621). Without the benefit of explicit decoding instruction this type of reader may display the long term reading consequences reported by Byrne et al (1992). They followed Chinese readers' progress through to Grade 4, where an increasing load on memory is experienced as the frequency of new words increases, and found that they either moved into using phonic information, or became an LB reader. This has serious implications for the child's literacy development (Byrne et al, 1992).

Proponents of the "phonological deficit hypothesis" believe that a deficiency in this ability does not necessarily equate to an imbalance between word-specific knowledge and phonological reading skills (Rack, Snowling and Olsen, 1992). Poor readers may be able to use the compensatory strategy of acquiring a large sight word vocabulary to compensate for poor phonological ability. Variables contributing to this acquisition include the instruction to which the child is exposed [Barr, 1972; Beck, 1981; Snowling, (1987, cited in Rack et al, 1992)] and the types of words encountered in early reading materials (Juel and Roper-Schneider, 1985). The individual's preschool exposure to print, is also thought to affect the choice of reading style (Adams, 1990; Ehri, 1987; Gough and Hillinger, 1980; Marsh et al, 1981).

Readers who have a working knowledge of letter-sound correspondences

and who are developing phonological recoding skills share the characteristics of Phoenician readers. According to Groff and Seymour (1987), these children have the ability to translate spellings into sounds by applying letter-sound rules and then recognise the word's identity from its pronunciation. Initially they do this in a slow and deliberate way but, with further refining of their segmenting and blending skills coupled with the opportunity to practise, they are able to make the transition to fast and automatic word recognition. Phoenician readers are likely to exhibit explicit letter-by-letter phonological recoding when faced with the task of word reading. This has implications for reading instruction at this level of development in that phonological recoding skills should be further refined and practised until larger word parts can be processed efficiently and automatically.

A number of studies have shown the importance of children acquiring phonological knowledge (Chall, 1983; Gough and Hillinger, 1980; Perfetti, 1985; Rozin and Gleitman, 1977). However, once beginning readers become familiar with words they may no longer phonologically recode them but, instead, identify the words instantaneously or by "sight" (Gough, 1984; Stanovich, 1986). This type of reader has the option of reverting back to the process of phonological recoding when faced with an unknown or unfamiliar word. The child with these skills would be classified as an HB reader. Progress to this level is supported through repeated readings of a word, which strengthens the connection between letter order and pronunciation until the meaning of the word, retained in memory, is represented solely by its spelling (Chall, 1983; Ehri, 1991, 1992). Therefore, when the word is encountered again the mature reader has established a visual letter representation, or orthographic image, of the

word and does not have to phonologically recode it to access its pronunciation. "Being able to read words as units is thought to become possible when the spellings of sight words are fully connected phonemically to pronunciations in memory" (Ehri, 1991, p. 403).

The HB reader's orthographic capabilities contrast with the Phoenician's in that the former are able to quickly access a word's meaning in the lexicon without the need to go through the phonological recoding process (Perfetti and Lesgold, 1979). This differs from the Phoenician process where immediate access is not gained until after recoding has taken place, by transforming letters to recognisable pronunciations. The major difference between being able to read words by visual-phonological connections, or by phonological recoding, is in the unit that is utilised to locate that word in the lexicon, a sequence of letters as opposed to a blend of phonemes.

Stage models of reading acquisition have major implications for reading instruction. In this context Ehri (1991, 1992) stated that prerequisites for independent reading must include knowledge of letter sounds, letter names, plus phonemic segmentation skills. Stanovich (1986), Chall (1983), and Vellutino (1991) among others have maintained that beginning readers need to acquire the alphabetic principle in order to learn to read. To obtain a functional understanding of this principle the child requires both an explicit awareness of phonemes and familiarity with print, especially letter-sound knowledge (Chall, 1967, 1979, 1983; Adams 1990; Carnine et al 1990).

Carnine et al (1990) recommended teaching word reading strategies as soon as the child has mastered 2 to 3 letter-sound correspondences.

Similarly Groff (1987) maintained that decoding skills are facilitated in the beginning reader if the shortest possible words are provided first. He recommended initial practice with monosyllabic words that contain the short, unglided vowel sound before a gradual increase in word type difficulty occurs, as a child's word recognition span increases leading to multi-syllabic word reading. Carnine et al (1990) presented a sequence of word types and a recommended order for their introduction, based on the relative difficulty of each word type.

Ehri (1992) has also highlighted the importance of instruction and practice in phonological recoding, as these are needed, to ensure that the transition from a rudimentary alphabetic reader to an orthographic reader takes place. It is also recommended that words that are encountered initially should include phonically regular letter-sound relations, so that beginning readers can form connections into memory based on phonetic cues. Repeated practice of these words will allow these connections to occur.

CHAPTER 3

LITERATURE REVIEW

In this review of relevant literature, a summary of important research that is pertinent to the research questions will be provided. These questions relate to the classification of students by word reading strategies; the definition, measurement and role of phonemic awareness in beginning reading; and effects of explicit decoding instruction on word reading strategies.

3.1 Classification by word reading strategy

The issue of how to determine children's word reading strategies is crucial to this study. Typically, researchers have used a combination of regular, irregular and pseudo (nonsense) words to test children's word reading strategies. Regular words (which conform to spelling-sound rules), can be read as either whole words or by phonological recoding processing. Irregular words, since they do not conform to spelling-sound rules, have been used to test whole word, or sight word recognition. However, the notion that irregular words tap only sight word recognition abilities has been questioned by Van Orden (1987) who proposed that phonological processes are, in fact, partially used in reading those parts of irregular words that do correspond to spelling-sound rules (e.g. the letters *y* and *t* in the irregular word yacht).

The rationale for using pseudowords has been presented by Rack et al (1992) as follows:

a commonly used technique used for assessing phonological processes in reading involves the presentation of pronounceable regular nonsense words. Since nonsense words are visually unfamiliar they cannot be "recognized" directly; in many cases they require an unfamiliar spoken response to be generated (e.g. eap, toab, smilcrit) so subjects must employ their phonological skills to some extent. Performance on nonword reading therefore gives an indication of phonological skill, and this can be interpreted in relation to word-reading performance (p. 32).

It is thought that the use of pseudowords enables a researcher to assess a beginning reader's ability to "break the code" because failure to use the alphabetic strategy would show up as a problem in using letter-sound correspondences and thus result in poor performance in reading pseudowords (Frith, 1986).

Freebody and Byrne (1988) and Byrne et al (1992) used a combination of irregular words and pseudowords in order to classify children by word reading strategies. This decision was based on comparisons of correlations between nonsense and regular word reading measures which were consistent with those reported by Baron (1979) and Treiman (1984). This judgement is supported by Rack et al (1992) who stated that "the most sensitive test for differential use of phonological reading strategies is the comparison of irregular words with nonwords" (p. 39).

Olsen, Kliegl, Davidson and Foltz (1985) gave dyslexic and normal readers a task that involved the recoding of pseudowords coupled with a matching activity between the phonological form of the pseudowords and

recognisable words. Dyslexic readers' performance on this phonological choice task was significantly inferior to that of the normal reading group. These researchers then proceeded with a test of orthographic spelling knowledge. Finding no difference between groups, they concluded that a dyslexic's phonological difficulties were somewhat independent of their orthographic knowledge.

Rack et al (1992) interpreted this and following studies as evidence for a "nonword reading deficit" theory, namely that dyslexics are able to achieve a greater level of word recognition than their phonological skills warrant. Rack (1989) and also Rack and Olsen (1991) (both cited in Rack et al 1992) examined the word recognition skill and pseudoword reading of large samples of poor readers. They found that it was not "possible to attribute their poor word recognition skills to poor nonword reading abilities" (Rack et al, 1992, p. 46). A further study by Olsen, Wise, Conners, Rack and Fulker (1989) adds support to the idea that the reading problems of dyslexics are specific to their phonological processes and not their orthographic domain.

Snowling (1981) and Holligan and Johnston (1988) (both cited in Rack et al, 1992) observed that dyslexic readers and a normal reading-level-matched group were able to read single-syllable pseudowords. Differences between the two group's reading performance were noted as the phonological structure of the pseudowords increased in complexity, with two-syllable pseudowords that included consonant clusters proving more difficult for the dyslexic group to decode. Snowling (1980) identified the specific problem of recoding a pseudoword into its phonological form as the reason for differences on a pseudoword visual-auditory matching task

between dyslexic and reading-level-matched normal readers.

Many studies reviewed by Rack et al (1992) support the "nonword reading deficit" theory. There are also conflicting findings, some of which do not support this theory. Rack et al (1992) asserted that differences in the presentation of words and the nature of the words used in word recognition tests may account for the disparity in these findings. They noted that words presented in connected text may prove more difficult for some children to read than words presented in isolation, due to an increased demand on memory and the presence of contextual clues.

There can also be significant differences between tests of word recognition depending on whether words are presented in isolation or in context. The balance of word types used may suit a particular reading strategy, for example a task made up of predominantly regular words will benefit a reader with good phonological skills.

Test instructions are also worthy of note, as a test that requires a quick response from a subject is more likely to assess the subject's sight word recognition skills than one which enables the subject more thinking time. Rack et al (1992) have pointed out the importance of documenting the characteristics of the reading test used and the manner in which it was administered.

The issue of task familiarity may also be an important consideration with reading tests involving pseudowords. Rack et al (1992) suggested that beginning readers are likely to be unfamiliar with the task requirements and so they may not understand the response requirements. Students who

have received no instruction in phonic decoding skills may find pseudowords, particularly in isolation, an unfamiliar reading activity.

Rack et al (1992) questioned the role of the child's age in the reading of pseudowords. Beginning readers are in a period of rapid reading developmental growth where they are acquiring and refining their phonological skills. This may contribute to a relatively high level of variability in reading performance using pseudowords.

3.2 Significance of different word reading strategies

The identification of distinct sub-groups of readers within the reading disabled population, had been noted as early as 1917 by Bronner, but it was Johnson and Myklebust, in 1967, who first theorised that children with reading disability could be grouped as having either an auditory or visual processing deficit (cited in Olsen et al, 1985). Boder (1971), using spelling and reading patterns as a diagnostic device, identified three distinct subtypes of reading disabled students. The label "dysphonetic" was used for those readers who lacked phonological decoding skills such as "the blending of component letters and syllables of a word" (p. 303). She noted that these students read words as if taught by whole word techniques "as instantaneous visual Gestalt" rather than reading analytically (p. 303). The second sub-group, much smaller than the first, were labelled "dyseidetic" readers. These readers were characterised by their use of laborious phonetic analysis when reading a new or familiar word "as if seeing each word for the first time" (p. 303). Boder (1971) suggested that they resembled a new reader who had only been exposed to phonetic teaching. The third group she identified showed characteristics of

both of the previous two groups: they were basically non-readers. Boder (1971) hypothesised that the differences between the three groups represent deficits in psycho-neurological functions that she considered were prerequisite to reading.

Dual route theory of word recognition was developed to account for the performance of fluent readers who were able to recognise a word without generating its phonological form (Barron, 1986). According to this theory, these readers can recognise words "through either of two distinct and independent processes: 1) by direct, visual recognition or 2) by applying some set of spelling-to-sound rules to translate the print into an image of its spoken equivalent" (Adams, 1990, p. 104). According to dual-route theory the connections formed between words and their meaning in memory are arbitrary rather than systematic, they are learned by rote, and do not involve letter-sound correspondences.

Working within the framework of dual-route theory, the possibility of classification by word reading strategies has also been investigated by Baron and Strawson (1976); Baron (1979); Baron and Treiman (1980); Mitterer (1982, cited in Olsen et al 1985); and Treiman (1984). These authors found evidence, through the use of correlation procedures, of both "Chinese" and "Phoenician" readers, among samples of normal and poor readers. Although sharing some similarity with Boder's sub-groups, Baron (1979) considered personal preference to be the basis of the different reading styles. The reading style differences found in these studies were inferred from tests of phonological and orthographic coding, regular, irregular, and pseudoword reading, as well as spelling errors.

Also from a dual-route perspective, Olsen et al (1985) considered that the differential use of the phonological and orthographic paths to the lexicon lead to particular reading styles among reading disabled individuals. "A reciprocal relation is hypothesised wherein subjects with good orthographic codes tend to use the orthographic path in reading while those subjects with poor orthographic codes tend to use the phonological path, regardless of their phonological skill" (p. 27).

With reference to normal readers, Olsen et al (1985) concluded that there was not sufficient evidence to support reading style preferences. Instead, they argued that their finding, that normal readers did not fall into clear sub-groups, should be contrasted with reading disabled students as their reading styles may be more conspicuous due to the development of unique strategies to deal with their reading problems. Importantly, Olsen et al (1985) reported that:

analyses within younger and older age groups suggest that decoding processes change qualitatively with age, and some of the reading style differences observed among disabled readers are diminished in the older subjects (p. 6).

and

developmental changes in reading and spelling styles leads to different patterns of individual differences for younger and older disabled readers. Differences in orthographic skill and spelling indicate substantial variance in the use of the small-unit phonological path for younger subjects, but these differences are not significantly related to reading style in older disabled readers (p. 54).

Rack et al (1992) supported the interpretation that reading styles may, indeed, change through the process of normal reading development. They present the possibility that developing readers pass through a stage which resembles the characteristics of a surface dyslexic reader. Bryant and Impey (1986) cautioned against viewing the word reading strategies used by "developmental dyslexic" students as being different from the normal strategies of primary school children. This line of reasoning is consistent with stage models of reading development.

Although Baron and Strawson (1976) supported the existence of groups who over depend on distinct word reading mechanisms, they described these as extreme groups selected from a large sample of college students. Interestingly, these authors viewed such readers as part of a reading continuum of individual differences, ranging from Phoenician at one extreme, to Chinese at the other. Kinsbourne (1982, cited in Olsen et al, 1985) and Rack et al (1992) concluded that their studies provided no direct evidence of particular sub-groups. They postulated that their subjects should be considered to be positioned somewhere on a continuum, ranging from phonological dyslexics to surface dyslexics. Byrne et al (1992) added a qualification to their original sub-group hypothesis, stating that it was misleading to view Chinese and Phoenician readers as discrete groups. They described these children as occupying "points in a bi-variate space which contains separate but correlated dimensions. At best, the terms refer to regions in this space, representing relative standing on the two dimensions" (p. 142).

Similarly, Lundberg (1985) had little success in delineating possible sub-groups of reading disabled children, although he did not interpret this as a

reason to abandon the sub-group hypothesis.

The literature on the classification of children by their word reading strategies has focused predominantly on those children who already display a disability in reading. Results have been interpreted that favour an individual view of reading style within a dimension of reading disability. The lack of studies that concentrate on the differences within normal readers is viewed as surprising by Goswami and Bryant (1990). Evidence provided by Rack et al (1992) and Olsen et al (1985), suggests that the strategies typically used by these readers may change as they progress through natural stages of reading development. They also reported that phonological abilities, in particular, have an underlying effect on these children's reading difficulties.

3.3 Definition of phonemic awareness

Griffith and Klesius (1990) defined phonemic awareness in the following terms: "phonemic awareness is one of several metalinguistic abilities which allows children to reflect on features of spoken language ... specifically, phonemic awareness is an insight into the structure of spoken language, including some ability to manipulate phonemes" (p. 4).

Juel (1991) made the point that phonemic awareness skill should not be thought of as one ability. Goswami and Bryant (1990) noted that "phonemic awareness is itself a blanket term" (p. 2). In summarising phonemic awareness research, Adams (1990) identified at least five levels of phonemic awareness:

1. The recognition of differences in the overall sound of spoken words.
2. The capacity to attend to the components of spoken words as evidenced by "the ability to compare and contrast the sounds of words for rhyme and alliteration" (p. 80).
3. The realisation that words can be split into sounds that correspond to phonemes as well as the capability to produce these sounds in isolation and then blend them together.
4. The ability to analyse and segment a spoken word into its phonemic sequence.
5. The recognition that phonemes in a word can be manipulated, added or deleted in order to make a new word.

3.4 Phonemic awareness and word reading

The relationship between phonemic awareness and word reading strategies is not clear. Some authors have argued that phonemic awareness is a prerequisite for successful use of phonic information (Hollingsworth, 1983; Tunmer and Nesdale, 1985; Byrne and Fielding-Barnsley, 1991). On the other hand, a reciprocal relationship has been postulated by Ehri (1979); Stanovich (1986); Foorman and Liberman (1989); and Foorman, Novy, Francis and Liberman (1991). Others believe that phonological processing is a necessary but not a sufficient condition for attaining proficient word identification skills (Juel et al, 1986; Tunmer and Nesdale, 1985). Goswami and Bryant (1990), in a review of related literature, claimed that

there are two distinct types of phonological ability that are causally linked to later reading development. They suggested that a child's awareness of rhyme and alliteration, as intra-syllabic units of speech, is related to the later development of phoneme awareness. These, in turn, are considered to develop only when children learn grapheme-phoneme correspondences through early reading experiences.

There is now a large body of evidence which has been interpreted as showing causal links between phonological processing and reading ability (Bradley and Bryant, 1983; Maclean, Bryant, and Bradley, 1987; Perfetti, 1985; Share, Jorm, Maclean and Matthews, 1984; Tunmer and Nesdale, 1985; Stanovich, 1986, 1988a). Research in this area has included longitudinal correlational investigations (Juel, Griffith and Gough, 1986; Maclean et al, 1987; Perfetti, Beck, Bell, and Hughes, 1987; Stuart and Coltheart, 1988; Torneus, 1984) as well as training studies (Ball and Blachman, 1991; Bradley and Bryant, 1983; Fox and Routh, 1975, 1984; Lie, 1991; Lundberg, 1985; Lundberg, Frost and Peterson, 1988; Treiman and Baron, 1983; Williams, 1980). Lundberg et al (1988) showed that phonological training enabled children in their experimental group to increase their ability to identify phonemes in a word which positively affected later post-tests of reading and spelling. Vellutino (1991) assigned particular importance to phonemic awareness as a prerequisite for the mapping of alphabetic symbols to sounds which, in turn, is a prerequisite to word identification and reading in general.

In summary, phonological awareness training alone, and phonemic awareness training coupled with alphabetic coding instruction, have been shown to positively impact on reading acquisition. Byrne and Fielding-

Barnsley (1989) found that training in phonemic awareness needed to be supplemented with letter-sound knowledge in order for preschoolers to display an understanding of the alphabetic principle. These training strategies are thought to be best developed in young readers using explicit instruction (Bradley and Bryant 1983; Beech and Harding 1984; Juel 1988; Liberman, Rubin, Duques and Carlisle 1985; Wallach and Wallach 1979; Williams 1980, 1986).

There is also evidence of a strong predictive relationship between phonological processing abilities and early reading acquisition, with phonological processing tasks proving to have better predictive properties than wide ranging, standardised intelligence tests (Share et al, 1984; Stanovich, Cunningham and Feeman, 1984; Stanovich, 1988a). Furthermore, phonological awareness is considered to be a relatively unique predictor of beginning reading ability (Juel, 1988; Stanovich, 1988b) accounting for "a statistically significant proportion of variance in reading ability after the variance associated with a variety of intelligence and other cognitive tasks have been partialled out" (Bradley and Bryant, 1985; cited in Stanovich, 1988b, p. 159).

A study of factors relating to reading acquisition by Share et al (1984) found that phonemic segmentation skill, along with letter knowledge, were the strongest predictors of beginning reading achievement ($r = .58$ to $r = .68$). A high correlation between phonemic awareness ability and later reading acquisition has been reported by Share et al (1984); Stanovich, Cunningham and Feeman (1984); and Stanovich (1988a). This finding is thought to occur as phonemic awareness is linked to the ability to decode which, in itself, is linked to reading comprehension (Juel et al,

1986; Tunmer and Nesdale, 1985). The importance of phonemic awareness led Davies and Williams (1974, cited in Stuart and Coltheart, 1988) to conclude that growth in word recognition does not take place until phonic skills are developed.

Phonemic awareness is considered by Stanovich (1988b) and Chall (1983) to be independent of other cognitive skills in that it impacts on reading and spelling but not on other global intellectual skills. Stanovich (1986, 1988b) made the distinction between two types of readers and their related phonological processing capabilities: those students who can be described as having a specific reading disability with no other associated cognitive deficits; and the reader who has followed down the "Matthew effects" path. The latter has a less severe phonological deficit coupled with associated cognitive deficits. In observing "Matthew effects" on beginning readers, Stanovich described a developmental lag hypothesis (Stanovich 1988b) that may lead to a poor reader displaying associated cognitive skill deficits. The distinction between the two types of readers is highlighted in that the dyslexic reader has a specific phonological deficit, described by Rack et al (1992) as a "phonological deficit hypothesis" as opposed to the more general deficit displayed by the "Matthew effects". Stanovich (1988b) also noted that there are other performance differences between poor and highly skilled readers. He considered these to be due to reading failure, rather than the cause of reading failure. This issue will be examined in more detail later in the thesis.

Olsen et al (1985) and Rack et al (1992) strongly supported the view that disabled readers as a group are uniquely deficient in phonological skills. Agreeing with Venezky and Massaro (1979, cited in Olsen et al 1985) these

authors saw this deficit as having implications for word identification. They argued that phonological skills help to orient the beginning reader to the orthographic structure of words that may later be utilised independently from phonological coding in lexical access. Therefore, any weakness in phonological abilities may impact on the later use of the orthographic path for word identification (Ehri, 1991, 1992).

3.5 Measurement of phonemic awareness

Comparison and analysis of different phonemic awareness measures have been undertaken in a number of studies (Stanovich, Cunningham and Feeman, 1984; Yopp, 1988; Stahl, Osborn and Lehr, 1990). While there are differences in the degree of difficulty of these measures, generally they can be used to predict later reading achievement.

A classic study into the measurement of phonemic awareness was carried out by Stanovich, Cunningham and Cramer (1984). They compared ten common measures to see if they all showed evidence of being valid measures of future reading achievement. Analysis by Stanovich, Cunningham and Cramer, (1984) of the phonemic awareness measures later used by Freebody and Byrne (1988) and Byrne et al (1992) found initial-consonant elision to be the most difficult test for preschool children but, nevertheless, a good predictor of future reading ability. Significantly, the mean age of children for whom Stanovich, Cunningham and Cramer (1984) reported results was 6 years and 2 months, which is roughly comparable with beginning Grade (Year) 2 in Western Australia. Adams (1990, cited in Stahl et al, 1990) argued that this task is easier than either phonemic segmentation or phoneme manipulation tests as "children only

have to attend carefully to the sound of the syllable and apply the insight that the initial sound can be broken away" (p. 41). Kirtley, Bryant, Maclean, and Bradley (1989) used two types of these tests and reported that the initial sound task was easier than the end sound task. This result supports Goswami and Bryant's (1990) view that it is easier for a beginning reader to detect phonemes when they coincide with a word's onset. Stanovich, Cunningham and Cramer (1984) noted that in tasks where the initial or final sounds in words had to be compared and contrasted then the final sound contrast measure was the more difficult of the two. The final-consonant-matching test, as used by Freebody and Byrne (1988) and Byrne et al (1992) was considered by Stanovich, Cunningham and Cramer (1984) to be of medium difficulty and not quite as good a predictor of future reading ability.

3.6 Effects of decoding instruction on word reading

According to Adams (1990) learning to read requires learning to link patterns of information from different sources (linking print to sounds, contexts, functions and meanings) in order to generate meaning from text. She postulated that memory acts to organise these inter-connections in a hierarchical manner. Taking these two together, she argued that:

in order for any memory to be economical and robust and to do what it is supposed to do, one must first have learned to respond to each of its nodal parts as wholes. Thus, in order to remember a word or spelling pattern as a sequence of letters rather than an array of smaller visual features, one must have first learned to respond to the component letters as wholes (p. 207).

Adams' thesis implies then, that phonic instruction is one route to the development of the links required for word reading. In reviewing reading research from 1910 to 1967, Chall (1979) concluded that teaching programmes that emphasised the alphabetic code from the beginning showed better results for the task of reading for meaning. In 1983 she brought her review up to date but saw no evidence to change this conclusion.

A number of authors have discussed the relationship between reading comprehension and word decoding skills. Byrne et al (1992) reported that even though their Phoenician readers could be described as "plodders" this did not impact negatively on measures of reading comprehension. They took this result to emphasise the need for accurate word attack skills as a part of the beginning reader's repertoire. The mature reader needs to develop fast, automatic and accurate decoding skills in order that greater memory capacity is available for gaining meaning from what is read (Lesgold et al, 1985; Perfetti, 1985; Samuels, 1984, 1988). The development of these skills were put into context by Groff (1987):

English writing is based on the alphabetic principle. That is, the speech sounds in our language are represented, in relatively predictable ways, by letters of the alphabet. Once children understand the workings of this code, they can decode, on their own, the names of unfamiliar written words. With continued practice in the use of this code, such decoding of written words becomes automatic - easy, quick, and effortless (p. 11-12).

Groff (1987) considered that these skills are best developed through early, intensive, direct and systematic phonics based instructional programmes which emphasise the practice of skill attainment. He warned that without explicit instruction in this code, children may experience extra difficulty in learning to read.

Support for the notion that automatic decoding is a prerequisite for comprehension, is provided by Perfetti (1985), who noted that children who were unable to identify words quickly and accurately experienced difficulty in comprehending written text. The thrust of his "verbal efficiency theory" is that inefficient access to the reader's lexicon hinders the storage of the phonological representations of words held in short-term memory. He argued that because the temporary representation of text held in working memory is disrupted, then this will lead to a corresponding disruption in comprehension.

There is a large body of reported research which has shown consistently that programmes which include systematic phonic instruction lead to higher levels of achievement in terms of word recognition and spelling (Adams, 1990; Bond and Dykstra, 1967; Chall, 1967, 1979, 1983; Stebbins, St Pierre, Proper, Anderson and Cerva, 1977; Vellutino and Scanlon, 1987; Williams, 1980, 1984). A number of studies which focused directly on the effect of decoding instruction on word reading have involved teaching a sounding out strategy for regular words. Taken together, these studies have shown that merely teaching letter-sound correspondences is insufficient, and that the skill of blending sounds together is necessary if students are to apply their phonic knowledge to word reading (Blachman, 1987; Chapman and Kamm, 1974; Coleman,

1970; Haddock, 1976, 1978; Muller, 1973; Ramsey, 1972; Richardson and Collier, 1971; Silberman, 1964; Skatland, 1971; Williams, 1980).

In particular, Johnson and Baumann (1984) highlighted the skill of blending sounds together (telescoping) and its crucial role in the decoding of unfamiliar words. This is noteworthy in light of Haddock's (1976) finding that, in many classrooms no explicit blending training was given, instead, the children were, "expected to acquire the blending concept on their own" (p. 825).

The development of segmenting and blending skills is viewed by many as crucial for beginning readers to transfer their knowledge of phonemic awareness and letter-sound correspondences to decoding skills (Fox and Routh 1976; Muller, 1973; Haddock 1976; Carnine 1977). Johnson and Baumann (1984) considered that both of these skills "must be present if transfer to decoding unknown words is to occur" (p. 591). Fox and Routh (1976) found that children who could not segment were unable to benefit from blending training and concluded that the relationship between blending and segmenting is interactive. Tunmer and Nesdale (1985) found that segmentation skills alone were not enough for reading acquisition but that the child must also possess blending abilities. According to Foorman et al (1991), it is the training in segmenting and blending letter sounds that is the key issue in facilitating reading development.

Barr (1974-5) and Chall (1967, 1979, 1983) found that word reading skills are influenced by instructional methods, particularly in phonetic recoding. Children who are taught phonics initially acquire superior phonological recoding skills when compared to beginning readers who are instructed in

a whole word approach to word identification. However, this early advantage dissipated as children in whole word programmes acquired phonological recoding skills. It has been argued that the children instructed in whole word programmes induce letter-sound relationships as they practice reading and spelling (Gough and Hillinger, 1980; Ehri and Wilce, 1987a). Chall (1983), however, warned that many children do not induce letter-sound relationships and, consequently, advocated that systematic phonics should be taught to all beginning readers.

There is convincing evidence that children who are unable to break the code will receive unequal exposure to text (Biemiller, 1977-1978; Allington, 1984) and this may lead to their inappropriate placement in reading materials (Allington, 1984; Juel, 1988). This combination adds to the problems in efficient word identification experienced by poor readers and further impacts on their ability to progress to the orthographic stage of reading.

Reading materials may also have a direct bearing on the strategies employed by children of different ages. Byrne et al (1992) cited studies by Freebody (1983) and Carroll, Davies, and Richman (1971) which demonstrated that a large proportion of the most frequently encountered words in early reading texts were irregular. By contrast, in later grades, the majority of words read in school texts were now regular.

CHAPTER 4

METHOD

4.1 Sample and Setting

The complete cohort of Year 2 students taken from three classes attending a metropolitan primary school in Western Australia participated in the first phase of the study. The sample consisted of 75 students, made up of 41 boys and 34 girls (mean age 7 years 0 months; range 6 years 5 months to 7 years 6 months).

Six students from a single Year 2 class took part in the second stage of the study, which involved a single subject design. They included three boys and three girls, ranging in age from 6 years 5 months to 7 years 6 months, with a mean of 7 years 3 months. All were of Caucasian descent. These subjects were selected on the basis of their word reading scores, discussed below.

A brief outline of demographic features of the school and community is provided here in order to describe the context in which the study took place. The school is situated in a small geographical area bounded by significant green belts and major roads. It is effectively dislocated from access to amenities and community activities in the surrounding suburbs. Residents generally go out of the community to shop and transact business. It is classified as a Level 5 school, on the basis of an enrolment of 567 students at the time of the study. There are 28.5 equivalent full-time teachers at the school and a number of ancillary staff. Recent changes to the school's intake have included an increase in

students from "white collar" families. Nonetheless, there is still a 32.5% unemployment rate in the school catchment area, while the state average stands at 11.2%. The majority of residents are first home buyers with 10-12% of the housing being rental accommodation provided by the State. The school population is made up predominantly of Australian-born children with a small number of children from different ethnic backgrounds. Children of Aboriginal descent represent 4% of the student population. A combination of whole language and skills approaches is used in teaching in the junior school. Twenty of the Year 2 children had also been taught using *Reading Mastery I*, or *Reading Mastery I: Fast Cycle* (Engelmann and Bruner, 1988) on a withdrawal basis. They had covered between 25 and 27 lessons at the time of testing.

4.2 Research design

The first stage of this study was correlational, involving cluster analysis in order to group students by their word reading strategies. This phase of the study replicated the procedures used by Freebody and Byrne (1988). Each student was asked to read a list of 30 pseudowords and 30 irregular words. The scores of each student on these measures was then subjected to the same cluster analysis techniques that Freebody and Byrne (1988) used in order to investigate whether or not similar sub-groups of readers emerged. In addition, a comparison of the phonemic awareness skills of students falling within different clusters was carried out using independent sample t tests.

Single subject methodology, incorporating both a multiple baseline across subjects design and a changing criterion design, was then implemented in

order to investigate the effect of decoding instruction on the word reading strategies of six individual students. The multiple baseline design involved the collection of baseline data for a single behaviour (reading regular word types) replicated across six subjects. It was planned that intervention would then be introduced sequentially, to one subject at a time, in order to evaluate the effects of explicit decoding instruction on word reading. In fact, the changing criterion design was used, instead, to evaluate the effectiveness of the intervention procedures with only one subject because it was found that the remaining five subjects showed either ascending baselines or baselines that were close to criterion. The changing criterion design was described by Hartmann and Hall (1976) in the following terms:

The design requires initial baseline observations on a single target behavior. This baseline phase is followed by implementation of a treatment program in each of a series of treatment phases. Each treatment phase is associated with a stepwise change in criterion rate for the target behavior. Thus, each phase of the design provides a baseline for the following phase. When the rate of the target behavior changes with each stepwise change in the criterion, therapeutic change is replicated and experimental control is demonstrated (p. 527).

In order to evaluate generalisation from specific word types on which instruction was provided (Appendix C) to mixed word types (Appendix D), additional baseline data for mixed word types was collected throughout the intervention phases for this child. In addition, for all six subjects, a pre-test post-test comparison was made of each child's ability to read pseudowords (Appendix A). This was done in order to investigate whether there was a change in their ability to apply phonological recoding

strategies, following the collection of baseline data for only five subjects, and following intervention for the sixth.

4.3 Instruments

A number of instruments were used to collect word reading, phonemic awareness, and single subject design data:

1. Classification by word reading strategy was based on scores on the irregular and pseudoword lists used by Freebody and Byrne (1988). Each word list consisted of 30 items with no preliminary practice items or corrective feedback given before testing. These word lists, and the verbatim instructions for administration used in this study, are presented in Appendix A. Reliability of these measures was calculated using an index of internal consistency, Coefficient Alpha (Cronbach, 1970).
2. Phonemic awareness was assessed for all students using the initial-consonant elision task and final-consonant matching task reported by Freebody and Byrne (1988). The initial-consonant measure consisted of 20 items and the final-consonant matching task of 10 items. Again, reliability of these test instruments was calculated using formula for Coefficient Alpha. Word lists and verbatim instructions for both these tasks are presented in Appendix B. Each of these measures included three practice items with corrective feedback before the test items were introduced.

Phonemic awareness was also assessed using three additional tasks:

auditory rhyming, auditory segmenting, and auditory telescoping. In each case the test format based on Formentin (1993), contained in Appendix B, was used. Word lists were developed specifically for this study and are included in the same Appendix. Before each test was administered, three practice items including corrective feedback were given. The reliability, for each of these instruments, was also calculated using Coefficient Alpha.

3. Single subject design data was collected using probes made up of regular words taken from Carnine et al (1990, p 440-443). A word is considered regular if "each of its letters represents its most common sound" (Carnine et al, 1990, p. 198). Each letter is also classified as either a continuous sound or a stop sound. Continuous sounds can be said for several seconds without changing its sound (e.g. mmmm). Stop sounds can only be said quickly, (e.g. k). If the sound /k/ is said over several seconds, an intrusive vowel will be added e.g. /kuh/.

The difficulty of each word type is dependent on a number of factors, including: whether the word begins with a continuous or stop sound; the length of the word; the position and length of consonant blends; and the position of the vowel. The regular word types are shown in order of difficulty in Table 1. Words for each phase were chosen randomly from the word types listed.

Table 1

Regular Word Types Listed According to Difficulty

- **VC** and **CVC** words that begin with continuous sound (e.g. fin)
- **CVC** words that begin with stop sound (e.g. big)
- **VCC** and **CVCC** words that begin with continuous sound (e.g. dust)
- **CVCC** words that begin with consonant blend (e.g. crib)
- **CCCVC** and **CCCVCC** words (e.g. blunt, scrap and strand)

(Carnine and Silbert, 1979, p. 95).

Note: the symbol **C** represents a consonant letter, and **V** a vowel.

4.4 Data collection

Data collection commenced in Term 2 of the school year and took place during school hours, in the morning. Each student was tested individually, in a withdrawal area, by the experimenter on each of the word lists and phonemic awareness tests contained in Appendices A and B. Responses were recorded on an individual test record sheet. Cluster Analysis procedures were used to group students according to their word reading strategies. Six of the lowest performing LB readers were then identified as subjects for the single subject aspect of the study.

The baseline data collection stage of the multiple baseline design involved the daily testing of six LB students (who had never received any *Reading Mastery* instruction) from a single class using ten randomly selected words taken from the list of one hundred **CVCC** words (Appendix D). Words that were already known to a child were omitted from these baseline test lists. Five of the six subjects did not show a stable level or trend in this initial baseline phase. Therefore, a second baseline phase was implemented using a more difficult independent measure. Again, ten randomly selected words were used each day for testing purposes, this time from lists of mixed word types (**CCVC** beginning with a consonant blend, **CCVCC**, **CCCVC** or **CCCVCC**, Appendix D).

4.5 Intervention procedures

The one child, Jeremy, who showed consistently low baseline data in both baseline phases was given the Diagnostic Test of Word Attack Skills (Formentin, 1993, reproduced in Appendix F). Single letter sounds that were, at that time, unknown to Jeremy were identified. This also assisted in setting the criterion for the first phase of the changing criterion design (**CVC** beginning with a continuous sound). The first changing criterion phase required Jeremy reach a 90% accuracy level on the dependent measure. Each progressive phase then maintained the 90% criterion level but introduced a more difficult word type. In all, sixteen intervention sessions were provided beginning in week 6 of second term. Regular data-based decisions were made on the basis of visual analysis of Jeremy's daily scores.

Instruction was provided by the researcher. Prior to this study, he had completed a Bachelor of Arts (Education), and a Bachelor of Education with a major study in "Children with Special Needs". He also had prior experience, in a variety of educational settings, with the formats and procedures that were used to teach Jeremy.

Each session with Jeremy lasted thirty minutes, consisting of twenty-five minutes instructional time and five minutes allocated for testing procedures. The sessions ran from 9.30 am. - 10.00 am., for four mornings a week and were located in a withdrawal room separate from his classroom.

Instructional procedures involved using modified formats derived from Carnine et al (1990). Jeremy was taught using the *Format for Teaching Letter Sounds*, the *Introductory Format for Sounding Out Words*, and the *Format for Testing Sounding Out Words*, as described by Formentin (1993) and reproduced in Appendix E. The sessions included periods of teaching and reviewing single letter sounds. Jeremy also was taught an explicit strategy for blending individual sounds together, without stopping, so that a word can be said the "fast way". Sessions were supplemented by oral and written games that reinforced the instructional objectives for each session.

4.6 Teaching materials

Single letters and regular words from word types shown in Appendices C and D, were written in print formation on A4 card. Testing materials prepared prior to each session were also presented using a similar format.

CHAPTER 5

RESULTS

5.1 Test reliability

Reliability of the irregular and pseudoword lists used by Freebody and Byrne (1988) was calculated using Coefficient Alpha (Cronbach, 1970). For both the irregular word and pseudoword lists reliability was acceptable (Irregular words $\alpha = .947$, and Pseudowords $\alpha = .922$).

Phonemic awareness was assessed for all students using the initial-consonant elision task and final-consonant matching task used by Freebody and Byrne (1988). The initial-consonant measure consisted of 20 items. The reliability of this test was acceptable ($\alpha = .946$). The final-consonant matching task consisted of 10 items. The reliability coefficient of this test instrument was unacceptably low ($\alpha = .635$). Since Freebody and Byrne (1988) combined the scores of these two tests, the reliability of these tests combined was also calculated. It was acceptable ($\alpha = .926$).

Phonemic awareness was also assessed using auditory rhyming, segmenting and telescoping, utilising the test format for each reported by Formentin (1993) and word lists developed for this study. The reliability of each of these instruments was also calculated using Coefficient Alpha. Two tests showed adequate reliability (Auditory rhyming $\alpha = .850$ and auditory segmenting $\alpha = .853$). However, the auditory telescoping test produced an unacceptably low level of reliability ($\alpha = .529$).

5.2 Classification by word reading strategies

Before the word reading performance of the Year 2 students was subjected to cluster analysis, a simple scatterplot of their scores on the pseudoword and irregular word lists was prepared. Figure 1 shows the resultant location of each student. It can be seen that the majority of students were clustered around a diagonal line extending from a position that is low on both irregular and pseudoword reading to high on both irregular and pseudoword reading. There were very few students placed in the quadrant that represents low performance on pseudowords and high on irregular words. On the other hand, there were students in the quadrant representing high performance on pseudo words and low scores on irregular words. Scatterplot data from a similar study by Gough and Walsh (1991) is reprinted in Figure 2. This has been presented here in order that direct visual comparisons can be made between the results of their study and the present one.

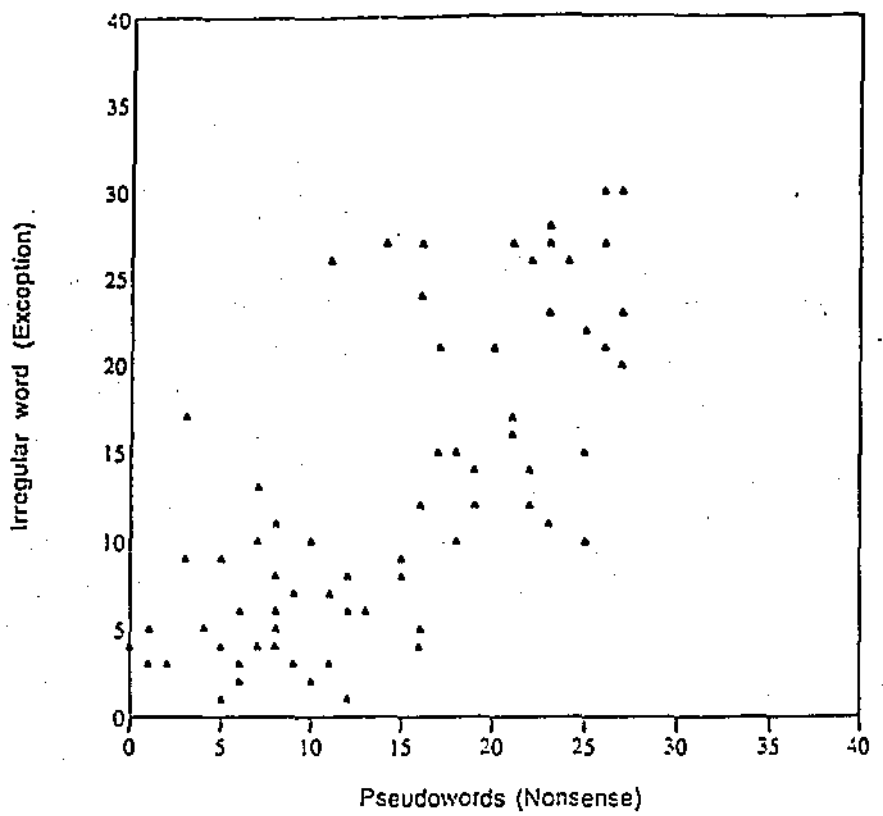


Figure 1
Scatterplot Data Showing Irregular Word Naming as a Function of Pseudoword Naming

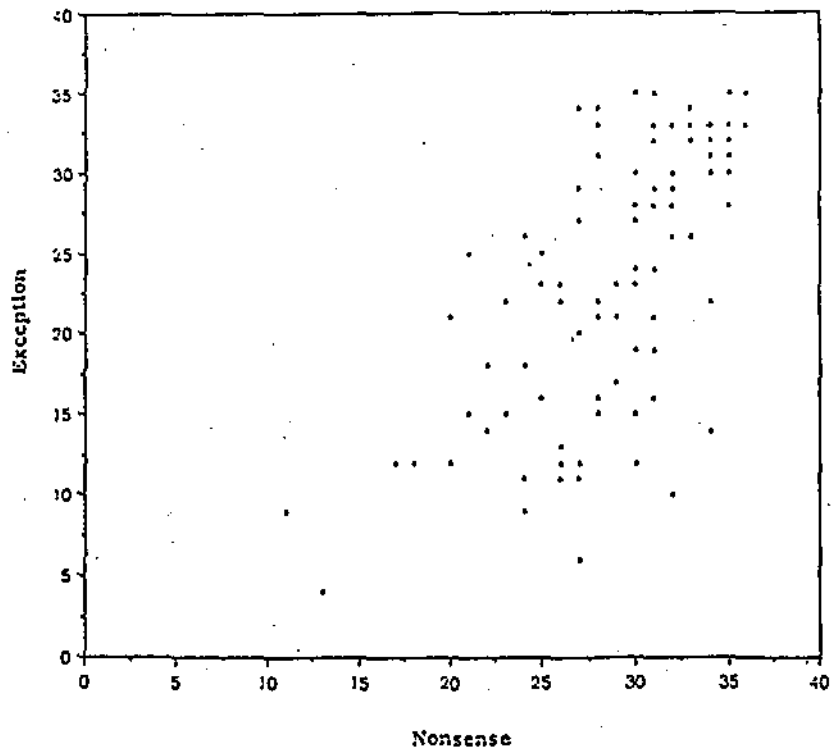


Figure 2
Gough and Walsh (1991): Scatterplot Data Showing Exception (Irregular) Word Naming as a Function of Nonsense (Pseudoword) Word Naming.

From Gough, P.B., & Walsh, M.A. (1991). Chinese, Phoenicians, and the orthographic cipher of English. In S.A. Brady and D.P. Shankweiler (Eds.), *Phonological processes in literacy. A tribute to Isabelle Y. Liberman*. Hillsdale, NJ: Erlbaum. Reprinted with permission

The first research question explored in this study, concerned whether a four group clustering would be found in Year 2 students based on their word reading strategies, as reported by Freebody and Byrne (1988). [The cluster analysis procedure used by Freebody and Byrne (1988) was a modified version of the ISODATA minimum-squared-error clustering algorithm reported by Hall and Khanna, 1977].

The four-cluster-analysis solution for the results of this study of Year 2 students revealed: a group of twenty students performing well above average on both word reading measures (Cluster IV); a larger group of twenty-eight students performing substantially below average on both measures (Cluster II); another group of fifteen students performing at average or above average on pseudoword reading, while performing close to average on the irregular word measure (Cluster I); and finally a group of twelve children performing close to, or just below average, on pseudoword reading and substantially below average on irregular word reading (Cluster III). Cluster analysis did not identify a group with above average irregular reading and below average pseudoword reading. The mean word reading scores for each group in the four-cluster-analysis solution are shown in Table 2.

Table 2

Four-Cluster-Solution for all Students in Year 2 on Irregular and Pseudoword Reading Performance (Mean Word Reading Scores)

	Cluster			
	I	II	III	IV
Membership				
n	15	28	12	20
% of total	20	37.3	16	26.6
Word reading*				
irregular	13.66	5.89	5.75	24.85
pseudoword	20.26	5.57	12.75	21.70

*Overall word means: Irregular = 12.48, Pseudoword = 13.96.

A second cluster analysis was carried out, this time using a three-cluster-solution. This produced a group of thirty-two students performing well above average on both word reading measures (Cluster C); a smaller group of twenty-five students performing substantially below average on both measures (Cluster A) and a third group of eighteen students performing at or above average on pseudoword reading and close to the average on irregular words (Cluster B). The results of the three-cluster-analyses are presented in Table 3.

Table 3**Three-Cluster-Solution for all Students in Year 2 on Irregular and Pseudoword Reading Performance (Mean Word Reading Scores)**

	Cluster		
	A	B	C
Membership			
n	25	18	32
% of total	30	27.3	42.7
Word reading*			
irregular	4.3	9.06	20.88
pseudoword	6.04	11.94	21.41

*Overall word means: Irregular = 12.48, Pseudoword = 13.96.

5.3 Phonemic Awareness

Freebody and Byrne (1988) used three planned contrasts in their investigation of the relationship between phonemic awareness and word reading strategy. They compared a) the means for the HB group versus the pooled means for the other three groups, b) the means for the LB group versus the pooled means of the other three groups and, c) the Phoenician versus the Chinese group. In this study, Cluster IV most closely approximated the HB group in the Freebody and Byrne (1988) study, and Cluster II their LB group. In order to replicate, as far as possible, the phonemic awareness comparisons made by Freebody and Byrne (1988), the phonemic awareness scores of Cluster IV were compared with the combined data from the other three groups. Similarly, the phonemic

awareness scores of Cluster II were compared with the pooled scores of the other three groups. A third comparison was undertaken to compare the phonemic awareness performance of Clusters II and III. This was done to investigate any differences in phonemic awareness of the two groups that were situated in close proximity to each other. An independent samples t test was used in each case. (Analysis of variance was not utilised, as the effect of comparing one group with all other subjects resulted in two group comparisons).

When the planned contrasts were examined they revealed that Cluster IV readers performed significantly better in the combined initial-consonant elision and final-consonant matching tasks than the other groups ($t = 3.45$, $df = 73$, $p < 0.01$). This was also repeated with the rhyming test ($t = 3.73$, $df = 73$, $p < 0.01$). There was not a significant difference between these groups on segmenting ($t = 0.98$, $df = 73$, NS) and telescoping tasks ($t = 0.56$, $df = 73$, NS). Cluster II readers performed significantly worse than the pooled means of the rest on the combined initial-consonant elision and final-consonant matching phonemic awareness measures ($t = 3.62$, $df = 73$, $p < 0.01$) and the rhyming test ($t = 4.15$, $df = 73$, $p < 0.01$). The results for segmenting ($t = 1.22$, $df = 73$, NS) and telescoping ($t = 1.81$, $df = 73$, NS) in this comparison were not significant.

Comparison of Cluster II and III, in terms of their phonemic awareness results, showed no significant difference in the combined initial-consonant elision and final-consonant matching ($t = -0.94$, $df = 38$, NS), auditory segmenting ($t = -0.07$, $df = 38$, NS) or auditory blending measures ($t = -1.59$, $df = 38$, NS). However, there was a significant difference in the rhyming results of these two groups ($t = -3.34$, $df = 38$, $p < 0.01$). The

mean scores and standard deviations of the phonemic awareness performance of each group in the four-cluster-analysis solution are shown in Table 4.

5.4 Single subject design and decoding intervention

The multiple baseline data for the six children involved in this phase of the study is presented in Figure 3. During the initial baseline phase, Zara (median = 7.5), Alyssa (median = 5.5), and Christopher (median = 6) produced results that were ascending, while Gary's scores (median = 6) were generally level, but close to criteria. Only Melissa (median = 1.5) and Jeremy (median = 3) displayed consistently low scores on the task of reading the simplest regular word types, namely **CVC** words (Appendix C). Following the collection of the first four baseline points, the decision was made to collect further baseline data, but using more difficult word types (Appendix D). Mixed word types were introduced in order to ascertain the extent to which these students could already read the all of the basic word types required for successful decoding.

Table 4

Means and Standard Deviations for the Four Cluster Groups for Year 2
Students on Phonemic Awareness

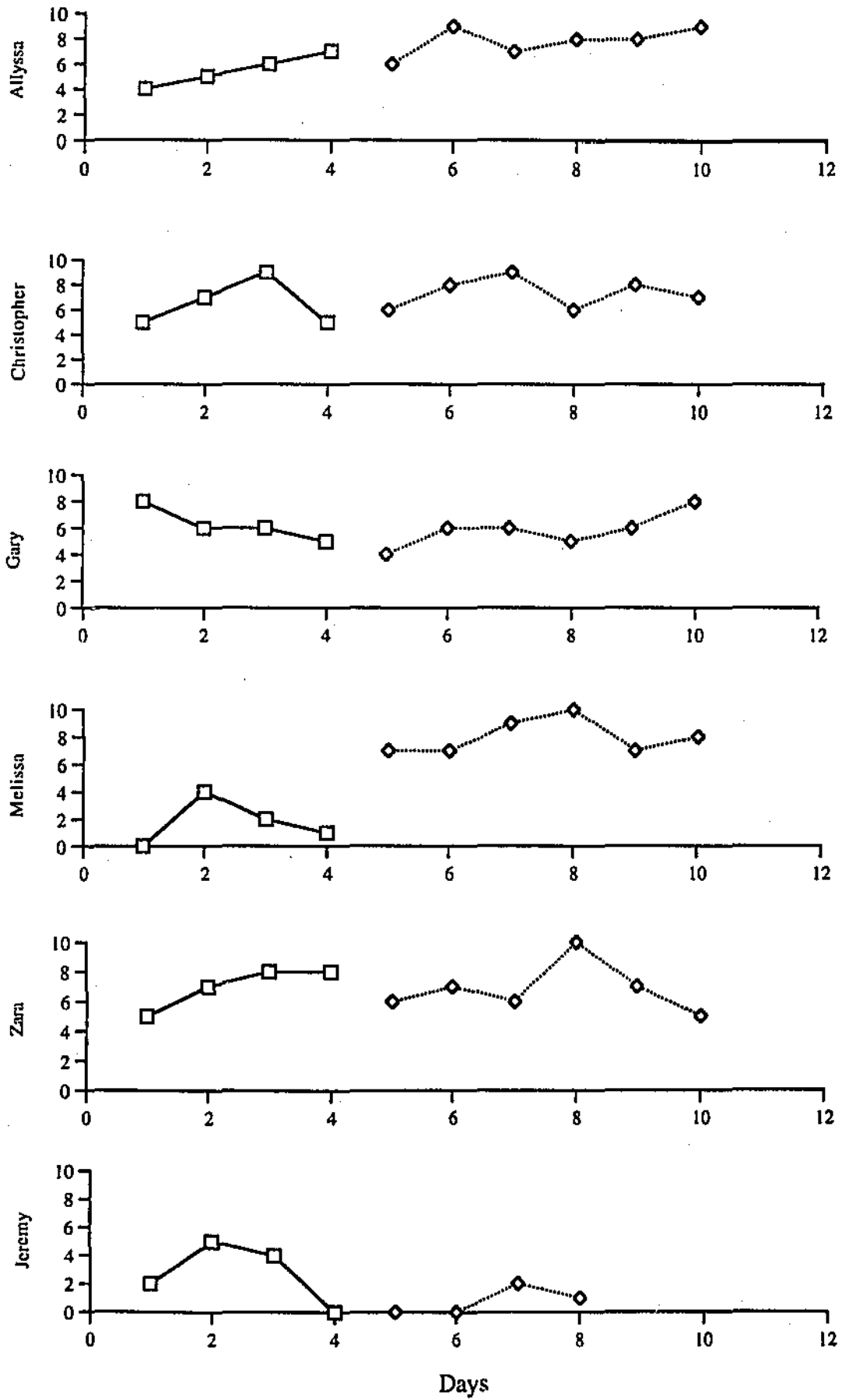
IC & FC*		Rhyming		Segmenting		Telescoping	
M	sd	M	sd	M	sd	M	sd
Cluster IV							
21.70	6.32	16.80	2.02	18.90	2.12	18.10	1.48
Clusters I, II, & III							
15.56	8.04	13.89	4.73	18.31	2.76	17.85	2.13
Cluster II							
13.18	7.35	12.00	4.85	17.93	3.41	17.32	2.57
Clusters I, II, & IV							
19.60	7.55	16.25	3.15	18.79	2.00	18.28	1.42
Cluster II							
13.18	7.35	12.00	4.85	17.93	3.41	17.32	2.57
Cluster III							
15.83	8.47	16.08	2.81	18.00	2.52	18.33	1.44

*IC & FC: Combined scores of the initial-elision and final-consonant tests.

Figure 3. Multiple Baseline Data Across Six Subjects

□ = cvcc words
 ◇ = mixed words

Words Read Correctly



The results for this second baseline phase were similar to the first in that Zara (median = 6.5), Alyssa (median = 8) and Christopher (median = 7.5) continued to show ascending trends, while Gary's results (median = 6) stayed level. Of the two low performing students, Jeremy continued to perform poorly (median = 0.5). On the other hand, Melissa, who had scored between 0 and 4 words correct out of 10 in the first baseline phase, showed a sudden jump to between 7 and 10 out of 10 (median = 7.5). At this point, Melissa's classroom teacher was interviewed. It was revealed that the teacher considered she had a history of underachieving, in order to gain attention. In order to check on this possibility, a previous baseline word reading test (session 4 of baseline A1) was re-administered. Whereas she had originally scored 1 out of 10, on the retest one week later, she obtained 8 out of 10 correct.

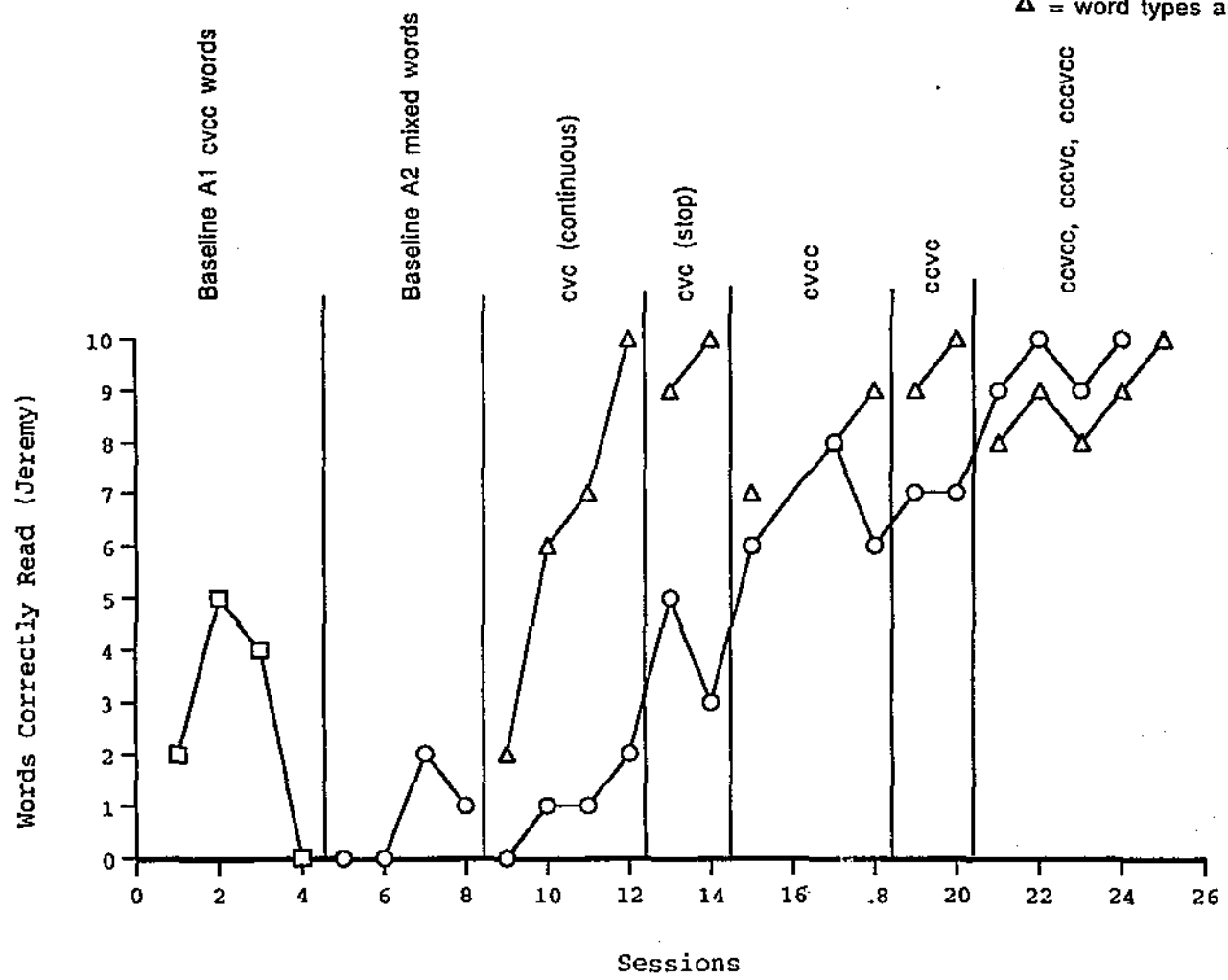
Thus, the baseline results of five of the six students showed that they were close to, or achieving, criterion levels of performance which had been set at 90% or better. On the basis of their baseline data, it was decided to intervene with only one of these students. Consequently, a changing criterion design was then implemented for Jeremy. His daily scores on the word type under instruction, as well as words drawn from the mixed word types lists, are shown in Figure 4. These results indicate that Jeremy achieved the 90% criterion for each word type on which instruction was provided. In the last phase, his performance on reading mixed word types was above his performance on the word types under instruction (**CCCVCC**, **CCVC** and **CCVCC**).

Figure 4. Changing Criterion Design Data for One Subject

□ = cvcc

○ = mixed word

△ = word types as shown



Both Jeremy and the other five subjects were given a post-test on the pseudoword reading task, these results are displayed in Table 5. In each case, their post-test scores were at least double their initial scores.

Table 5

Pre and Post-Test Scores for Six Students on 30 Pseudoword List

(Number Correct)

Student	Pre-test	Post-test	Difference
Melissa	7	19	+12
Alyssa	7	20	+13
Zara	8	17	+9
Gary	5	14	+9
Christopher	8	16	+8
Jeremy	3	18	+15

CHAPTER 6

DISCUSSION

6.1 Classification by word reading strategies

Does a replication of the word reading measures and cluster analysis used by Freebody and Byrne (1988) with Grade 2 (Year 2) students result in their classification into the following groups: HB, LB, Chinese, and Phoenician?

The classification of students according to their word reading strategies is of central importance to this study and was based on the performance of each student on irregular and pseudoword reading measures that were used originally by Freebody and Byrne (1988).

In order to identify groups of students using different word reading strategies, Freebody and Byrne (1988) used cluster analysis in order that "relatively discrete, homogeneous groups or clusters of elements may be identified" (Diekhoff, 1992, p. 361). The same procedures were replicated in this study. Before examining the grouping of students by word reading strategy, it is important to evaluate the extent to which the criterion measures were reliable, particularly as Freebody and Byrne (1988) did not report reliability data for these tests. The results of this study revealed that both measures were in fact highly reliable (Irregular words $\alpha = .947$ and Pseudowords $\alpha = .922$).

A four-cluster-solution was carried out initially so that the results of this study could be compared with those of Freebody and Byrne (1988). It was

possible to match three of the groups of students in this study to similar groups in the Freebody and Byrne (1988) study.

It is apparent that Cluster II subjects could be described as LB readers because they were weak on both irregular and pseudoword reading tasks. Cluster IV subjects best fitted the HB definition, these students achieving above average scores on both measures. Cluster III most closely fits the Phoenician classification, as their word reading scores showed average or better pseudoword scores and poor irregular word scores, matching the criteria set out by Freebody and Byrne (1988). Cluster I students could not realistically be described as either Chinese or Phoenician readers, because their mean scores were above average on irregular word reading and also well above average on the pseudoword list. This cluster clearly does not conform to any of the original classification criteria of beginning readers used by Freebody and Byrne (1988). Thus, the four-cluster-solution identified LB, HB and Phoenician readers. However, 20% of the sample did not fit the descriptions presented by Freebody and Byrne (1988).

A marked comparison to the four-cluster-solution is evident in the three-cluster-solution in which all subjects were accommodated under the HB, LB or Phoenician categories. Cluster A students clearly showed LB characteristics, while Cluster C readers fulfilled the HB description. The mean irregular word reading score for Cluster B (9.06) was below the mean score for all subjects, while the mean pseudoword reading score (11.94) for this group was slightly below average. That is, this group overlapped with but did not entirely fulfil the criterion for Phoenician readers. Closer examination of the scores of students in Cluster B revealed that there was one student in this group whose raw scores were clearly not representative

of a Phoenician reader (irregular = 17, pseudoword = 3). If this child's scores were removed from Cluster B, then the remaining students were very close to the description of a Phoenician reader (irregular word mean below average, pseudoword mean just below average).

It is interesting to note how the members of each cluster were relocated from the four-cluster-solution to the three-cluster-solution. While there was minimal variation in the membership of the LB groups for both clustering solutions (Clusters II and A), there were some differences between Clusters III and Cluster B. A large proportion (75%) of subjects in Cluster III were relocated within the Phoenician readers of Cluster B. In the same way many of the readers (80%) in Cluster I, the group which did not clearly meet the criteria for any cluster according to the Freebody and Byrne (1988) classification, were relocated in Cluster C (HB).

Consequently, the three-cluster-solution produced a group which closely resembled the Phoenicians in the Freebody and Byrne (1988) study. Thus, a three-cluster-solution appears the more appropriate resolution for the classification of students by word reading strategy in this study.

A general concern with cluster analysis procedures is that they produce a number of alternative solutions so that "selecting the 'right' solution is the greatest challenge facing the researcher using cluster analysis" (Diekhoff, 1992, p. 368). Byrne et al (1992) observed that since cluster analysis is used to "deduce typological groupings from the spread of scores" (p. 149), this procedure would have obscured the positive correlation between irregular and nonsense word reading. In 1992, they used a canonical analysis which they described as providing a "different perspective on the findings by taking full account of that correlation" (p. 149). The results of

the canonical analysis provided evidence that led them to caution against interpreting cluster analysis results as evidence of discrete groups.

The need to use a supplementary analysis in the Byrne et al (1992) investigation raises questions about the validity of the prior cluster analysis of their data in 1988. The current study also raised doubts about the appropriateness of the four-cluster-solution for this sample of beginning readers. Drawing evidence from the beginning reading literature, particularly from the theoretical perspective of developmental stage models of reading acquisition, it appears that a three-cluster-solution best describes the beginning readers of this study. Diekhoff (1992) highlighted some of the difficulties in selecting a correct clustering solution. He noted that not only should statistical analysis be considered when forming this decision, but that "theory and interpretability should also guide our choice of cluster solutions. If it makes more theoretical sense for the elements being clustered to form three clusters than four, use the three-cluster solution" (p. 369).

In contrast to the findings of Freebody and Byrne (1988), this study did not reveal a clearly distinguishable group of Chinese readers. The identification of only three sub-groups of beginning readers may be best understood within a theoretical framework that is based on stage models of reading development.

The HB reader can be viewed as functioning as an orthographic reader, being able to identify irregular words by their orthographic structure, as well as being able to use this strategy coupled with phonological recoding in order to read regular pseudowords. The LB reader displayed the features of a logographic or rudimentary alphabetic reader, with an

inability to phonologically recode. In many cases in this study, when confronted with the irregular or pseudoword reading task, students who were classified as LB readers would use one of two strategies. They would either make a wild guess (e.g. "football" for the word "was") or focus on a small portion of the word, usually the initial letter, in an attempt to identify the word (e.g. "washing machine" for the pseudoword "winsup"). These strategies were associated with poor performance on both measures of word reading.

The Phoenician readers identified in this study demonstrated use of the alphabetic strategy, performing at a higher level with pseudowords than irregular words. Their use of letter-by-letter decoding with pseudowords was a feature of their reading style. They generally used the same sounding out procedure to identify unknown irregular words. It cannot be said of these readers that they displayed the more mature reading strategies as used by the HB reading group. They are more aptly described as "semi-skilled" readers (Gough and Walsh, 1991).

With respect to the failure to identify a group of Chinese readers in this study, it is significant that in their longitudinal investigation, Byrne et al (1992) also alluded to the possibility that few Chinese readers actually exist. They conceded that:

Even though irregular and nonsense-word reading are correlated, other researchers have produced evidence of asymmetry in the relationship. In particular there appear to be few, if any, children in the off-diagonal defined by high irregular-but low nonsense word score. Gough and Walsh (1991), for example, suggest that word-

specific learning mechanisms are not separate from decoding skill, although children can be competent decoders without simultaneously building a substantial stock of sight words (p. 142).

Gough and Walsh (1991) asserted that the relationship between reading irregular words and reading pseudowords is not merely correlational. They conducted a study in which 93 first, second, and third graders were required to read 36 item regular, irregular, and pseudoword lists that were developed by Baron (1979). The results of their irregular word (exception word) and pseudoword scores, reproduced in Figure 2, indicated a systematic relationship between the ability to read irregular words and the ability to read pseudowords. "What the scatterplot exhibits is that, if children can read many pseudowords, they may or may not read many exception words. But if they can read few pseudowords, then they can read few exception words" (Gough and Walsh, 1991, p. 206).

The word reading results of the present study were also plotted in the same manner as those of Gough and Walsh (1991) and show an overall pattern that is consistent with their findings. There is a clear similarity between the two scatterplots (Figures 1 and 2): the majority of students are clustered around the diagonal of low on both to high on both irregular and pseudoword reading. The main differences between these two scatterplots is that a smaller number of children in this study were able to read a higher number of irregular words than pseudowords. Only one of the subjects in this study fulfilled the criteria of a Chinese reader that is, achieving a high irregular word score but a low pseudoword score. It is noteworthy that this study included a larger number of subjects who achieved low scores on both reading tasks.

Gough and Walsh (1991) further investigated the relationship between the ability of early readers to read pseudowords and their corresponding ability to learn a number of exception words. Children who had an alphabetic understanding (i.e. had broken the code) performed better than their peers in this task. Their understanding of the alphabetic principle "evidently facilitated the acquisition of the word-specific information necessary to read the irregular words" (p. 207). This finding, combined with the evidence on the importance for readers of acquiring the alphabetic principle, may be seen as supporting the notion that a proficient reader could not be described as either Chinese or Phoenician but rather a combination of the two. That is, a mature reader may use either letter-to-sound correspondence to decode an unknown word, or use the word's orthographic structure to identify it (Ehri, 1991).

It could be argued that the Phoenician reader is a semi-skilled reader whereas a Chinese reader is not. Gough and Walsh (1991) reasoned that the Phoenician reader has developed alphabetical knowledge and is able to apply this to word reading, although they are not yet able to identify instantaneously words based on their orthographic structure. The same authors maintained that the Chinese reader could not be considered semi-skilled, as they have not yet broken the code. This line of reasoning is supported by Byrne et al (1992) who found that although some Year 2 readers displayed a Chinese reading style, over the subsequent two years this sub-group virtually disappeared. The obvious conclusion is that these children had either learned to use the alphabetic code and thus moved into the Phoenician and HB groups or, failing to come to grips with the alphabetic principle, developed the characteristics of a member of the LB

group.

Dual-route theory was previously used by Baron and Strawson (1976), Baron (1979), and Baron and Treiman (1980) to explain the word reading strategies used by subjects with different levels of reading ability. There is some similarity between the dual-route theory and Ehri's (1991, 1992) theory of skilled word recognition, in that two sorts of information are thought to be required to read words quickly and efficiently. The difference is that, in the latter theory, it is considered that phonological and orthographic paths to the lexicon are not separate, but rather inextricably connected. To quote Gough and Walsh (1991) "reading ability in our language, like its orthography, begins in Phoenicia" (p. 208).

A range of variables has been postulated to account for the child's ability to build a store of sight words. These include the number of times they practise reading the word and their overall exposure to printed materials (Frith, 1986), particularly in the home environment (Olsen, Wise, Connors, and Rack, 1990). The type of instruction received in the early grades is also thought to impact on the strategies used by beginning readers [Beck, 1981; Snowling (1987, cited in Rack et al, 1992)].

Any one, or combination of, the variables referred to above, may have had a direct bearing on why Freebody and Byrne (1988) found a number of Chinese readers while this study did not. The ability to acquire a store of sight words, learned by memory, is relatively easy for beginning readers since the volume of written words to which they are exposed is usually relatively small (Byrne et al, 1992). The progression to later grades, particularly three and above, is accompanied by an explosion in the sheer

quantity of written vocabulary to which the child is exposed (Carnine et al, 1990). For the Chinese reader this may well have dire consequences. Byrne et al (1992) noted that by Grade 4, the Chinese reader had almost ceased to exist. The fact that the relative proportion of students in the various clusters was different in this study to that reported by Freebody and Byrne (1988), may account for the identification of Chinese readers by the latter, but not in this study. Whereas the majority of subjects in the Freebody and Byrne (1988) study performed relatively well on both irregular and pseudoword reading, this could not be said of the sample used in the current inquiry.

6.2 Phonemic awareness

Is there a statistically significant difference between the phonemic awareness skills (measured by initial-consonant elision and final-consonant matching; and segmenting, telescoping and rhyming) of groups of students classified by word reading strategy?

Discussion of the phonological awareness results will be confined to the four-cluster-solution because this question was based on a replication of that aspect of the study by Freebody and Byrne (1988).

The segmenting and telescoping results in this study were confounded by ceiling effects, with virtually every child scoring close to the maximum on each of these tasks. This may well account for the low reliability coefficients of these tests as there was very little variability in the scores. Furthermore, the low reliability for telescoping ($\alpha = 0.529$) and the final-consonant matching ($\alpha = 0.635$) tasks limits the conclusions that can be

made on the basis of each of these tests. Yet, when the results of the initial-consonant elision and final-consonant matching tasks were combined (replicating Freebody and Byrne, 1988) an acceptable level of reliability resulted ($\alpha = 0.926$). In contrast, the rhyming test scores in this study did not reach ceiling, and the test demonstrated acceptable reliability ($\alpha = 0.850$). Since only the combined scores, and the scores from the rhyming test, were unaffected by low reliability or ceiling effects, the discussion of the phonemic awareness results will be limited to these tests.

When the three planned contrasts that Freebody and Byrne (1988) and Byrne et al (1992) used were incorporated into the analysis, a predictable set of results arose. The HB group performed better on the combined-initial elision and final-consonant matching tasks than the pooled means of the other students, while the LB group performed worse than the pooled means of the other groups. These results were not surprising: the better readers had better phonemic awareness and the weaker students had weaker phonemic awareness! This is consistent with the findings of Freebody and Byrne (1988) and the large body of research that documents a relationship between phonological awareness and reading acquisition (Byrne and Fielding-Barnsley, 1991; Maclean et al, 1987; Share et al, 1984; Stanovich, 1986).

Comparison of the two clusters that shared close proximity to each other, Cluster II (LB) and Cluster III (Phoenician) on the combined test failed to show a statistically significant difference. This result is in marked contrast to the findings reported by Freebody and Byrne (1988). While the mean combined phonemic awareness score of the Phoenician groups in this study and Freebody and Byrne's were very close (15.83 and 16.09), the

mean phonemic awareness score of the LB group in this study was considerably higher (13.18) than that of the other study (9.17). Given that all 20 of the students who received *Reading Mastery* instruction were located in the LB group, and that *Reading Mastery* explicitly teaches rhyming, segmenting and telescoping it is likely that their phonemic awareness scores reflect the effects of this instruction. In fact, the *Reading Mastery* instruction that was used with some, but not all, of the students in this study represents an uncontrolled or confounding variable.

On the other hand, the rhyming test, which appears to be an easier task (Stanovich, Cunningham and Cramer, 1984; Yopp, 1988), did produce a significant difference between Clusters II and III in favour of the Phoenician group. Goswami and Bryant (1990) and Yopp (1988) considered that rhyming taps a distinct and different phonological awareness ability. In the same vein, Carnine et al (1990) have argued that the reason for teaching rhyming is that it provides a strategy for demonstrating to the child how to blend stop sounds with continuous letters.

6.3 Decoding instruction and regular word reading of a single subject

Is there evidence that the reading of regular words by individual students, classified as LB readers, improves with systematic decoding instruction?

The second stage of this study involved the use of single subject methodology to investigate, in an exploratory way, the possible effects of systematic decoding instruction on the word reading strategies of children selected on the basis that they scored in the LB group and who had not

received any *Reading Mastery* instruction. The original plan was to implement a multiple baseline design in which intervention would be introduced to one child in each pair, while the second remained on baseline, followed by a phase in which the second child also received intervention. In order to demonstrate a functional relationship between the dependent and independent variables in a multiple baseline design, it is first necessary to establish stable baselines: That is, baselines that show little change in direction (trend) and have limited variability. Once performance on baselines for all subjects is stable, intervention is introduced. A functional relationship is considered to exist when "each dependent measure changes when, and only when, treatment is initiated for that behaviour" (Poling & Grossett, 1986, p. 15).

As the requirement of stable and level baselines was not met for five of the six LB subjects in this study, a decision was made to implement a changing criterion design with one subject. This design is ideally suited to instructional purposes as it is possible to set attainable small-step increments in criterion levels, allowing a student to make steady progress toward a goal (Schloss, Sedlak, Elliot and Smothers, 1982). If the progress of the student matches set criteria, then this is a powerful demonstration of the effectiveness of the intervention.

Of the six LB students, only Jeremy was observed to have difficulties in reading regular word types, producing consistently low baseline data. Before intervention, he was found to have gaps in his letter-sound knowledge, as well as poor discrimination of the letters "b", "d", and "p". He was also unable to use a telescoping or blending strategy to sound out words using their letter sounds. Jeremy was given explicit instruction in

which he was taught to discriminate between the letters he had previously confused, and the strategy of sounding out regular word types without stopping between sounds. His daily data showed that by the end of the intervention phase he was able to reach criteria in reading mixed regular word types. During the last phase of the intervention, it was found (Figure 4) that Jeremy was scoring better on the mixed word types (used to assess generalisation) than on the word types on which he was currently receiving instruction. This may be due to the mixed word types including easier word types such as **CCVC** words, that began with a consonant blend (Appendix D). The word types on which Jeremy received instruction in the final phase of intervention were more difficult, namely **CCVCC**, **CCCVC**, and **CCCVCC** word types.

Clearly, the data show that for Jeremy systematic decoding instruction was associated with improvement in reading regular word types. This result was achieved over a relatively short period of time (16 teaching sessions).

6.4 Decoding instruction and pseudoword reading

Is there evidence of increased ability to read pseudowords by individual students classified as LB readers who receive systematic decoding instruction?

When post-tested on the pseudoword list Jeremy was found to have increased his score dramatically, so that he would now have been classified in the Phoenician group on the basis of his ability to decode pseudowords.

Apart from Jeremy, who showed consistently low scores on regular word

reading before intervention, there were five other students who performed poorly on the pseudoword test in the first place, but then either produced evidence that their ability to read regular words was improving (ascending baselines) or that it was close to criterion. This raises the question of how this could have happened.

There are several variables that may have a direct bearing in seeking the answer to this question. Rack et al (1992) described a phenomena which they called the "nonword reading deficit". Developmental dyslexics showed a nonword reading deficit relative to the complexity of the nonwords they encountered when compared with normal reading matched level groups. Dyslexic children were able to read single syllable pseudowords but had increasing difficulty as the pseudowords became more complex in their orthography (Snowling, 1981; Holligan and Johnston, 1988; both cited in Rack et al 1992). The performance of dyslexic children on nonword tests raises questions about the orthographic composition of the pseudowords that Freebody and Byrne (1988) used.

A closer look at the elements of Freebody and Byrne's (1988) pseudoword list (Appendix A), indicated that the pseudowords used included 15 single-syllable words and 15 two-syllable word types, of which the latter also included 5 pseudowords that contained a consonant cluster. In the test used, ten of the pseudowords were visually similar to real words, leading to the possibility that these may have been able to be read by analogy (Glushko, 1979). It was observed that many children tried to read a pseudoword as a real word if its orthography closely resembled a known real word (e.g. "lamp" for "lemp" and "desk" for "besk").

As a measure of the decoding skill of the reader, this word list comprised a range of different pseudoword types. The order of introduction was not arranged so that the easier pseudowords were read first. Instead, the first pseudoword that a subject had to read was "lopeb". The difficulty of this particular word was highlighted by the fact that none of the 75 subjects read it correctly. Four of the more difficult pseudowords were encountered by the subjects within the first seven items. The combination of this, together with a lack of prior practice items from which corrective feedback could have been given, made the task more difficult than necessary. Many of the children seemed unsure of what was required of them, with most HB and some Phoenician readers only becoming more comfortable with the task after several words had been attempted. Many of those subjects who achieved poor results on this measure simply gave up and refused to attempt to read the whole pseudoword list.

The instruction given to the subjects before reading each pseudoword was: "Tell me how they sound". It was observed that many of the subjects did not have a complete knowledge of the sounds of either the single letters or consonant clusters that were contained in this pseudoword list. A child who, attempting to read the pseudoword "monut", incorrectly used the /a/ sound for the letter u pronounced the word as "monat". This type of mistake was repeated many times during testing.

Relatively minor changes to the administration and structure of this task may well result in scores that better tap the phonological recoding skills of beginning readers. In particular, the provision of several practice items with corrective feedback would be useful as this would acquaint the subject with the required task. In addition, if the pseudoword list was re-

ordered from least to most difficult, then it may not seem so daunting. The issue of task familiarity and test difficulty, can be seen to provide possible answers to why a poor pseudoword ability did not equate to a poor regular word reading ability in five of the LB students who were targeted for intervention.

Another variable that may account for the baseline data of these students, is the likelihood that the classroom teacher provided explicit instruction on the sounding out strategy. She reported that single letter sounds were taught to the whole class, and instruction on how to sound out words was provided individually as the need arose. Consequently, the possibility that the performance of these five students may have been due to the effects of regular classroom instruction, cannot be overlooked. This may also account for the differences between pseudoword and irregular word reading results and for the gains in pseudoword reading scores when the five students were post-tested.

A possibility that cannot be ruled out is the effect of "reactivity" to the measures used in reading regular word types during baseline conditions (Cooper, Heron and Heward, 1987). As these students were tested daily on differing types of regular words, one possible explanation for this phenomenon was that "assessment methods that require an individual to repeatedly perform a specified behaviour are susceptible to practice effects; in other words, the person's ability to perform the behaviour improve simply because of the opportunities to practice" (Cooper et al, 1987, p. 42). The students could have been improving, without need of intervention, simply through practice.

The length of time between the pre and post-tests for the LB students was five or more weeks. While it is unlikely that they were able to remember any of the test items, it may have been the case that as a result of the pre-test, they were more familiar with what was required of them in the post-test. What is evident is that they all made considerable gains in their post-test scores.

6.4 Limitations

Replication of the classification procedures used by Freebody and Byrne (1988) and Byrne et al (1992) permitted a comparison to be made with the findings of the previous studies, with a different population of students and in a different state education system. Nonetheless, a representative sample of students, covering the full demographic range of the total school-age population would be required before conclusions could be drawn about the word reading strategies of Year 2 students in Western Australia, or Australia.

Furthermore, the use of pseudowords as a criterion in the classification of students according to the word reading strategies they use, implies that the list of pseudowords, test instructions and administration procedures result in an accurate indication of each child's ability to decode unknown words. There are clear doubts about the technical adequacy of the pseudoword test used by Freebody and Byrne (1988).

A major disadvantage of single subject research methodology is to be found in the level of confidence that may be placed in the generalisability of findings to other subjects. It is only by the systematic replication of single

subject designs that this issue can be addressed (Cooper et al, 1987).

Therefore, the implications of the intervention procedures are limited due to the size of the sample ($n = 1$). Replication of this phase of the study would be required with larger samples and representative groups of students before results could be generalised to other populations.

REFERENCES

- Adams, M.J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, Massachusetts: The MIT Press.
- Allington, R.L. (1984). Content coverage and contextual reading in reading groups. *Journal of Reading Behaviour*, 16(2), 85-96.
- Ball, E.W., & Blachman, B.A. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly*, 26(1), 49-66
- Baron, J. (1979). Orthographic and word-specific mechanisms in children's reading of words. *Child Development*, 50(1), 60-72.
- Baron, J., & Strawson, C. (1976). Orthographic and word-specific mechanisms in reading words aloud. *Journal of Experimental Psychology: Human Perception and Performance*, 2(3), 386-393.
- Baron, J., & Treiman, R. (1980). Use of orthography in reading and learning to read. In J.F. Kavanagh & R.L. Venezky (Eds), *Orthography, reading and dyslexia*. Baltimore: University Park Press.
- Barr, R.C. (1972). The influence of instructional conditions on word recognition errors. *Reading Research Quarterly*, 7(3), 509-529.
- Barr, R.C. (1974-1975). The effect of instruction on pupil reading strategies. *Reading Research Quarterly*, 10(4), 555-582.
- Barron, R.W. (1981). Development of visual word recognition: A review. In G.E. Mackinnon & T.G. Waller (Eds), *Reading research: Advances in theory and practice* (Vol. 1). San Diego, CA: Academic Press.
- Barron, R.W. (1986). Word recognition in early reading: A review of the direct and indirect access hypotheses. *Cognition*, 24(1-2), 93-119.
- Beck, I.L. (1981). Reading problems and instructional practices. In G.E. Mackinnon & T.G. Waller, (Eds), *Reading Research: Advances in theory and practice*, (Vol. 2). New York: Academic Press.
- Beech, J.R., & Harding, L.M. (1984). Phonemic processing and the poor reader from a developmental lag viewpoint. *Reading Research Quarterly*, 19(3), 357-366.
- Biemiller, A. (1970). The development of the use of graphic and contextual information as children learn to read. *Reading Research Quarterly*, 6(1), 75-96.

- Blemiller, A. (1977-1978). Relationships between oral reading rates for letters, words, and simple text in the development of reading achievement. *Reading Research Quarterly*, 13(2), 223-253.
- Blachman, B.A. (1987). An alternative classroom reading program for learning disabled and other low-achieving children. In W. Ellis (Ed.), *Intimacy with language: A forgotten basic in teacher education*. Baltimore: Orton Dyslexia Society.
- Boder, E. (1971). Developmental dyslexia: Prevailing diagnostic concepts and a new diagnostic approach. In H. Myklebust (Ed.), *Progress in learning Disabilities* (Vol 2). New York: Grune and Stratton.
- Bond, G.L., & Dykstra, R. (1967). The cooperative research program in first-grade reading instruction. *Reading Research Quarterly*, 2(4), 5-42.
- Bradley, L., & Bryant, P.E. (1983). Categorizing sounds and learning to read - a causal connection. *Nature*, 301, 419-421.
- Bryant, P., & Impey, L. (1986). The similarities between normal readers and developmental and acquired dyslexics. *Cognition*, 24(1-2), 121-137.
- Byrne, B., (1992). Studies in the unbiased acquisition procedure for reading: Rationale, hypotheses, and data. In P.B. Gough (Ed), *Reading Acquisition*. Hillside, NJ: Erlbaum.
- Byrne, B., & Fielding-Barnsley, (1989). Phonemic awareness and letter knowledge in the child's acquisition of the alphabetic principle. *Journal of Educational Psychology*, 81(3), 313-321.
- Byrne, B., & Fielding-Barnsley, (1991). Evaluation of a program to teach phonemic awareness to young children. *Journal of Educational Psychology*, 83(4), 451-455.
- Byrne, B., Freebody, P., & Gates, A. (1992). Longitudinal data on the relations of word-reading strategies to comprehension, reading time, and phonemic awareness. *Reading Research Quarterly*, 27(2), 141-151
- Carnine, D.W. (1977). Phonics versus look-say: Transfer to new words. *Reading Teacher*, 30(6), 636-640.
- Carnine, D., Silbert, J., (1979). *Direct instruction reading* (1st ed.). Columbus, Ohio: Merrill.
- Carnine, D., Silbert, J., & Kameenui, E.J. (1990). *Direct instruction reading* (2nd ed.). Columbus, Ohio: Merrill.
- Chall, J.S. (1967). *Learning to read: The great debate*. New York: McGraw-Hill.

- Chall, J.S. (1979). The great debate: Ten years later, with a modest proposal for reading stages. In L.B. Resnick and P.A. Weaver (Eds.), *Theory and practice of early reading* (Vol. 1). Hillsdale, New Jersey: Lawrence Erlbaum.
- Chall, J.S. (1983). *Stages of reading development*. New York: McGraw-Hill.
- Chall, J.S. (1989). Learning to read: The great debate 20 years later. *Phi Delta Kappan*, 70(1), 521-538
- Chapman, R.S., & Kamm, M.R. (1974). *An evaluation of methods for teaching initial sound isolation*. (ERIC Document ED 066-231).
- Coleman, E.B. (1970). Collecting a database for a reading technology. *Journal of Education Psychology Monograph* 61(4 Part 1), 1-21.
- Cooper, J.O., Heron, T.H., & Heward, W.L. (1987). *Applied Behavioral Analysis*. Columbus, Ohio: Merrill.
- Cronbach, L.J. (1970). *Essentials of Psychological Testing: Third Edition*. New York: Harper and Row.
- Diekhoff, G. (1992). *Statistics for the social and behavioral sciences*. Dubuque, IA: Wm.C.Brown.
- Ehri, L.C. (1979). Linguistic insight: Threshold of reading acquisition. In T.G. Waller & G.E. Mackinnon (Eds.), *Reading research: Advances in theory and practice*. New York: Harcourt Brace Jovanovich.
- Ehri, L.C. (1986). Sources of difficulty in learning to spell and read. In M.L. Wolraich & D. Routh (Eds), *Advances in developmental and behavioral pediatrics*. Greenwich, CT: Jai Press.
- Ehri, L.C. (1987). Learning to read and spell words. *Journal of Reading Behavior*, 19(1), 5-31.
- Ehri, L.C. (1989a). Movement into word reading and spelling: How spelling contributes to reading. In J. Mason (Ed), *Reading and writing connections*. Boston, MA: Allyn & Bacon.
- Ehri, L.C. (1989b). The development of spelling knowledge and its role in reading acquisition and reading disability. *Journal of Learning Disabilities*, 22(6), 356-365.
- Ehri, L.C. (1991). Development of the ability to read words. In R. Barr, M.L. Kamil, P.B. Mosenthal, & P.D Pearson (Eds), *Handbook of Reading Research*, (Vol II). New York: Longman.
- Ehri, L.C. (1992). Reconceptualizing the development of sight word reading and its relationship to recoding. In P.B. Gough (Ed), *Reading Acquisition*. Hillside, NJ: Erlbaum.

- Ehri, L.C., & Wilce, L.S. (1983). Development of word identification speed in skilled and less-skilled beginning readers. *Journal of Educational Psychology*, 75(1), 3-18.
- Ehri, L.C., & Wilce, L.S. (1985). Movement into reading: Is the first stage of printed word learning visual or phonetic? *Reading Research Quarterly*, 20(2), 163-179.
- Ehri, L.C., & Wilce, L.S. (1987a). Cipher versus cue reading: An experiment in decoding acquisition. *Journal of Educational Psychology*, 79(1), 3-13.
- Ehri, L.C., & Wilce, L.S. (1987b). Does learning to spell help beginners to read words? *Reading Research Quarterly*, 18(1), 47-65.
- Engelmann, S., & Bruner, S.E. (1988). *Reading Mastery*. Chicago: Science Research Associates.
- Foorman, B.R., & Liberman, D. (1989). Visual and phonological processing of words - A comparison of good and poor readers. *Journal of Learning Disabilities* 22(6), 349-355.
- Foorman, B.R., Novy, D.M., Francis, D.J., & Liberman, D. (1991). How letter sound instruction mediates progress in first-grade reading and spelling. *Journal of Educational Psychology*, 83(4), 456-469.
- Formentin, P.J. (1993). *Let's decode: Inservice manual*. Perth, Western Australia: Edith Cowan University.
- Fox, B., & Routh, D.K. (1976). Phonemic analysis and synthesis as word attack skills. *Journal of Educational psychology*, 68(1), 70-74.
- Fox, B., & Routh, D.K. (1984). Phonemic analysis and synthesis as word attack skills: Revisited. *Journal of Educational psychology*, 76(6), 1059-1064.
- Freebody, P., & Byrne, B. (1988). Word-reading strategies in elementary school children: Relations to comprehension, reading time, and phonemic awareness. *Reading Research Quarterly*, 23(4), 441-453.
- Frith, U. (1985). Beneath the surface of developmental dyslexia. In K.E. Patterson, J.C. Marshall, & M. Coltheart (Eds), *Surface Dyslexia*. London: Erlbaum.
- Frith, U. (1986). A developmental framework for developmental dyslexia. *Annals of Dyslexia*, 36, 69-81.
- Glushko, R.J. (1979). The organization and activation of orthographic knowledge in reading aloud. *Journal of Experimental Psychology: Human Perception and Performance*, 5(4), 674-691.

- Goodman, K.S. & Goodman, Y.M. (1979). Learning to read is natural. In L.B. Resnick and P.A. Weaver (Eds.), *Theory and practice of early reading*, (Vol. 1). Hillsdale, New Jersey: Lawrence Erlbaum.
- Goswami, U., & Bryant, P.E. (1990). *Phonological skills and learning to read*. Hove, Sussex: LEA.
- Gough, P.B. (1984). Word recognition. In P.D. Pearson (Ed.), *Handbook of reading research*, (Vol 1). New York: Longman.
- Gough, P.B., & Hillinger, M.L. (1980). Learning to read: An unnatural act. *Bulletin of the Orton Society*, 30, 171-176.
- Gough, P.B., & Tunmer, W.E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education*, 7(1), 6-10.
- Gough, P.B., & Walsh, M.A. (1991). Chinese, Phoenicians, and the orthographic cipher of English. In S.A. Brady and D.P. Shankweiler (Eds.), *Phonological processes in literacy. A tribute to Isabelle Y. Liberman*. Hillsdale, NJ: Erlbaum.
- Gough, P.B., Juel, C, & Griffith, P.L. (1992). Reading, spelling, and the orthographic cipher. In P.B. Gough (Ed.), *Reading Acquisition*. Hillsdale, NJ: Erlbaum.
- Goswami, U., & Bryant, P. (1990). *Phonological skills and learning to read*. Hove, U.K. Erlbaum
- Griffith, P.L., & Klesius, J.P. (1990). *The effect of phonemic awareness ability and reading instructional approach on first-grade children's acquisition of spelling and decoding skills*. (ERIC Document ED 332160).
- Groff, P. (1987). *Preventing reading failure: An examination of the myths of reading instruction*. (ERIC Document ED 284200).
- Groff, P., & Seymour, D.Z. (1987). *Word recognition: The why and the how*. Springfield, Illinois: Thomas
- Haddock, M. (1976). Effects of an auditory and auditory-visual method of blending instruction on the ability of pre-readers to decode synthetic words. *Journal of Educational Psychology*, 68(6), 825-831.
- Hall, D.J., & Khanna, D.K. (1977). The ISODATA method computation for the relative perception of similarities and differences in complex and real data. In K. Enstein, A. Ralston, & H.S. Wilf (Eds.), *Statistical methods for digital computers* (Vol. 3). New York: Wiley.
- Hartmann, D.P., & Hall, R.V. (1976). The changing criterion design. *Journal of Applied Behavior Analysis*, 9(4), 527-532.

- Herman, P.A. (1985). The effect of repeated readings on reading rate, speech pauses, and word recognition accuracy. *Reading Research Quarterly*, 20(5), 553-565
- Hollingsworth, S. (1983). *Decoding acquisition: A study of first-grade readers*. (ERIC Document ED 240504).
- Johnson, D.D., & Baumann, J.F. (1984). Word Identification. In P.D. Pearson, *Handbook of Reading Research*, (Vol.1). New York: Longman.
- Juel, C. (1983). The development and use of mediated word identification. *Reading Research Quarterly*, 18(3), 306-327.
- Juel, C. (1988). Learning to read and write: A longitudinal study of fifty-four children from first through fourth grade. *Journal of Educational Psychology*, 80(4), 437-447.
- Juel, C. (1991). Beginning reading. In B. Barr, M.L. Kamil, P. Mosenthal, & P. David Pearson (Eds). *Handbook of Reading Research (Vol II)*, 759-788.
- Juel, C., & Roper-Schneider, D. (1985). The influence of basal readers on first grade reading. *Reading Research Quarterly*, 20(2), 134-152.
- Juel, C., Griffith, P.L., & Gough, P.B. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology*, 78(4), 243-255.
- Kazdin, A.E. (1982). *Single-case research design: Methods for Clinical and Applied Settings*. New York: Oxford University Press.
- Kirtley, C., Bryant, P., Maclean, M., & Bradley, L. (1989). Rhyme, rime and onset of reading. *Journal of Experimental Child Psychology*, 48(2), 224-245.
- Lesgold, A., Resnick, L., & Hammond, K. (1985). Learning to read: A longitudinal study of word skill development in two curricula. In G. MacKinnon & T.Waller (Eds), *Reading Research: Advances in Theory and Practice (Vol 4)*. London: Academic Press.
- Liberman, I.Y., Rubin, H., Duques, S., & Carlisle, J. (1985). Linguistic abilities and spelling proficiency in kindergarteners and adult poor spellers. In D.B. Gray and J.F. Kavanagh (Eds.), *Biobehavioral measures of dyslexia*. Parkton, M.D: New York Press.
- Liberman, I.Y., & Shankweiler, D., Fischer, F.W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology*, 18(2), 201-212.

- Liberman, I.Y., & Shankweiler, D. (1985). Phonology and the problems of learning to read and write. *Remedial and Special Education*, 6(6), 8-17.
- Lie, A. (1991). Effects of a training program for stimulating skills in word analysis in first-grade children. *Reading Research Quarterly*, 26(3), 234-250.
- Lundberg, I. (1985). Longitudinal studies of reading and reading difficulties in Sweden. In G.E. MacKinnon and T.G Waller (Eds), *Reading Research: Advances in theory and practice* (Vol 4). London: Academic Press.
- Lundberg, I., Frost, J., & Peterson, O. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly*, 23(3), 263-284.
- MacLean, M., Bryant, P.E., & Bradley, L. (1987). Rhymes, nursery rhymes and reading in early childhood. *Merrill-Palmer Quarterly*, 33(3), 255-282.
- Marsh, G., Friedman, M.P., Desberg, G., & Saterdahl, K. (1981). Comparison of reading and spelling strategies in normal and reading disabled children. In M.P. Friedman, J.P. Das, and N. O'Connor (Eds), *Intelligence and learning*. New York: Plenum.
- Mason, J. (1980). When do children begin to read: An exploration of four-year-old children's letter and word reading competencies. *Reading Research Quarterly*, 15(2), 203-227.
- McGee, L.M., Lomax, R.G., & Head, M.H. (1988). Young children's written language knowledge: What environmental and functional print reading reveals. *Journal of Reading Behavior*, 20(2), 99-118.
- Muller, D. (1973). Phonic blending and transfer of letter training to word reading in children. *Journal of Reading Behavior*, 5(3), 212-217.
- Nagy, W.E., & Anderson, R.C. (1984). How many words are there in printed school English? *Reading Research Quarterly*, 19(3), 304-330.
- Olsen, R.K., Kliegl, R., Davidson, B.J., & Foltz, G. (1985). Individual and developmental differences in reading disability. In G.E. MacKinnon and T.G Waller (Eds.), *Reading Research: Advances in theory and practice* (Vol 4). London: Academic Press.
- Olsen, R.K., Kliegl, R., Davidson, B.J., Foltz, G., & Fulker, D. (1989). Specific deficits in component reading and language skills: Genetic and environmental influences. *Journal of Learning Disabilities*, 22(6), 339-348.

- Olsen, R.K., Wise, B., Conners, F.A., & Rack, J.P. (1990). Organization, heritability, and remediation of component word recognition and language skills in disabled readers. In T.H. Carr and B.A. Levy (Eds.), *Reading and its development: Component skills approaches*. New York: Academic Press.
- Park, H-S., Marascuilo, L., & Gaylord-Ross, R. (1990). Visual inspection and statistical analysis in single-case designs. *Journal of Experimental Education*, 58(4), 311-320.
- Perfetti, C.A. (1985). *Reading ability*. New York: Oxford University Press.
- Perfetti, C.A., Beck, I., Bell, L.C., & Hughes, C. (1987). Phonemic knowledge and learning to read are reciprocal: A longitudinal study of first-grade children. *Merrill-Palmer Quarterly*, 33(3), 283-319.
- Perfetti, C.A., & Lesgold, A.M. (1979). Coding and comprehension in skilled reading and implications for reading instruction. In L.B. Resnick & P.A. Weaver (Eds.), *Theory and practice of early reading*, Vol. I. Hillsdale, N.J: Erlbaum.
- Poling, A., & Grosset, D. (1986). Basic research designs in applied behavior analysis. In A. Poling and R.W. Fuqua (Eds.), *Research Methods in Applied Behavior Analysis*. New York: Plenum.
- Rack, J.P., Snowling, M.J., & Olsen, R.K. (1992). The nonword reading deficit in developmental dyslexia. *Reading Research Quarterly*, 27(1), 29-53.
- Ramsey, W.Z. (1972). *Evaluation of assumptions related to the testing of phonics skills* (Final Report). St. Louis: National Centre for Educational Research and Development (ERIC Document ED 068-893).
- Richardson, E., & Collier, L. (1971). Programmed tutoring of decoding skills with third and fifth grade non-readers. *Journal of Experimental Education*, 39(3), 57-64.
- Rovin, P., & Gleitman, L. (1977). The structure of reading acquisition and reading: II. The reading process and the acquisition of the alphabetic principle. In A. Reber and D. Scarborough (Eds.), *Toward a Psychology of Reading*. Hillsdale, NJ: Erlbaum.
- Rusch, F.R., Rose, T., & Greenwood, C.R. (1988). *Introduction to Behavior Analysis in Special Education*. Englewood Cliffs, NJ: Prentice-Hall.
- Samuels, S.J. (1984). Automatic decoding and reading comprehension. In A.J. Harris and E.R. Sipay (Eds.), *Readings on reading instruction*. New York: Longman.

- Samuels, S.J. (1988). Decoding and automaticity: Helping poor readers become automatic at word recognition. *The Reading Teacher*, 41(8), 756-761.
- Schloss, P.J., Sedlak, R.A., Elliot, C., & Smothers, M. (1982). Application of the changing-criterion design in special education. *Journal of Special Education*, 16(3), 359-367.
- Share, D.L., Jorm, A.F., Maclean, R. & Matthews, R. (1984). Sources of individual differences in reading achievement. *Journal of Educational Psychology*, 76(6), 1309-1324.
- Silberman, H.F. (1964). *Exploratory research on a beginning reading program*. Santa Monica, California: System Development Corporation.
- Skalland, D.B. (1971). *A comparison of four language units in teaching beginning reading*. Paper presented to the American Educational Research Association, New York.
- Snowling, M. (1980). The development of grapheme-phoneme correspondence in normal and dyslexic readers. *Journal of Experimental Child Psychology*, 29, 294-305.
- Stahl, S.A. (1992). Saying the "p" word: Nine guidelines for exemplary phonics instruction. *The Reading Teacher*, 45(8), 618-625.
- Stahl, S.A., Osborn, J., & Lehr, F. (1990). *Beginning to read by Marilyn Jager Adams: A summary*. Center for the Study of Reading, The Reading Research and Education Center: University of Illinois at Urbana-Champaign.
- Stanovich, K.E. (1980). Toward an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly*, 16(1), 32-71.
- Stanovich, K.E. (1982). Individual differences in the cognitive processes of reading I: Word decoding. *Journal of Learning Disabilities*, 15(8), 485-493.
- Stanovich, K.E. (1985). Explaining the variance in reading ability in terms of psychological processes: What have we learned? *Annals of Dyslexia*, 35, 67-96.
- Stanovich, K.E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, 21(4), 360-406.
- Stanovich, K.E. (1988a). Speculations on the causes and consequences of individual differences in early reading acquisition. In P. Gough (Ed.), *Reading Acquisition*. Hillsdale, NJ: Erlbaum.

- Stanovich, K.E. (1988b). The right and wrong places to look for the cognitive locus of reading disability. *Annals of Dyslexia*, 38, 154-177.
- Stanovich, K.E. (1991). Word recognition: Changing perspectives. In B. Barr, M.L. Kamil, P. Mosenthal, & P. David Pearson (Eds). *Handbook of Reading Research* (Vol II), 418-452.
- Stanovich, K.E., Cunningham, A.E., & Cramer, B.B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology*, 38(2), 175-190.
- Stanovich, K.E., Cunningham, A.E., & Feeman, D.J. (1984). Intelligence, cognitive skills, and early reading progress. *Reading Research Quarterly*, 19(3), 278-303.
- Stebbins, L.B., St Pierre, R.G., Proper, E.C., Anderson, R.B., & Cerva, T.R. (1977). *Education as experimentation: A planned variation model, Volume IV-A, An evaluation of Follow Through*. Cambridge, Massachusetts: Abt Associates.
- Stuart, M., & Coltheart, M. (1988). Does reading develop in a sequence of stages? *Cognition*, 30(2), 139-181.
- Tawney, J.W., & Gast, D.L. (1984). *Single subject research in special education*. Columbus, Ohio: Merrill.
- Torgesen, J. (1985). Memory processes in reading disabled children. *Journal of Learning Disabilities*, 18(6), 350-357.
- Torneus, M. (1984). Phonological awareness and reading; A chicken and egg problem? *Journal of Educational Psychology*, 76(6), 1346-1358.
- Treiman, R. (1984). Individual differences among children in reading and spelling style. *Journal of Experimental Child Psychology*, 37(3), 463-477.
- Treiman, R. & Baron, J. (1983). Phonemic-analysis training helps children benefit from spelling-sound rules. *Memory and Cognition*, 11, 382-389.
- Tunmer, W.E., Herriman, M.L., & Nesdale, A.R. (1988). Metalinguistic abilities and beginning reading. *Reading Research Quarterly*, 23(2), 134-158.
- Tunmer, W.E., & Nesdale, A.R. (1985). Phonemic segmentation skill and beginning reading. *Journal of Educational Psychology*, 77(4), 417-427.
- Van Orden, G. (1987). A ROWS is a ROSE: Spelling, sound, and reading. *Memory and Cognition*, 15(3), 181-198.

- Vellutino, F.R. (1991). Introduction to three studies on reading acquisition: Convergent findings on theoretical foundations of code-orientated versus whole-language approaches to reading instruction. *Journal of Educational Psychology*, 83(4), 437-443.
- Vellutino, F.R., & Scanlon, D.M. (1987). Phonological coding, phonological awareness, and reading ability: Evidence from a longitudinal and experimental study. *Merrill-Palmer Quarterly*, 33(3), 321-363.
- Wallach, M.A., & Wallach, L. (1979). Helping disadvantaged children learn to read by teaching them phoneme identification skills. In L.A. Resnick and P.A. Weaver (Eds.), *Theory and practice of early reading* (Vol. 3). Hillsdale, N.J: Erlbaum Associates.
- Williams, J.P. (1980). Teaching decoding with a special emphasis on phoneme analysis and phoneme blending. *Journal of Educational Psychology*, 72(1), 1-15.
- Williams, J.P. (1984). Phonemic analysis and how it relates to reading. *Journal of Learning Disabilities*, 17(4), 240-245.
- Williams, J.P. (1986). The role of phonemic analysis in reading. In J. Torgesen and B. Wong (Eds.), *Psychological and educational perspectives on learning disabilities*. San Diego, CA: Academic Press.
- Yopp, H.K. (1988). The validity and reliability of phonemic awareness tests. *Reading Research Quarterly*, 23(2), 159-177.

APPENDICES

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APPENDIX A

WORD READING STRATEGIES: WORD LISTS

Pseudowords

lopeb	ipdoc
pilk	gebus
sut	crot
nintred	fes
noxtof	winsup
skep	jelpic
sopog	besk
id	bax
sifton	tupas
lemp	yent
lg	monut
tipk	jit
flontel	hant
marpi	prodox
lut	ap

Verbatim Instructions

Say "I want you to read some words that are not real words. I want you to tell me how they sound".

Point to the first word, "how does this word sound?"

If subject does not respond correctly, point to the word and say the word. Point to the word and say "Now try it again, how does this word sound?"

Allow 5 seconds for identification.

Irregular Words

was	half
does	sure
learn	laugh
one	write
gone	eyes
lawn	calf
work	move
among	talk
early	knife
flood	listen
there	know
right	built
any	monkeys
sugar	should
nothing	buy

Verbatim Instructions

Point to the word and say "what is this word?"

If subject does not respond to the first word, score the word zero.

Say the word and ask the subject to repeat it. Do not tell the subject any other words.

Allow 5 seconds for identification.

APPENDIX B

PHONEMIC AWARENESS TESTS

Initial-Consonant Elision Test Words

flip	pride
train	crest
stop	draft
play	flight
spill	scold
pram	twit
tread	grope
clam	bright
bring	strap
grip	plot

Verbatim Instructions

"I'm going to say a word.

You say the word without its first sound".

3 practice items with feedback: bend/end, stub/tub, grow/row

Final-Consonant Matching Test Words

worm	ham	dish	ball
cup	mat	fin	tap
pan	bag	win	slash
bent	pink	glass	bit
leaf	surf	train	lamp
bud	skin	sand	phone
house	dress	tin	whip
hook	can	rat	lick
nail	pill	hand	right
bug	book	wish	flag

Verbatim Instructions

"Listen, /meat/, which of these words /pram, yellow, want/ has the same ending as /meat/?"

3 practice items with feedback, e.g:

meat: pram: yellow: want
bend: take: sand: rug
stool: can: sell: said

Rhyming Words

fan/pan	rag/bag
lip/tip	sip/rip
mop/pop	lot/not
rum/mum	hum/sum
beg/leg	pet/set
lap/cap	bat/sat
sit/fit	rid/lid
rod/nod	old/gold
bug/rug	tub/cub
men/den	net/jet

Format For *Testing Auditory Rhyming*

1. We are going to rhyme with
2. Rhymes with _____ and starts with

Practice words: sat/fat, rip/dip, mop/top

Adapted from Formentin, P.J. (1993). *Let's decode: Inservice manual*.

Perth, Western Australia: Edith Cowan University.

Segmenting Words

rag	mad
sip	sit
rod	mop
rug	mum
set	leg
sad	rat
lid	fin
log	not
sun	nut
fed	men

Format For *Testing Auditory Segmenting*

1. We're going to say words slowly.
Every time I clap, you say the next sound.
The word is _____ (e.g. Sam)
2. (Clap) **SSSSS** (clap) **aaaaa** (clap) **mmmmm**

Practice words: ram, lip, mud

Adapted from Formentin, P.J. (1993). *Let's decode: Inservice manual*.

Perth, Western Australia: Edith Cowan University.

Telescoping words

fan	ram
fin	run
men	Sam
leg	Ron
fun	sum
rim	red
mum	sit
man	log
sin	nut
net	not

Format For *Testing Auditory Telescoping*

1. Listen, I'll say a word slowly, then you say it fast.
2. Listen, e.g. **sssssaaaaattttt**
3. What word?

Practice words: sat, rip, mop

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APPENDIX C

WORD LISTS BY WORD TYPE

CVC Words Beginning With Continuous Sound

fad	fan	fat	lad	lag	lap
mad	man	map	mat	Nat	nap
rag	ram	ran	rap	rat	sad
Sam	sat	sap	fin	fit	lid
lip	lit	mid	mit	nit	nip
rid	rig	rim	rip	Sid	sin
sit	sip	log	lot	mop	nod
not	rod	Ron	rot	fun	mud
mum	nut	rug	rum	run	rut
sum	sun	fed	led	leg	let
men	met	Ned	net	red	set

CVC Words Beginning With A Stop Sound

bag	bad	bam	bat	cap	cab
can	cat	dad	Dan	gas	gag
had	ham	hat	jab	jam	pan
pat	tab	tag	tan	tap	big
bid	bit	did	dig	dip	hid
him	hit	hip	Jim	jig	kin
kid	pin	pit	pig	tin	tip
Tim	cop	con	Don	dog	hot
hop	hog	job	jog	hot	pop
top	Tom	bug	bud	bum	but
cup	cub	cut	dud	dug	Gus
gun	hum	hut	hug	jug	pup
tub	tug	beg	bed	bet	den
hen	jet	Ken	pen	pet	peg
pep	ten				

CVCC Words Ending With A Consonant Blend Or Double Consonant

band	bank	sank	rank	back
rack	camp	damp	lamp	fact
pact	tact	hand	bang	rang
sang	land	pant	rant	sack
sand	bill	fill	mill	will
film	fist	hint	lick	lift
rift	sift	limp	milk	silk
mint	lint	tint	mist	sick
hilt	silt	tilt	bump	bunt
bust	dump	dust	gulp	pulp
gust	hunt	runt	bung	hung
rung	jump	junk	luck	lump
must	sunk	rust	sung	beck
deck	bend	bent	best	belt
deft	dent	felt	held	left
lend	lent	kept	melt	mend
neck	nest	pest	rest	self
send	sent	test	tent	weld
went	golf	lock	bond	fond
pond	rock	romp	sock	soft

APPENDIX D

WORD BANK FROM WHICH MIXED WORD TYPES SELECTED

CVCC Words Beginning with A Consonant Blend

bled	blot	brag	brat	bred	brig
brim	clad	clam	clan	clap	clip
clot	club	crab	cram	crib	crop
drag	drip	drop	drug	drum	flag
flap	flat	fled	flip	flop	frog
from	glad	glum	grab	gram	grim
grin	grip	plan	plop	plot	plug
plum	plus	prop	scan	scat	scab
skid	skim	skin	skip	skit	slam
slap	slat	sled	slim	slip	slob
slot	slug	slum	smog	smug	snag
snap	snip	snub	snug	span	spat
sped	spin	spit	spot	spun	stab
stem	step	stop	stun	swam	swim
trap	trim	trip	trot	twig	twin

CCVCC, CCCVC and CCCVCC Words

blunt	blond	blend	blink	black
block	bluff	bring	brunt	brand
clamp	cling	clung	cliff	cramp
crust	crisp	drink	drank	drift
dress	drill	fling	flung	frost
frank	frisk	frill	glint	gramp
grump	grill	plump	print	prank
press	skill	slung	smack	smell
snack	sniff	spend	spent	spank
spell	spill	stand	stamp	stump
sting	still	stiff	stack	swift
swing	trunk	trick	split	splat

APPENDIX E
TEACHING FORMATS

Format for teaching *Letter Sounds*

Teacher	Student
1. When I touch under a letter you say its sound. Keep saying the sound as long as I touch it.	
2. (Hold your finger under a continuous sound for 2 seconds, but only for a split second for a stop sound).	
3. My turn. mmmmm	
4. Your turn. What sound?	mmmmm
5. (Child's name). What sound?	mmmmm

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Introductory format for **Sounding Out Words**

Teacher

Student

Words: man, fan

1. When I touch a letter, I'll say its sound. I'll keep saying the sound until I touch the next letter. I won't stop between sounds.

2. My turn. (Signal. Remember to point to each continuous sound for the full 1 1/2 seconds).

3. Sound out this word with me. (Signal).

mmmmmaaaaaannnnn

mmmmmaaaaaannnnn

4. Your turn. (Signal).

mmmmmaaaaaannnnn

5. (Child's name) sound it out. (Signal).

mmmmmaaaaaannnnn

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Format for testing **Sounding Out Words**

Teacher

Student

Words: man, ran, fan, can

1. First you're going to sound out the word, then you'll say it fast.

2. Sound it out. (Signal).

mmmmmaaaaannnnn

3. What's the word? (Signal).

man

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APPENDIX F

RECORD FORM FOR DIAGNOSTIC TEST OF WORD ATTACK SKILLS: Part 1

Instructions

1. *Single letter sounds:* Point to each letter and ask, "What sound does this make?" If the child gives the letter name, then say "Yes, that's the letter name, but can you also tell me the SOUND it makes?" Circle any letter the child does not sound. If the child gives the letter name, then write LN beside the letter.
2. *Regular words.* Point to each word and ask, "What word is this?" Continue testing until the child gets three words in a column incorrect. Circle any word that the child did not read correctly, and indicate the point at which testing was stopped.

Letters

a	m	t	s	i	f	d	r	o	g
l	h	u	c	b	n	k	e	v	p
y	j	x	w	q	z				
D	A	R	H	G	B	E	Q		

Words

1	2	3	4	5
it	cat	must	flag	stamp
am	him	hats	step	strap
if	hot	hand	drop	split
sam	tag	list	skin	skunk
mad				

Irregular Words

the	said	was	has	put
-----	------	-----	-----	-----

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