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**THE BENEFITS OF SYLLABLE SEGMENTATION AND WORD READING
PRACTICE FOR ADOLESCENTS WITH READING AND SPELLING
DIFFICULTIES**

by

ALPANA BHATTACHARYA

A dissertation submitted to the Graduate Faculty in Educational Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2001

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Abstract**THE BENEFITS OF SYLLABLE SEGMENTATION AND WORD READING
PRACTICE FOR ADOLESCENTS WITH READING AND SPELLING
DIFFICULTIES**

by

Alpana Bhattacharya**Advisor: Professor Linnea Ehri**

This study examined the effectiveness of two instructional treatments, a syllable segmentation approach and a whole word approach, on adolescent disabled readers' ability to read words, to decode nonwords, and to spell words from memory. Sixty junior high and high school students who scored between the third and fifth grade-equivalent levels on a standardized word identification test were selected for the study. Triplets of disabled readers matched on word reading scores were randomly assigned to one of two instructional treatments or a no-treatment control condition. Syllable-treatment participants practiced reading 100 multisyllabic words by breaking them into syllables. Whole word participants practiced reading the same words as wholes. Several tasks measured participants' pre-treatment and post-treatment word reading, nonword reading, and spelling skills.

Results showed that the syllable treatment produced superior gains in reading words, decoding nonwords, and spelling words compared to the whole word treatment and no-treatment control. Gains were especially large on the nonword decoding subtest of the Woodcock Reading Mastery Tests - Revised (Woodcock, 1987) among syllable-

trained participants who read at the third grade-equivalent level. The whole word treatment did not improve participants' reading and spelling performance compared to the no-treatment control group.

Results suggest that reading and spelling deficits of disabled readers can be treated effectively through explicit instruction and practice segmenting multisyllabic words into constituent syllables. Effects are attributed to the benefit of fully analyzing words. According to Ehri's (1992) theory, disabled readers retain only partial representations of words in memory when they learn to read them. Word reading practice that requires forming connections between syllabic spelling units and pronunciation help disabled readers attend to and remember the full spellings of words.

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Chapter 1

Introduction

The purpose of this study was to examine the effectiveness of two instructional approaches to word reading, a syllabic segmentation method and a whole word method. Effects were examined in adolescent disabled readers. Of interest was whether either method would improve students' ability to remember how to read words in various ways and also to spell words. According to Ehri and Saltmarsh (1995), "To read and comprehend text, readers must be able to read most of the words easily" (p. 296). The ability to read words easily in various ways in and out of context is fundamental for efficient reading and comprehension of text (Adams, 1990; Stanovich, 1986).

In the process of reading and comprehending text, readers may read words by sight, by sounding out and blending letters, by analogy to known words, by decoding common spelling patterns, or by using context cues (Ehri, 1991, 1994). Readers generally read familiar words (i.e., words they have read many times before) by sight. Unfamiliar words (i.e., words never read before) may be read by sounding out and blending, or by analogy to known words, or by processing common spelling patterns, or by using context cues, or by a combination of these strategies (Ehri, 1995b; Ehri & Saltmarsh, 1995).

Whereas skilled readers read most words rapidly and accurately in the process of reading and comprehending text, disabled readers do not. According to the amalgamation theory of sight word reading (Ehri, 1992), skilled readers read words by forming complete connections between letters and sounds of words in memory. Disabled readers, in contrast, read words by forming partial connections between letters and sounds of words in memory. Weak knowledge of letter-sound correspondences and weak phonemic

segmentation skill restrict disabled readers' ability to recognize individual words rapidly and accurately (Greenberg, Ehri, & Perin, 1997; Juel, Griffith, & Gough, 1986; Rack, Snowling, & Olson, 1992; Stanovich, 1986). Difficulty recognizing individual words accurately and rapidly is a hallmark of reading backwardness (Bruck, 1988, 1990; Gough & Tunmer, 1986; Stanovich, 1982, 1986, 1988; Torgesen & Barker, 1995).

Difficulty reading individual words is a primary indicator of reading disability (Stanovich, 1986). Some research pertaining to treatment of word recognition deficits of disabled readers has been conducted (Das-Smaal, Klapwijk, & Leij, 1996; Levy, Bourassa, & Horn, 1999; Lovett, Borden, DeLuca, Lacerenza, Benson, & Brackstone, 1994; Lovett, Ransby, & Barron, 1988; Lovett, Ransby, Hardwick, Johns, & Donaldson, 1989; Lovett, Warren-Chaplin, Ransby, & Borden, 1990; Van Daal & Reitsma, 1990; Vellutino & Scanlon, 1986; Wise, 1992; Wise, Ring, & Olson, 2000). Treatment studies that have been reported (e.g., Lovett & Steinbach, 1997; Roth & Beck, 1987; Olson, Wise, Ring, & Johnson, 1997; Scheerer-Neuman, 1981; Shefelbine, 1990; Van Daal, Reitsma, & Ven Der Leij, 1994; Vellutino & Scanlon, 1987; Wentink, Van Bon, & Schreuder, 1997) suggest that the persistent word recognition deficits of disabled readers can be treated with specific instruction in word decoding processes.

The present study explored ways to strengthen the word recognition skills of adolescent disabled readers by engaging them in two forms of word decoding training, a syllable segmentation method or a whole word reading method. It was anticipated that the word recognition skills of adolescent readers who received syllable segmentation training would show greater improvement over the course of learning to read words than the word skills of readers given whole word training or no training. Findings were expected to make

a significant contribution to methods of treating word recognition deficits of disabled readers.

Chapter 2

Literature Review

Learning to Read Words

A central part of becoming literate is developing the ability to recognize words accurately and rapidly in or out of context (Ehri, 1987; Stanovich, 1980).

Acknowledgement that word recognition skill is at the core of reading acquisition has been adequately documented (Adams, 1990; Adams & Huggins, 1985; Bruck, 1988; Manis, 1985; Szeszulski & Manis, 1987). According to Gough, Juel, and Griffith (1992), “conventional literacy begins when children learn to recognize specific words” (p. 35).

The Simple View of reading conceptualizes reading as the product of decoding and comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990; Juel, 1988; Juel, Griffith, & Gough, 1986; Tunmer & Hoover, 1992). Decoding, the first component in the Simple View, is a process by which printed symbols of words are transformed into recognizable words. Comprehension, the second component in the Simple View, is a process by which meanings of words are integrated into sentences and text structure to facilitate understanding of written text (Juel, 1988). Proponents of the Simple View consider word recognition as a fundamental component of reading acquisition because comprehension depends on children’s ability to recognize specific words included in written text (Juel, 1988; Juel et al., 1986). The acquisition of word recognition skill, therefore, is a foundational feature of learning to read (Baron, 1979; Greenberg, 1995; Greenberg et al., 1997).

Ways to Read Words

Since learning to read words is central to reading acquisition, it is necessary to understand the process by which children learn to recognize words. Ehri (1991, 1994) identifies five different ways of reading words. Readers can learn to read words: 1) by sight, 2) by phonological recoding, 3) by analogizing, 4) by orthographic generalization, and 5) by contextual guessing.

The process of sight word reading is used to read words that have been read frequently. Repeated experience reading those words establishes an access route for retrieving information pertaining to the words' identity from lexical memory (mental dictionary). When readers see a familiar word, the visually encoded string of letters directly activates the word's identities, including its pronunciation, meaning, and spelling, and enables the reader to recognize the word by sight (Ehri, 1991, 1994, 1995b). A word is recognized by sight when readers read the word as a whole unit without sounding out or blending the phonemes or syllables, and they read the word within one second of seeing it (Ehri, 1992, 1995a; Torgesen, Waters, Cohen, & Torgesen, 1988).

Phonological recoding is another way to recognize words. The phonological recoding procedure involves transforming printed letters (graphemes) into sounds (phonemes) of words and then combining the sound units to pronounce the word (Ehri 1991, 1994, 1995b). A child who knows the major grapheme-phoneme correspondences in English and knows how to blend correspondences into pronunciations can use the letter-sound decoding procedure to recognize novel words. The following example explains how the letter-sound decoding procedure works. When confronted with an unfamiliar word "MAT", a child who knows the sounds associated with the letters "M-A-

T”, can assign a sound to each letter, “muh-ah-tuh”, and then blend the sounds to form an approximate pronunciation for the word, “mat” (Bruck & Treiman, 1992; Rack, Hulme, Snowling, & Wightman, 1994). Phonological recoding is a slow and effortful procedure compared to sight word reading. This process is generally used to recognize unfamiliar words that are not known by sight (Ehri, 1991, 1994, 1995b; Torgesen et al., 1988).

Reading words by analogy is another approach for identifying individual words (Bowey & Hansen, 1994; Glushko, 1979; Goswami, 1986, 1988, 1990, 1993). To read an unfamiliar word by analogizing to a known sight word, first, readers have to recognize the similarity of spelling patterns between the unfamiliar word and the known sight word. Next, they have to access the known sight word from lexical memory. Finally, they have to infer the pronunciation of the unfamiliar word from the pronunciation of the known sight word (Bruck & Treiman, 1992; Ehri, 1991, 1994, 1995b; Goswami & Mead, 1992). For example, if the target word is “brain”, a reader can identify the unfamiliar word by retrieving from memory the known word with a similar spelling pattern, “train”. The reader would then substitute /t/ for /b/, and thus identify the target word by utilizing an analogy procedure (Bruck & Treiman, 1992; Glushko, 1979).

The process of orthographic generalization helps readers identify unfamiliar words by processing chunks of letters rather than individual letters in a word. Sufficient experience reading different words with common letter patterns (e.g., book, look, took, hook; tall, ball, fall, wall) enables readers to store the pronunciation and spellings of those words in memory (Ehri, 1994). When readers see an unfamiliar word resembling known words, the letters in the word may activate in memory an entire neighborhood of words that share orthographic features with the unfamiliar word. Readers can then retrieve and

use pronunciations of common spelling patterns to recognize unfamiliar words (Glushko, 1979). For example, experience reading words like ran, man, fan, and can helps readers recognize the spelling pattern and pronunciation shared by the stem or rime “AN”; readers then apply knowledge gained from the orthographic features of the familiar words to read an unfamiliar word, “PAN.”

Contextual guessing is a final way of identifying words. The process of contextual guessing allows readers to identify individual words by using context cues such as pictures and words that appear in the text along with the target word to be identified (Ehri, 1994; Greenberg, et. al., 1997; Stanovich, 1980). The interactive model describes reading as a process involving the use of various knowledge sources. The different sources of knowledge available to readers include: their knowledge of the language, their knowledge of the world, and their memory for the text read (Rumelhart, 1977). The different sources of knowledge, included in the interactive model, serve as context for readers to identify words included in the text.

Skilled readers, according to Ehri (1987, 1995b), find it easy to utilize each of the five ways to read words. Disabled readers, on the other hand, do not use the different ways of reading words effectively. As discussed below, disabled readers not only recognize words slowly and inaccurately but also use word recognition strategies that are inappropriate relative to their reading levels (Bruck, 1990).

Research focused on reading acquisition indicates a strong relationship between spelling-sound knowledge and word recognition skills (Jorm & Share, 1983; Share, 1995; Vandervelden & Siegel, 1995; Wagner & Torgesen, 1987). To read a word accurately and fluently, readers have to use information included in a printed word to access the mental

lexicon and retrieve the word's identity including its pronunciation, spelling pattern, grammatical structure and meaning (Jorm & Share, 1983). Findings from studies designed to investigate word recognition skills of disabled readers indicate that disabled readers' weak knowledge of letter-sound correspondences substantially limits their ability to recognize words accurately and rapidly (Hoover & Gough, 1990; Ehri, 1987; Gough & Tunmer, 1986; Juel et al., 1986; Stanovich, 1986). Insufficient knowledge of spelling-sound correspondences not only affects disabled readers' word recognition skills, but also their ability to derive the meaning of the corresponding words as well (Tunmer & Hoover, 1992).

According to the interactive-compensatory model of reading, "a deficit in any knowledge source results in a heavier reliance on other knowledge sources, regardless of their level in the processing hierarchy" (Stanovich, 1980, p. 63). Because of their poor word recognition skills, disabled readers rely on contextual information to aid word recognition and text comprehension (Stanovich, 1986). Although research evidence indicates that disabled readers show a greater reliance on contextual information, their slow and inaccurate word decoding skills often inhibit their ability to utilize contextual information to facilitate word recognition and text comprehension (see Stanovich, Cunningham, & Feeman, 1984b; Stanovich, West, & Feeman, 1981). Disabled readers' ability to use contextual facilitation is influenced by difficulty of the written material being read. Disabled readers show greater use of contextual information in the case of reading and understanding easy materials (i.e., texts at or below the reading level of the disabled readers). Conversely, disabled readers fail to rely on contextual information in situations that require comprehension of difficult materials (i.e., texts above the reading level of the

poor readers). Written materials that are above the reading level of the disabled readers contain a greater percentage of unfamiliar words and unfamiliar information.

Consequently, disabled readers, who often are also extremely poor decoders, do not use contextual information because of their inability to recognize unfamiliar words and understand unfamiliar context. Word recognition and text comprehension, therefore, suffer because of poor decoding skills and inability to use contextual information.

Use of Phonological and Visual Information for Word Recognition

A review of literature pertaining to reading acquisition suggests that ability to recognize single words is a major difficulty experienced by disabled readers (see reviews by Gough & Tunmer, 1986; Stanovich, 1982). In the process of reading and comprehending text, readers use two basic mechanisms to recognize words. The first process involves use of phonological information. Readers use knowledge of spelling-sound correspondences to recognize words. The second process involves use of visual information. Readers use orthographic representations to recognize words (Bruck, 1988, 1990).

Adams and Huggins (1985) studied the process of sight-word reading by asking students to read 50 irregularly spelled words such as ocean, bouquet, aisle, and busy. The selected words, which were ordered by frequency of occurrence in text, could not be read by application of spelling-sound correspondences and had to be read by reliance on orthographic representation of words in memory. Adams and Huggins found that students in grades 2 through 5 read the irregularly spelled words by use of visual information until they reached a point in the list when the words became unfamiliar (i.e., were not part of their sight vocabularies). Readers then shifted from reliance on visual information to

application of spelling-sound correspondences to read the unfamiliar words. This shift in word reading process resulted in misreading of words (e.g., pronouncing tongue as /ton/ - /gyu/) and increased latency in response time. These findings indicate that readers use visual information to read familiar and high-frequency words that have been established in their lexical memory. Conversely, unfamiliar and low-frequency words that have not been established in their lexical memory are read by use of grapho-phonological information.

Bruck (1990) also investigated the process of sight-word reading. In order to assess what kind of information disabled readers use to recognize sight words, Bruck compared their ability to read regular words whose pronunciations could be generated by using spelling-sound information (e.g., must) with exception words whose pronunciations could not be derived from reliance on letter-sound information (e.g., have). Bruck reasoned that if disabled readers relied on phonological information to recognize words, they would find regular words easier to read than exception words. Conversely, if disabled readers depended on visual information to recognize words, there would be no differences in the recognition of regular and exception words. Analysis of error and latency data for regular and exception words indicated that compared to age-matched (i.e., normally reading college students) and reading-level-matched (i.e., normally reading Grade-6 children) control participants, disabled readers had higher error scores and took longer to recognize exception words than regular words. Disabled readers, therefore, were using spelling-sound information to recognize words. The two control groups, comparatively, did not show reliable differences in the recognition of regular and exception words. Control group participants, therefore, were relying on visual information to read both regular and exception words.

From a review of studies presented above and others (see Backman, Bruck, Herbert, & Seidenberg, 1984), it is evident that skilled readers rely on phonological information to recognize unfamiliar words and visual information to recognize familiar words. Disabled readers, comparatively, show greater reliance on phonological information to recognize both familiar as well as unfamiliar words. Disabled readers' greater reliance on phonological information, however, does not mean that they are efficient decoders. As will be evident from the literature review to follow (e.g., Bruck, 1990, 1992; Kochnower, Richardson, & DiBenedetto, 1983; Szeszulski & Manis, 1987), disabled readers have relatively poor and incomplete knowledge of spelling-sound correspondences which deter their accurate and rapid recognition of single words.

Use of Analogy for Word Recognition

As stated earlier, whereas skilled readers recognize words by direct access of orthographic information established in memory, disabled readers rely on spelling-sound correspondence rules and appear to be deficient in use of the direct access route to identify printed words (Bruck, 1988, 1990). Since disabled readers use knowledge of spelling-sound correspondences to recognize words, their knowledge of spelling-sound correspondences and the mechanisms by which they are used has become the focus of recent research. According to Manis, Szeszulski, Howell, and Horn (1986), readers make use of two mechanisms to read words by phonological recoding. First, readers may make use of rules governing single letters and larger spelling patterns. Second, readers may use analogies to read visually similar words. For example, the nonword "chape" may be read by application of pronunciation rules for ch, a, and p, or by making analogy to the visually similar word "shape". Analogies to visually similar words, alternately, may be made by

segmenting “chape” into “ch” and “ape” and matching the syllables to pronunciation of words beginning with ch (chin, check) and ending with ape (cape, tape).

Marsh, Friedman, Welch, and Desberg (1981) assessed disabled readers’ ability to use spelling-sound correspondence rules and analogies by giving them a nonword reading conflict task. Adolescent disabled readers (11- to 15-year-old) reading at the 4th grade level and 2nd and 5th grade normal readers were asked to read nonsense words that could be read correctly by application of pronunciation rules or analogies to visually similar real words. The nonsense word “faugh”, for example, could be pronounced faw by spelling-sound rule or faf by analogizing to the exception word “laugh”. Participants’ pronunciations indicated whether words were being read by application of rules or analogies. Results indicated that adolescent disabled readers read fewer words by analogy compared to 5th graders and more compared to 2nd graders indicating that reliance on analogy strategy increases with advances in reading skill.

In a related study using the nonword conflict task, Manis et al. (1986) compared use of rule and analogy strategies in 5th and 6th grade disabled readers and age-matched and reading-level-matched normal readers. Children were asked to read 18 nonwords with low, medium, and high frequency analogues. For example, the analog to sinth is low in frequency (ninth), the analog to sugan is medium in frequency (sugar), and the analog to fody is high in frequency (body). The researchers reasoned that high frequency analogues more often than low frequency analogues would lead to extensive use of analogy strategy. Since each nonword (e.g., sinth, sugan, and fody) had only one analogue (e.g., ninth, sugar, and body) and one regular pronunciation, children’s responses could be classified as analogy-based (i.e., pronounced by analogy to exception word) or rule-based (i.e.,

pronounced according to rule) based on the strategy used. Results indicated that disabled readers produced fewer analogy responses compared to age-matched and reading-level matched normal readers across all word frequency levels. Analogy-based responses, however, increased for all three groups with increase in the frequency of the analogy words. Disabled readers also lagged behind age-matched readers in use of rule-based decoding strategy; they, however, did not differ from the reading-level-matched readers in their use of spelling-sound rules. Analyses of error responses suggested that whereas age-matched and reading-level-matched normal readers made partial analogies by reading smaller words embedded in the nonwords (e.g., do-domach, sin-sinth, pus-puscle, etc.), disabled readers failed to notice and make analogies to real words embedded in the nonwords.

Findings from the Manis et al. (1986) and Marsh et al. (1981) studies indicate that ability to use analogy-based decoding strategy fails to develop adequately amongst disabled readers. Although disabled readers exhibited ability to use spelling-sound correspondence rules appropriate for their reading-level, they failed to use analogy-based decoding strategy as effectively as age-matched and reading-level-matched normal readers. According to Manis et al. (1986), disabled readers' failure to use an analogy-based strategy may reflect an inadequate ability to "locate words in memory that have a close visual resemblance to a target word, even when they know the appropriate words." An additional reason for disabled readers' poorer use of analogy-based decoding strategy may lie in their "ability to retrieve an accurate phonetic representation for words, or in integrating the phonetic information into a pronunciation" (p. 215).

Use of Orthographic Properties for Word Recognition

According to Rumelhart and Siple (1974), words can be processed by recognizing: (a) single letters in words, (b) larger units within each word (i.e., spelling patterns and syllables), or (c) whole words. In the beginning stages of reading, readers recognize words by analyzing letters within words. With advances in reading skills, readers begin to recognize words by analyzing letter clusters within words, and eventually by identifying whole word patterns. In her literature review, Santa (1976-77) summarizes Gibson and Levin's (1975) conceptualization of word recognition as a process in which readers learn the orthographic structure of English words through repeated practice reading words with specific spelling patterns. Repeated exposure to words provides readers the opportunity to recognize and process letter clusters within words which circumvents the need to analyze individual letters in words.

Santa (1976-77) examined achieving and non-achieving 2nd graders' and normally reading 5th graders' ability to recognize single words by processing letter clusters within words. In a same-different reaction time task, individual participants were presented with a target word followed by a set of letter clusters (e.g., BLAST: BL). For the "Same" condition, participants saw a target word with a letter string that was part of the target word (e.g., BLAST: LA). In the "Different" condition, a target word was presented with a letter string that consisted of a letter which differed from the target word (e.g., BLAST: LE). The letter strings included same and different single letters, all adjacent double letters, and the whole word. Participants had to decide whether or not a letter string was part of a target word.

Findings from the Santa (1976-77) study indicated that the three reading groups had faster reactions to the single letter and initial consonant cluster probes than to the other double letter and whole word probes. Responses to single letter and initial consonant cluster probes differed according to reading level. Non-achieving 2nd graders seemed to rely more on single letter probes compared to achieving 2nd graders and 5th graders. Achieving 2nd graders' reaction to the two kinds of probes was equivalent. Fifth graders' reaction to initial clusters was significantly faster than to all other probes. Although, whole word probes were not processed as efficiently as other units, 5th graders were able to process whole words faster than the non-achieving and achieving 2nd graders. In sum, analysis of the data suggests that readers use a variety of orthographic units in the process of word recognition: single letters, letter clusters, and whole words. Data also suggest that readers' ability to process orthographic units develops as they acquire word recognition skills. Non-achieving 2nd graders, for instance, were processing words by analyzing individual letters within words. They were restricted to a single letter processing strategy and were unable to make use of higher levels of analysis. Achieving 2nd graders and 5th graders, on the other hand, were able to process words by analyzing larger spelling units, especially letter clusters. Skilled readers, compared to disabled readers, recognized words by using a variety of decoding strategies: single letter, letter clusters, and whole words.

Bruck (1990) compared dyslexic college students, age-matched college students, and reading-level-matched Grade-6 students' sensitivity to orthographic units within words and their ability to use orthographic units in recognizing words. Participants were given a list of 51 orthographically legal strings of letters that were divided into three categories: hard embedded condition, easy embedded condition, and nonword embedded

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condition. The hard condition consisted of 17 words that were embedded in the orthographic letter strings in such a way that the initial or final letter of the target word was part of a digraph in the letter string (e.g., ice in baicer). In the easy condition, words were embedded in letter strings in such a way that the entire digraph was part of the target word (e.g., aim in straim). The nonword condition consisted of letter strings without any words embedded in them (e.g., baiver). Participants had to decide whether or not there were any words embedded in the different letter strings. According to Bruck, 'if dyslexic persons are sensitive to orthographic properties or boundaries within words and use this information in reading, then they should more easily recognize words embedded in letter strings that fall within orthographic boundaries (easy words) than words that invade such boundaries (hard words). If however, dyslexics are not sensitive to orthographic segments that are used for parsing, then they should have equal difficulty in locating the target word in each of the two conditions" (p.447).

Based on analyses of data, Bruck (1990) found that dyslexic adults were sensitive to some orthographic units within words which was evident from their ability to identify easy words embedded in letter strings. Like the control group participants, dyslexic adults made more errors on hard words than easy ones. Although dyslexic adults made similar number of errors as the reading-level-matched 6th Grade readers, they experienced greater difficulty identifying hard words than the age-matched college participants.

The preceding studies suggest that although disabled readers are aware of orthographic units within words, they do not use age-appropriate, and in some cases reading-level appropriate strategies to recognize polysyllabic words.

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Use of Context for Word Recognition

The extent to which readers use context to read and comprehend text depends on their word recognition skills. As reviewed previously, skilled readers are efficient decoders and hence do not depend on context to facilitate their word recognition when they read and comprehend text. Disabled readers, on the other hand, rely on contextual information to facilitate word recognition because of their weak word reading skills. Use of context to aid word recognition, therefore, is inversely related to reading skill (Bruck, 1988, 1990; West & Stanovich, 1978).

Bruck (1988) compared normal and disabled 2nd grade readers' ability to recognize words in and out of context. To investigate disabled readers' ability to recognize words in context, 30 polysyllabic words were embedded in: (a) a meaningful sentence context (e.g., We live on a lake. I like to sail my boat.) and (b) a meaningless sentence context (e.g., We live on a lake. I like to sail my eye.). The 30 words used for the context condition were presented in a list for the no-context condition. Participants were expected to find words embedded in meaningful sentences easier to recognize than words presented in isolation if they relied on context to aid word recognition. Conversely, they would find words presented in meaningless sentences difficult to recognize in comparison to words presented in isolation or in meaningful sentences. Thus, context should have a facilitating effect on word recognition in the meaningful condition and an inhibiting effect in the meaningless condition. Since disabled readers in the study had poorer word recognition skills compared to normal 2nd graders, Bruck expected them to show larger context facilitation effects. The error data indicated that disabled readers relied on context to a greater extent than normal readers in their word recognition. Although both disabled and

normal readers performed similarly in the meaningful condition, disabled readers made significantly more errors than normal readers in the meaningless and isolation conditions.

In a related study, Bruck (1990) compared dyslexic college students' ability to recognize words in a neutral as well as a meaningful passage of prose. For the context condition, a total of 64 target words were embedded in the meaningful passage of prose consisting of 696 words. The same 64 words were also presented at the end of a sentence (e.g., "When I press the button, you will see the word _____.") in the neutral condition. The data revealed that dyslexic college students were slower than age-matched college students and reading-level matched Grade-6 children in their recognition of target words in both neutral and context conditions. Although dyslexic college students were slower than age-matched college students and reading-level matched Grade-6 children in their recognition of target words in both neutral and context conditions, they read the target words more accurately and rapidly in meaningful context than the neutral context. Dyslexic participants exhibited greater reliance on context than reading-level-matched and age-matched comparison groups in their recognition of target words.

Amalgamation Theory of Sight Word Reading

According to the dual route theory, words are read in one of the two ways: (a) by phonological recoding or (b) by sight or visual access. Readers use phonological recoding to read words that are unfamiliar. Words that have been recoded several times, on the other hand, become familiar to readers and are thus read by visual access (Baron, 1979; Barron, 1986; Barron & Baron, 1977).

Phonological recoding is the indirect route for word recognition. Phonological recoding, as described earlier, involves transforming spellings of words into pronunciations by application of letter-sound rules. To recognize a target word through phonological recoding, readers: (a) derive the word's pronunciation through the application of the letter-sound rules, and (b) use the pronunciation to identify the word's meaning in memory (Baron, 1979; Barron, 1986; Ehri, 1992).

Recognizing words by visual access is the direct route for word recognition. According to dual route theory, words are read by establishing direct links between the visual forms of words seen in print and their meanings stored in memory. Visual access requires readers to: (a) process the visual form of a word, and (b) access the word's meaning from memory. To process the visual form of a word, readers have to attend to and remember visual-spatial cues in the word. These might include: (a) some letters or sequence of letters in the word's spelling; (b) the length of the word; (c) boundary letters; or (d) graphic features. The visual-meaning connections found in memory, however, are arbitrary and readers must learn them through repeated readings of the word and rote memorization. The visual route facilitates word recognition by providing readers with a direct path for retrieving the connections between the visual form of a word and its meaning from memory (Baron, 1979). This view of sight word reading, however, has certain limitations (Ehri, 1992; Glushko, 1979).

Ehri (1992) questioned the adequacy of dual route theory, particularly the claim that words are learned through rote memorization of arbitrary connections between spellings and meanings. Very few word spellings in English are arbitrary and unsystematic. Most English word spellings, even those with irregular spellings, generally

include some letters that conform to conventional letter-sound rules. Words like island and sword, for instance, are only partially arbitrary because their spellings consist of only one unpronounced letter. All other letters in the target words conform to the spelling-sound rules. Readers can read most English words, even those with irregular spellings, by relying on systematic connections between spellings and pronunciations rather than rote memorization of arbitrary connections between spellings and meanings.

Ehri (1992) also questioned dual route theory's claim that word recognition is a visually based process which does not involve or require phonological recoding. Research studies indicate that phonological recoding is necessary in the process of learning to read (Gough & Tunmer, 1986; Share, Jorm, Maclean, & Matthews, 1984). Dual route theory does not explain how phonological recoding is involved in learning to read words by visual access.

Ehri (1992) provided an alternate explanation of sight word reading that addressed the shortcomings of the dual route theory. Her amalgamation theory describes sight word reading as a process that involves the formation of visual-phonological connections between the spellings of words and their pronunciations in memory. When an unfamiliar word is seen in print, readers may use phonological recoding to read the word. The process of phonological recoding enables readers to utilize spelling units seen in the printed word to retrieve the word's pronunciation from memory. A visual-phonological route, consisting of specific connections between spelling units and sounds in the pronunciations of words, gets established when readers apply their knowledge of letter-sound correspondences to read words. For example, when a reader is presented with a regularly spelled word, cat, knowledge of the letter-sound relations allows the reader to

set up links between the letters (i.e., C-A-T) in the spellings of the word and the sounds (i.e., /c/-/a/-/t/) included in the pronunciation of the word. Similarly, an irregularly spelled word, island, may also be represented in memory by forming connections between letters and sounds included in the word. Thus, a reader will link all letters except “S” in the word island to establish a complete representation of the word in memory (Ehri & Saltmarsh, 1995). Repeated exposure to a word eliminates the need for phonological recoding as readers’ memory for the spelling pattern of the word becomes bonded to the word’s pronunciation and enables them to retrieve the word from memory. The spelling of a specific word, in other words, serves as a symbol activating the word’s pronunciation stored in memory. Sight word reading, therefore, involves the amalgamation of spellings of specific words with their pronunciations in memory (Ehri, 1992).

Although knowledge of letter-sound relations enables readers to accumulate regularly and irregularly spelled words in memory, the process of forming connections between letters and sounds in words differs in skilled and unskilled readers. According to Ehri (1995a), sight word learning develops in four phases: pre-alphabetic, partial alphabetic, full alphabetic, and consolidated alphabetic.

Readers in the pre-alphabetic phase do not use letter-sound relations to identify words but instead form connections between salient visual cues (i.e., letter shapes, logos, length of word) and the pronunciations or meanings of words to accumulate sight words in memory. Because the process is not systematic, pre-alphabetic readers do not identify sight words with much accuracy (Ehri, 1995a).

Partial alphabetic readers, on the other hand, remember sight words by forming connections between boundary letters and sounds in written words. They attend to initial

and final letters and sounds in words and ignore the medial letters. For example, a partial alphabetic reader might remember how to read jail by forming connections between the initial and final letters (i.e., J and L) and sounds (i.e., /j/ and /l/) in the word. Partial alphabetic readers rely on partial letter and sound cues because of limited knowledge of letter-sound relations and inability to segment words into their constituent phonemes (Ehri, 1995a). Disabled readers often are partial cue readers (Ehri & Saltmarsh, 1995). Reliance on partial letter and sound cues constrains their ability to read words accurately and rapidly.

Readers in the full alphabetic phase store words in memory by forming complete connections between letters seen in written words and their sounds in pronunciation. For example, full alphabetic readers can remember how to read jail because they link all letters in the written word to their corresponding sounds in the pronunciation of the word. Readers in the full alphabetic phase, therefore, read both familiar and unfamiliar words accurately (Ehri, 1995a).

Consolidated alphabetic phase readers retain sight words in memory by forming connections between multi-letter units that may be morphemes, syllables, or sub-syllabic units. For example, -est might become known as a multi-letter unit through repeated exposure to words like nest, best, rest, and test. Knowledge of this consolidated unit (-est) would then help a reader to read chest by connecting ch to /c/ and est to /st/ rather than linking all letters to sounds in the word. Knowledge of multi-letter units is particularly useful in learning polysyllabic words, for example, interesting. When a reader has to read interesting, he or she can use knowledge of consolidated units - in, er, est, ing to form connections between letters in the written word and sounds in the pronunciation of the

word. Ability to segment and blend multi-letter units facilitates accurate and rapid identification of polysyllabic words (Ehri, 1995a).

Accurate and rapid recognition of words can take place when readers learn to form full or consolidated connections between letters in written words and their sounds in pronunciations. Disabled readers, particularly those in middle and high school grades, often are arrested in the partial alphabetic phase of sight word learning. They fail to establish complete or consolidated connections between letters and sounds in words, and this constrains their ability to read polysyllabic words accurately and rapidly.

Ehri and Saltmarsh (1995) performed a study to compare sight word learning processes in disabled and nondisabled readers in elementary school to see whether both groups read sight words by storing and accessing fairly complete letter-sound information of words in memory. Disabled and nondisabled readers were taught to read phonetic spellings (e.g., KRADL [cradle]) of 16 real words for 12 trials. After participants had learned to read the 16 target words, their sensitivity to single letter alterations in words was assessed by having them read a set of words consisting of both original (e.g., KRADL) and altered (e.g., CRADL) spellings in a reaction time task.

According to Ehri's (1992) theory of sight word reading described above, readers learn to read sight words by forming connections between the letters and sounds of words. Skilled readers, in particular, accumulate sight words in memory by establishing connections between all of the letters in the spellings of words and their corresponding sounds in pronunciations. Therefore, in the case of KRADL, Ehri and Saltmarsh (1995) reasoned that nondisabled readers would store information about this simplified phonetic spelling by linking each letter to its corresponding sound. In contrast, disabled readers

would accumulate sight words in memory by forming partial rather than complete connections. They would retain connections between salient letters and sounds (i.e., initial and final) in memory but ignore medial letters and sounds. This would result from their limited knowledge of letter-sound relations and deficient phonological processing skills (Rack et al., 1992; Stanovich, 1986; Wagner & Torgeson, 1987).

Findings from the Ehri and Saltmarsh (1995) study provided evidence consistent with expectations. The researchers found that nondisabled readers were sensitive to most of the spelling alterations (i.e., beginning, medial, and end) in words. Ehri and Saltmarsh interpreted nondisabled readers' sensitivity to a variety of spelling alterations to indicate that advanced readers were reading words by accessing fairly complete representations of words stored in memory (i.e., by sight). Disabled readers, conversely, were found to be sensitive to spelling alteration at the boundaries (i.e., beginning and end) of words, but they were insensitive to medial letter changes. The researchers interpreted disabled readers' reaction to spelling alterations as an indication that they were reading words by attending to partial cues, particularly letters in the initial and final letter positions, rather than storing and accessing fairly complete letter-sound information of words in memory. Disabled readers' error responses during the reaction time task indicated that they were reading words by using partial letter information in words. Ehri and Saltmarsh noted that disabled readers' misreading of altered spellings tended to contain words from the list having similar letters. Disabled readers, for instance, were found to read altered spellings of the target words, private and perfume, interchangeably. The error responses of disabled readers were interpreted as fitting the pattern of partial cue readers described earlier. In sum, skilled readers' success reading words accurately and rapidly by sight was believed to

have resulted from their ability to store and access fairly complete letter-sound information about the words in memory. Disabled readers' difficulties reading words accurately and rapidly by sight, conversely, may have resulted from their difficulty forming complete letter-sound connections for words and storing them in memory.

In a descriptive study, Shefelbine and Calhoun (1991) examined high, moderate, and poor 6th grade readers' ability to attend to syllables and letters in polysyllabic words that are not part of their sight vocabulary. Participants' were administered the word identification subtest of Woodcock Reading Mastery Tests - Revised (Woodcock, 1987). Individual participants' error responses for the last 10 polysyllabic words on the Woodcock were analyzed to determine the extent to which readers (high, moderate, and low) attend to letters and syllables in unfamiliar polysyllabic words. Three types of analyses (syllable analyses, consonant analyses, and vowel analyses) were conducted and summarized in terms of percentages and ratios. Findings from the data analyses indicated that high 6th grade readers attended to and made efficient use of syllable, consonant, and vowel information in reading difficult polysyllabic words. They exhibited greater ability to attend to and use final syllables and suffixes and lesser instances of omitting syllables and vowels, adding consonants, and substituting syllables and words sharing visual orthographic properties. Low 6th grade readers, in comparison, used strategies that focused on partial syllable and letter units. Although low readers had substantial difficulty identifying most of the syllables in polysyllabic words, syllables at the beginning and ending of words were identified more often compared to those in the middle. The majority of low readers' omissions and additions involved syllables, consonants, and vowels in the middle of words, and they made more syllable and real word substitutions as well. In sum,

results indicate that although skilled readers can successfully identify polysyllabic words by effortlessly attending to syllables and letters in words, poor readers have difficulty decoding polysyllabic words because they pay less attention to syllable units and letters within words.

In another study, Marmurek (1988) examined 2nd, 4th, and 6th grade good and poor readers' reading ability and the size of the visual units attended to during visual processing of words. Participants' word processing skills were assessed in two tasks of visual comparison trials: a primary task and a secondary task. In one block of the primary task, participants had to decide whether a target word matched a display word. In the second block of the primary task, participants had to decide whether a single letter target matched the first letter of a display word. In the secondary task, a display word would not be followed by a target word or letter but by a γ either to the left or right of the display word. Participants had to identify the single-element probe (i.e., γ) presented at a randomly determined position of a word or letter target display. Marmurek expected poor readers to be less likely to focus attention on specific visual units within words than good readers. Results for the word and first-letter comparisons on the primary task indicated that error rate was higher on first-letter comparisons ($M = 4.53$) than on whole word comparisons ($M = 3.18$) across all grades and reading ability. Participants of all grades and reading ability made whole word comparisons more quickly than first-letter comparisons. All participants, therefore, showed a significant advantage for whole-word rather than first-letter comparisons. Specifically all readers, regardless of ability, found it easy to process words holistically rather than analyzing visual units within words. The data for the secondary task indicated that the single-element probe (i.e., γ) was identified more quickly

in the first-letter than in the fourth-letter position. The probe-position effect was significantly related to reading ability. Poor readers compared to good readers across all grades were less able to shift attention to components in their visual processing of words. The results of the present study provide support for the view that poor readers are less able than good readers at recognizing words by analyzing visual units within words.

Review of the studies presented above suggests that skilled readers successfully identify words by analyzing syllables and letters whereas, disabled readers have difficulty decoding words because of difficulty attending to inter-letter relationships and spelling patterns within words. Since knowledge of letter and spelling patterns increases the chances of accurate and rapid identification of words, disabled readers should be encouraged to attend to syllable units and letter patterns as they occur in words.

Word Recognition Skills of Disabled Readers

Accurate and rapid recognition of individual words, as stated earlier, is an essential ingredient in the process of reading and comprehending printed material (Adams, 1990; Ehri, 1987; Ehri & Saltmarsh, 1995). Disabled children often fail to elicit meaning from text because of poor word recognition skills (Stanovich, 1986; Torgesen & Barker, 1995; Vellutino, 1991). Difficulty recognizing individual words accurately and rapidly is a hallmark of reading backwardness (Bruck, 1988, 1990; Gough & Tunmer, 1986; Lovett 1990, 1994; Stanovich, 1982, 1986, 1988; Torgesen et al., 1988; Torgesen & Barker, 1995).

Use of Spelling-Sound Information for Word Recognition

Research focused on reading acquisition indicates a strong relationship between phonological processing skills and development of word recognition capabilities (Adams,

1990; Juels, 1988; Lovett et al., 1990; McBride-Chang, 1995; Share et al., 1984; Vellutino & Scanlon, 1987; Vellutino, Scanlon, & Spearing, 1995; Wagner, 1988; Wagner & Torgesen, 1987; Wagner, Torgesen, & Rashotte, 1994). Phonological processing, according to Wagner and Torgesen (1987), refers to “the use of phonological information (i.e., the sounds of one’s language) in processing written and oral language” (p. 192). Failure to adequately utilize phonological processing skills tends to limit poor readers’ ability to recognize words accurately and rapidly (Adams, 1990; Lovett et al., 1990; Rack et al., 1992; Stanovich, 1986; Stanovich, Cunningham, & Feeman, 1984a).

According to Bruck (1990), “A frequently used paradigm for assessing knowledge of spelling-sound correspondences involves asking subjects to read aloud pronounceable nonwords (e.g., pask)” (p. 443). Although nonwords contain letter patterns similar to those found in real words, they cannot be read as sight words because their identities (i.e., spellings, meanings, pronunciations, grammar) are not stored in the mental lexicon from previous exposure (Wagner & Torgesen, 1987). Since unfamiliar orthographically legal strings of letters can be read only through the application of systematic letter-sound correspondences (Bruck, 1988, 1990; Vandervelden & Siegel, 1995), it is argued that nonword pronunciation tasks provide appropriate measure of phonological recoding skill (Wagner, 1988; Wagner & Torgesen, 1987).

Although disabled readers exhibit inadequate knowledge of letter-sound correspondences, reading-level-matched studies focused on comparing disabled and nondisabled children’s ability to pronounce nonwords (e.g., pring) or to decide which of two nonwords (e.g., kake vs. dake) sounded like an English word have provided conflicting results (Bruck, 1988, 1990). In some studies, disabled readers have performed

worse on the nonword tasks than nondisabled readers with similar word recognition skills (e.g., Felton & Wood, 1992; Kochnower et al., 1983; Szeszulski & Manis, 1987). In other studies, however, disabled and nondisabled readers with comparable word recognition skills exhibited similar performances on the nonword tasks (e.g., Bruck, 1988; Vellutino & Scanlon, 1987).

Bruck (1990) compared disabled and nondisabled readers' ability to pronounce nonwords and words of similar length, syllable structure, and orthographic structure (e.g., flaw-praw, planet-plamid, fringe-pringe, rickshaw-cullshew) to determine whether disabled readers would exhibit deficits in knowledge of spelling-sound information. The researcher reasoned that disabled readers would show discrepancies between word and nonword performance if they have specific deficit in phonological processing skills. The error data for word-nonword comparisons revealed that disabled readers made more nonword errors than age-matched and reading-level matched nondisabled readers. Disabled readers, on the other hand, made the same number of word errors as reading-level-matched readers, but they made more word errors than age-matched readers. The reaction time data showed that disabled readers read words and nonwords more slowly than did age-matched and reading-level-matched readers. These findings are consistent with results of Felton and Wood (1992), Kochnower et al. (1983), and Szeszulski and Manis (1987) studies which indicated that disabled readers performed more poorly on the nonword task than nondisabled readers of comparable word recognition skills. Conversely, these results differ from the results of Bruck (1988) and Vellutino and Scanlon (1987) studies' claim that disabled readers show similar performance on nonword tasks as reading-level-matched readers.

In a review of research evidence, Rack et al. (1992) evaluated the hypothesis that “dyslexic’s reading and spelling problems are related to a deficit in phonological language skills” (p. 29). The authors predicted that even if dyslexics and younger normal readers were matched for word recognition ability, they would differ in phonological processing skills. Rack et al. analyzed many studies of nonword reading in dyslexics and reading-level-matched normal readers to test the phonological deficit hypothesis. They found strong positive evidence indicating that most dyslexics have a specific deficit in phonological recoding.

Van IJzendoorn and Bus (1994) performed a quantitative meta-analysis on Rack et al.’s (1992) database to test their hypothesis that dyslexic children have specific deficit in phonological processes. The authors found evidence for a modest difference ($d = .48$; $N = 1183$) between dyslexic and reading-level-matched normal readers on nonword reading tasks. The Van IJzendoorn and Bus meta-analysis replicated Rack et al.’s findings and provided evidence for the widely established view that dyslexic children have a specific deficit in phonological processes.

In a recent research study, Greenberg et al. (1997) compared the word recognition skills of adult literacy (AL) students and elementary school children reading at the 3rd, 4th, and 5th grade-equivalent levels to determine whether their word reading processes were the same or different. The researchers administered various phonological tasks (phonemic segmentation, deletion, nonword reading) and orthographic tasks (sight word reading, spelling, rhyme word reading, letter position judgment, wordlikeness judgment) to assess participants’ word reading processes. Although adults and children were equated in their ability to read words on the word identification subtest of the Woodcock Word Reading

Tests - Revised (Woodcock, 1987) their performances differed on most of the literacy measures. Mean scores of adults and children on the phonological measures indicated that adult participants' phonological processing skills were significantly poorer than those of children. In contrast, mean scores on the orthographic tasks indicated that adult participants' orthographic processing skills were equal if not better developed than the skills of children. Adults' sight word reading was in fact stronger than that of the children. These findings support the view that AL participants' phonological processing skills exhibit deficiency rather than delay in reading. To summarize, although the adult disabled readers were matched to the children in Woodcock word reading skill and outperformed the children on Adams and Huggins (1985) sight word reading task, adults performed much worse than children on tasks requiring nonword decoding, sound deletion, and phoneme segmentation, revealing that the adults exhibited a severe deficiency in phonological processing skills.

Findings from studies reviewed above clearly show that disabled readers do not use age-appropriate and reading-level-appropriate phonological processes. Disabled readers' performance on nonword tasks lends support to the view that disabled readers' failure to acquire complete and adequate knowledge of spelling-sound correspondences inhibits their ability to recognize words, particularly polysyllabic words, on a direct visual basis. Incomplete knowledge of spelling-sound correspondences, consequently, compels disabled readers to rely on contextual information which often does not facilitate accurate and rapid recognition of polysyllabic words and efficient comprehension of text (Bruck, 1990; Juel et al., 1986; Stanovich et al., 1984b).

Use of Syllable Information for Word Recognition

The ability to read words by dividing them into smaller units (i.e., syllables) is generally considered to be an important strategy for word identification (Shefelbine, Lipscomb, & Hern, 1989). Studies focused on children's word recognition skills suggest that skilled readers identify individual words by breaking them down into syllables. Since skilled readers can effectively divide words into individual syllables, their ability to recognize polysyllabic words is instantaneous and accurate (Mewhort & Beal, 1977). Disabled readers, on the other hand, have a difficult time recognizing polysyllabic words even when they can effortlessly recognize monosyllabic words. Their reaction time for recognizing polysyllabic words is usually longer than that for monosyllabic words. Researchers attribute disabled readers' difficulty with recognition of polysyllabic words to their difficulty dividing polysyllabic words into individual syllables (Bruck, 1990).

Mewhort and Beal (1977) have evaluated the importance of syllables as functional units in the process of recognizing polysyllabic words. The researchers found that skilled readers were more accurate at recognizing polysyllabic words when the words were presented syllable-by-syllable rather than letter-by-letter or in nonsyllabic groups of letters (e.g., HO-SP-ITAL). Findings from the Mewhort and Beal study provide evidence for the view that skilled readers recognize polysyllabic words by breaking them into syllabic units during visual scanning.

Findings from the Bruck (1990) study, on the other hand, provide evidence that disabled readers generally are disadvantaged when reading polysyllabic words and that their difficulty stems from a deficit in the ability to subdivide words into syllabic units. In her investigation, Bruck compared disabled readers to age-matched and reading-level-

matched nondisabled readers. She examined their ability to recognize one- and two-syllable words of differing lengths (e.g., plod [four-letter, one-syllable word], plunge [six-letter, one-syllable word], planet [six-letter, two-syllable words], and platform [eight-letter, two-syllable word]). Overall, disabled readers had more difficulty recognizing polysyllabic words than nondisabled readers. They read both one- and two-syllable words more slowly than age-matched and reading-level-matched nondisabled readers. Compared to age-matched nondisabled readers, disabled readers made more errors on two-syllable than one-syllable words, which indicates that syllable information was not used for word recognition.

Based on evidence presented above, it may be concluded that disabled readers, compared to skilled readers, have significant difficulty reading polysyllabic words. Specifically, they are slower and less accurate reading words with polysyllabic units. Disabled readers' poor word recognition skills reflect their difficulty accurately subdividing words into syllable units because of their inadequate knowledge of spelling-sound correspondences (Adams, 1990; Bruck, 1990; Shefelbine et al., 1989).

Training the Word Recognition Skills of Disabled Readers

Although difficulty reading individual words rapidly and accurately is a primary indicator of reading disability (Stanovich, 1986), research pertaining to treatment of word recognition deficits of disabled readers has been limited (Lovett, et al., 1988, 1994, 1997). The few training studies that have been reported (e.g., Levy et al., 1999; Lovett et al., 1989, 1990; Olson et al., 1997; Roth & Beck, 1987; Scheerer-Neumann, 1981; Shefelbine, 1990; Van Daal & Reitsma, 1990; Van Daal et al., 1994; Vellutino & Scanlon, 1986, 1987; Wise, 1992; Wise et al., 2000) suggest that the persistent word recognition deficits

of disabled readers can be treated with specific instruction in word recognition skill. The training studies identified above focus on strengthening disabled readers' (1) use of spelling-sound information for word recognition, (2) use of syllable information for word recognition, and (3) use whole word information for word recognition.

Phonological Recoding Training

As mentioned earlier, the word recognition failure of disabled readers reflects a deficit in phonological processing skills. More specifically, inadequate knowledge of spelling-sound correspondences place disabled readers at a disadvantage in recognizing polysyllabic words (Bruck, 1989, 1990; Stanovich, 1986; Stanovich et al., 1984a). Training studies in recent years, however, suggest that direct instruction in use of spelling-sound correspondence rules can strengthen disabled readers' word recognition skills (e.g., Lovett et al., 1989, 1990; Olson et al., 1997; Vellutino & Scanlon, 1987; Wise et al., 2000).

Word recognition training studies by Lovett and her colleagues (1989, 1990), described below, provide evidence of significant treatment effects resulting from remediation of disabled readers' failure to acquire and use spelling-sound correspondence rules for efficient word recognition. In their methodologically rigorous line of research on treatment of disabled readers' word recognition deficits, the researchers used a variety of instructional approaches emphasizing training in (1) letter-sound correspondences, and (2) spelling pattern of words (i.e., whole-word approach). Disabled readers who received either forms of word recognition training showed significant gains in their ability to read words accurately and rapidly out of context.

In an experimental training study with reading disabled children between the ages of 8 and 13 years, Lovett and her colleagues (1989) compared the effectiveness of two

well-defined treatment approaches designed to remediate the pervasive word recognition deficits of disabled readers. A total of 178 students were randomly assigned to one of the three treatment conditions: (1) the Decoding Skills Program (DS), (2) the Oral and Written Language Stimulation Program (OWLS), and (3) the Classroom Survival Skills Program (CSS) which was the treatment provided to the control group. The DS Program focused on training disabled readers' word recognition and spelling skills. Participants in the DS Program were taught an enormous corpus of words that were subdivided into orthographically regular (e.g., wade) and irregular or exception words (e.g., broad). Regular words were taught in the context of a word family (e.g., fade, jade, made) with specific emphasis on use of spelling-sound correspondences for word recognition. Exception words, on the other hand, were taught by a whole word method. The OWLS Program was designed to remediate disabled readers oral and written language skills. Instruction focused on training disabled readers' oral language comprehension, reading and reading comprehension, and written composition. The OWLS instruction was provided in the context of language structure larger than that of single words. The CSS Program, an alternative control procedure, provided disabled readers training in the areas of social skills, classroom etiquette, life skills, organizational strategies, academic problem solving, and self-help techniques but not in word decoding skills.

Comparison of disabled readers' pre- and post-treatment performances on an array of standardized and experimental measures in the Lovett et al. (1989) investigation indicated that the two experimental treatment participants (i.e., DS and OWLS) exhibited significant improvement in word recognition and spelling skills compared to the control group (i.e., CSS). Although a few generalized treatment advantages were shared by both

experimental groups at posttest, effects specific to each experimental treatment revealed that DS-trained participants were superior to the two other treatment groups in their posttest recognition of both uninstructed regular words and exception words. The DS-instructed children also exhibited reliable improvement on standardized word identification tests. The DS Program's effectiveness in promoting spelling acquisition was observed on the experimental real words and pseudowords spelling-to-dictation measures. DS-trained participants exhibited greater improvement in spelling both uninstructed regular words and exception words, and spelling uninstructed pseudowords than the OWLS-treated and CSS-treated participants at posttest. The spelling gains, however, did not transfer to standardized tests of spelling achievement. DS-instructed participants' superior posttest performances on word identification and spelling measures indicated that treatment advantage of the DS Program had transferred to uninstructed materials. Although the DS-trained participants' posttest performances exhibited significant gains in their recognition of both uninstructed regular and exception words, the treatment advantage of the DS Program did not transfer to pseudoword reading.

Findings from the Lovett et al. (1989) study indicate that word recognition deficits of disabled readers are amenable to treatment and well-designed remedial treatments can result in significant improvement in the word recognition and spelling skills of disabled readers. Disabled readers' failure to demonstrate improvement in pseudoword reading, however, suggests that despite sizable gains in word recognition, disabled readers' failed to use the grapheme-phoneme correspondence rules trained and practiced in the DS Program to facilitate their recognition of unfamiliar words and pseudowords. The researchers recommend further research to determine whether disabled readers' ability to

use spelling-sound correspondence rules can be strengthened through specific training in phonological processing.

Lovett et al. (1990) conducted a follow-up experimental training study to address the issue of disabled readers' failure to use the grapheme-phoneme correspondence rules trained and practiced in the DS Program to facilitate their recognition of unfamiliar words and pseudowords in the Lovett et al. (1989) study. In the follow-up study, Lovett and her colleagues compared the effectiveness of two experimental word-training programs with a revised version of the Lovett et al. (1989) Classroom Survival Skills Program (CSS). The two experimental word-training programs were designed to determine whether disabled readers' word recognition skills could be strengthened through letter-sound instruction when the amount of time allocated to individual regular words is equated to that allocated to exception words. Fifty-four disabled readers were randomly assigned to one of the two experimental word recognition and spelling training programs or an alternate problem solving and study skills training control program. In one of the experimental word-training programs (REG \neq EXC), participants were trained in constituent letter-sound correspondences to read regular words; exception words were taught by a whole word method. Participants in this program were trained to spell regular words by breaking them into their individual sounds, and attending to the sequence of sounds, sequence of individual letters, and orthographic patterns within words. Spellings of exception words, on the other hand, were learned by orally rehearsing and writing the sequence of letter names. In the other experimental word-training program (REG = EXC), participants were taught to read both regular and exception words by the whole word method alone.

Spelling training for both regular and exception words in this program emphasized the letter-name approach.

Lovett and her colleagues (1990) found that both word-training groups (REG ≠ EXC and REG = EXC) made significant improvement in recognition and spelling of regular and exception words compared to the CSS control group. Although the word-training participants exhibited significant transfer of learning to uninstructed spelling words, their posttest gains were limited to instructed words and were not observed on uninstructed words and pseudoword reading tasks. In sum, while the word training programs improved disabled readers' ability to recognize and spell familiar words, their acquisition and use of letter-sound correspondences did not facilitate recognition of unfamiliar words and pseudowords. Based on the results of this investigation, the researchers speculate that disabled readers may benefit from more extended period of letter-sound training or explicit phonological awareness and subsyllabic segmentation training to facilitate recognition of unfamiliar words.

Although the Lovett et al. studies (1989, 1990) failed to demonstrate transfer of letter-sound training on disabled readers' ability to recognize unfamiliar words, Vellutino and Scanlon (1987) have shown transfer effects on an experimental "code acquisition" task after poor readers received phonemic segmentation training. The investigators utilized two approaches to train the word identification skills of good and poor readers: (1) a whole word/meaning based training, and (2) sound segmentation training. Greater gains in good and poor readers' word recognition skill were found following training which combined whole word/meaning based strategy with a sound segmentation procedure than were found following training in either of the approaches alone. The data

from Vellutino and Scanlon experimental training paradigm therefore provide additional evidence regarding effectiveness of word recognition training on disabled readers' word recognition skills. Since Vellutino and Scanlon's experimental "code acquisition" task involved learning of nonsense words and non-English alphabetic symbols, Lovett et al. (1990) are dubious about the extent to which effectiveness of the phonemic segmentation training may be generalized to recognition of real English words.

Syllable Segmentation Training

There is considerable evidence that ability to read words is essential for reading and comprehending text. And ability to read words accurately and instantaneously distinguishes skilled readers from disabled readers (Adams, 1990; Rack et al., 1992; Stanovich, 1980, 1986). Since disabled readers have a specific deficit in phonological decoding skill (e.g., Badian, 1994; Beech & Harding, 1984; Rack et al., 1992; Wagner & Torgesen, 1987), they have a difficult time reading polysyllabic words even when they can read monosyllabic words (Shefelbine, 1990; Shefelbine & Calhoun, 1991, Shefelbine et al., 1989). Although current reviews of the literature pertaining to phonological awareness identify lack of phonological blending rather than segmenting as a factor limiting disabled readers' word recognition skill (Wagner & Torgesen, 1987), Lovett and her colleagues (1989, 1990) suspect that phonemic segmentation deficits curtail disabled readers' acquisition of word recognition skill. Lovett et al. argue that disabled readers' inability to spontaneously segment words into syllables and subsyllabic units deter their ability to utilize letter-sound correspondences or orthographic patterns for recognition of unfamiliar words. Syllabication, the ability to parse words into pronounceable units, therefore is an important strategy for recognition of polysyllabic words (Shefelbine et al., 1989).

Since most children can effortlessly identify the number of syllables in spoken words and better readers can intuitively divide unfamiliar words into syllables (Schell, 1967), it is reasoned that syllabication instruction should improve students' decoding of unfamiliar words (Canney & Schreiner, 1976-77). Although the ability to syllabicate is seen as an essential strategy for word recognition, effectiveness of syllabication instruction has remained mixed in the relatively few studies that have been conducted (Shefelbine, 1990; Shefelbine et al., 1989). Studies conducted by Canney and Schreiner (1976-77), Cunningham (1979), and Cunningham, Cunningham, & Rystrom (1981), for example, failed to obtain empirical support for the effectiveness of syllabication instruction as a strategy for decoding unfamiliar words. Other studies (e.g., Roth & Beck, 1987; Shefelbine, 1990; Scheerer-Neumann, 1981; Van Daal et al., 1994), on the other hand, have provided evidence supporting the efficacy of syllabication instruction.

Canney and Schreiner (1976-77) compared the effectiveness of rule-directed syllabication instruction with a phonogram identification approach as word identification strategies. In the study, second grade high, average, and low readers were randomly assigned to one of the three treatment conditions: Syllabication, Phonogram, or Control. Ten 25-minute instructional sessions on syllabic principles or on phonogram patterns were conducted. During the 10 lessons, participants were taught to apply syllabication rules or to use phonogram patterns to decode 30 multiple syllable familiar and unfamiliar words presented in isolation or in context. The control participants remained in their regular classrooms and studied subjects other than reading. Comparison of participants' pre- and post-treatment performance on several measures (i.e., the Reading Comprehension, Syllabication, Blending, and Sound Discrimination subtests from the Stanford Diagnostic

Reading Test [Karlson, Madden, & Gardner, 1966, 1968], and two lists of unfamiliar stimulus words in Context and in Isolation) suggested that neither syllabication instruction nor phonogram recognition strategy improved the word decoding skills or reading comprehension skills of the training group participants over that of the control. The researchers believe that additional research with well-designed procedures would be required to resolve the controversy surrounding syllabication instruction. They also believe that empirical studies focused on training of third- or fourth-grade readers' word recognition, and based on a more flexible approach to word segmentation might improve word recognition skill of children.

In the recent past, Cunningham (1975-76) has developed a synthesized theory of mediated word identification based on the writings of Gibson (1965), Venezky and Calfee (1970) and Smith (1971). The theory contends that "in order to pronounce an unfamiliar word which cannot be recognized as a whole, the reader segments the word into units, compares these units to known words and non-words, and recombines these parts to produce a word for which the reader has an acoustic and/or semantic category" (p. 141). The original investigation into the validity of the synthesized theory was conducted with 32 second-grade children who knew many common words but were unable to figure out the pronunciation of similar but less common words and non-words.

Participants selected for the mediated word identification investigation (Cunningham, 1975-76) were randomly assigned to two conditions: experimental and control. Participants in the experimental group received a 2-week treatment in which they practiced a compare-contrast strategy to identify unknown words and nonwords.

Experimental participants were given three high-frequency, one-syllable words on the first

day and three additional words on each of the four succeeding days. These 15 high-frequency words, written on index cards, were a tangible word store to which participants matched the unknown words and nonwords. During the first week of training, participants were presented with 13 low-frequency, one-syllable words and 13 one-syllable nonwords each day. For each presented low-frequency word, participants found a word that looked most like the presented word from their tangible word store and showed that word to the investigator. They then compared and contrasted the low-frequency word with the “look-alike” high-frequency word and pronounced both the words. To facilitate the use of the compare-contrast strategy, participants were asked questions, such as “Where are the two words alike?” “Do they rhyme or begin alike?” “Where are the two words different?”

During the second week of treatment, participants were presented with additional 13 words and 13 nonwords each day. For each presented word, participants recalled a look-alike word from memory and used their tangible word store of 15 cards only when they failed to retrieve an image of their look-alike word from memory. The participants then compared and contrasted the unknown word with the image of the look-alike known word and pronounced the two words.

To determine the effectiveness of training in improving participants’ ability to identify unknown words, Cunningham (1975-76) individually administered a criterion/delayed retention word pronunciation task to all experimental and control participants. The criterion/delayed retention pronunciation task contained 10 low-frequency, one-syllable words, 10 one-syllable nonwords, and 10 two-syllable words. All words and nonwords were unfamiliar stimuli and had been purposely excluded from the training words and nonwords. The criterion/delayed retention word pronunciation task

was administered twice: as a criterion task, a week after treatment, and as a delayed retention task, a month after treatment. Results of a two-way analysis of variance indicated that experimental participants' scores on both the criterion and delayed retention administration of low-frequency, one-syllable word pronunciation task were significantly greater than control participants' scores. Experimental participants also exhibited significant improvement in their ability to identify two-syllable words on both administration of the word pronunciation task. Experimental participants' scores, however, did not differ significantly from control participants' scores on either administration of the non-word pronunciation task.

According to Cunningham (1975-76), the superior performance of the experimental group on both novel one-syllable and two-syllable words suggests that word identification abilities of poor readers can be improved through the process of comparing and contrasting the unknown words and nonwords to known words stored in lexical memory. Although results of this study do not indicate "whether knowing the parts is sufficient or whether some practice in segmenting and blending is required," Cunningham contends that "segmenting and recombining may be automatically performed if the word parts are stored and a compare-contrast strategy is internalized" (p. 142). Since experimental participants were given no practice or instruction in segmenting or recombining polysyllabic words, Cunningham assumes that having the parts (words and nonwords) of a polysyllabic word in a reader's lexical memory may be sufficient for identification of unfamiliar words.

Although Cunningham (1975-76) speculates that segmentation and blending skills may be implicitly learned from the process of comparing and contrasting of known and

unknown words and nonwords, Lovett et al. (1994) contend that “Intensive and focused phonologically-based training program appears essential for children with reading disabilities. Segmentation training, must be explicit – to the point of exaggeration” (p. 820). Lovett et al. (1988, 1989, 1990), for instance, have demonstrated that repeated practice with letter-sound constituents of newly acquired words and their similarly spelled rhymes does not adequately address the phonological recoding or word identification deficits of dyslexic children.

In a related investigation, Cunningham (1979) evaluated the effectiveness of the synthesized theory in the identification of unfamiliar polysyllabic words. Fourth- and fifth-grade children were screened on two word-pronunciation tasks: a one-syllable task (e.g., Bob, them, top, her, etc.) and a two-syllable task (e.g., problem, control). Sixteen students who had a store of one-syllable words but who could not pronounce two-syllable words were selected for this study, and were randomly assigned to an experimental condition and a control condition. Before the start of training, both control and experimental participants were given a two-syllable word pronunciation task, a two-syllable segmentation task, and a two-syllable recombining task.

The three-week (thirty-minutes per day) treatment was similar to that given to experimental participants in the Cunningham (1975-76) original investigation. Instead of comparing and contrasting unknown one-syllable words to known one-syllable words, participants in the Cunningham (1979) study were taught to compare and contrast unknown two-syllable words to known one-syllable words, the syllables of which rhymed with individual syllables of the two-syllable words (e.g., problem for Bob, them). During the course of treatment, fourth- and fifth-grade disabled readers learned to match 200

two-syllable words to their word store of 35 one-syllable words. When presented with a two-syllable word, first, the experimental participants located two one-syllable words that were similar to the parts of the two-syllable words (e.g., top and her for copper) from their word store. Next, they pronounced the two one-syllable words and identified the rhyming syllables in the two-syllable words and matched them with the two one-syllable words. Finally, they pronounced the two-syllable word. Aside from the compare-contrast strategy, participants were not taught to divide words into syllables.

Upon completion of training, all participants in the Cunningham (1979) investigation were administered a two-syllable word pronunciation task and a two-syllable segmentation task to assess the effectiveness of mediated word identification treatment. Compared to control participants, experimental participants exhibited significant improvement in their ability to pronounce unfamiliar two-syllable words, but their ability to divide words into syllables did not show gains as a result of compare/contrast instruction. Results of this investigation indicate that training in a compare and contrast strategy can significantly increase disabled readers' ability to decode polysyllabic unfamiliar words. Since experimental participants did not show a significant increase in their ability to divide words into syllables, Cunningham contends that instruction in syllabication rules does not necessarily aid decoding of unfamiliar words.

In another experimental training study, Cunningham et al. (1981) investigated the effectiveness of a new syllabication strategy as an aid to decoding unfamiliar-in-print words and its relationship to reading achievement. The syllabication strategy was based on an analysis of 405 most common polysyllabic words. The 405 words had 889 syllables and 484 division points. Three syllabication rules were developed for correctly dividing 87

percent of the words. Fourteen classes of 3rd and 4th grade children were taught the new syllabication strategy and Cunningham's (1975-76) compare/contrast word identification strategy for a period of 15 weeks (15 minutes per day). Comparison of pre- and post-training performance on word-recognition, comprehension, and syllable identification measures failed to show significant gains in reading achievement of experimental participants in relation to control participants. Although experimental participants exhibited significant improvement in their ability to divide polysyllabic words into syllables, they did not show superior performance on any other measures of reading achievement. Since the new syllabication strategy failed to show a relationship between syllabication and reading achievement, Cunningham and her colleagues contend "There is currently no empirical support for teaching pupils to divide words into syllables as an aide to successful reading. Until some evidence can be presented, we invite the readers to join us in calling for a moratorium on syllabication instruction" (p. 213).

The disappointing results from the Canney and Schreiner (1976-77), Cunningham (1975-76, 1979), and Cunningham et al. (1981) studies have been attributed to theoretical and practical problems associated with rules for dividing words into syllables. Factors possibly explaining the disappointing results include "instructional procedures requiring students to pronounce words before dividing them, lack of theoretical support for dictionary rules for syllabication, low utility of some rules, and number and complexity of rules taught by some approaches" (Shefelbine et al., 1989, p. 145). Although Canney and Schreiner and Cunningham and her colleagues contest the utility of syllabication as a word identification strategy, syllabication has been found by others to be effective for treatment of word identification deficits of disabled readers (see Das-Smaal et al., 1987; Lovett et

al., 1994; Scheerer-Neumann, 1981; Shefelbine, 1990; Van Daal et al., 1994; Wentink et al., 1997). The present study investigated the effectiveness of syllabication instruction by engaging adolescent disabled readers in syllable segmentation training which provided practice analyzing multisyllabic words without adhering to dictionary-based syllabication rules. As long as the vowel nucleus of the syllable was distinguished, learners were allowed to vary the division of consonants between the vowels. It was hypothesized that adolescent disabled readers would benefit from syllable segmentation training because disabled readers do not implicitly learn to segment multisyllabic words and explicit syllabication instruction is often recommended for treating their word recognition deficits (Lovett, et al., 1994; Mewhort & Beal, 1977; Santa, 1976-77; Shefelbine, 1990).

Results from the Canney and Schreiner (1976-77) investigation indicated that neither intensive instruction in the flexible application of syllabication rules nor identification of specific phonogram patterns improve the decoding performance of second grade readers. Canney and Schreiner therefore contend that "Additional research following carefully designed procedures is required to adequately resolve the many issues surrounding syllabication. Perhaps children in the third or fourth grade, having a broader experience base with printed material, or more strongly developed phonic analysis skills, might benefit more from the treatments (i.e., syllabication and phonogram identification). Suggestions for a more flexible approach to word division might be explored in the classroom as an alternative to traditional syllabication instruction" (p. 123).

The present study investigated the effectiveness of syllabication instruction by incorporating suggestions advanced by Canney and Schreiner (1976-77). The study was conducted with adolescent disabled readers with third, fourth, and fifth grade-equivalent

reading levels on the Woodcock Word Reading Tests - Revised (Woodcock, 1987). It was expected that adolescent disabled readers in this study would benefit from syllabication instruction because they would have a broader experience base with printed material and better developed phonics analysis skills than the second grade children tested in the Canney and Schreiner study. Additionally, the syllable segmentation training was intended to provide increased flexibility to students in the process of decoding multisyllabic words. Participants in the syllable segmentation group, for instance, were allowed to divide words in multiple ways (e.g., co-op-e-ra-tion or co-op-er-a-tion; or cath-e-dral; gen-er-a-tion, gen-e-ra-tion, or ge-ne-ra-tion) in the process of analyzing multisyllabic words. They were not restricted to use of dictionary-based syllabication rules as they learned to decode multisyllabic words.

Cunningham (1979) claims that poor second grade readers' failure to show a significant increase in their ability to divide words into syllables "adds more support to the theory that syllabication rules have more to do with dictionaries than decoding unfamiliar words" (p. 778). The present study intended to challenge Cunningham's conclusion because poor readers' failure to show a significant increase in their ability to divide words into syllables may have resulted from the absence of explicit instruction in segmentation of polysyllabic words. Although Cunningham (1975-76) asserts that "segmentation and recombining may be automatically performed if word parts are stored and a compare-contrast strategy is internalized" (p. 144), disabled readers do not automatically and instantaneously identify words by dividing them into syllables (Bruck, 1990; Samuels, LaBerge, & Bremer, 1978; Shefelbine, et al., 1989). Syllabication instruction therefore

may be essential for strengthening disabled readers' word identification abilities (Lovett et al., 1994; Shefelbine, 1990).

As an alternative to syllabication instruction, Cunningham (1978) suggests use of a compare/contrast strategy for decoding polysyllabic words. The compare/contrast strategy is advocated as a teaching strategy “designed to enable secondary remedial readers to use their large store of sight words and their knowledge of initial consonant, blend, and digraph sounds to decode polysyllabic words” (p. 609). The compare/contrast strategy strengthens poor readers' word identification skills by teaching them to look at an unfamiliar word and compare parts of that word to words already known. Readers then verify their pronunciation of the unfamiliar by matching it with words that are part of their vocabulary. Cunningham (1975-76, 1979) observed significant gains in second graders' ability to decode unfamiliar one-syllable and two-syllable words. Although the compare/contrast strategy has received empirical support as an effective teaching strategy for decoding two-syllable words in elementary grade (Cunningham, 1975-76, 1979), its effectiveness for decoding multisyllabic words at the secondary level has not been empirically investigated, particularly with adolescent disabled readers.

Although Cunningham (1978) does not report empirical evidence supporting the validity of her compare/contrast strategy for decoding polysyllabic words at the secondary level, she claims that adolescent remedial readers could become independent decoders through the application of her compare/contrast strategy to unfamiliar starter words (e.g., entertainment, chimpanzee, turpentine, etc.). In order to benefit from the compare/contrast strategy, however, readers must be able to use parts of unfamiliar polysyllabic words (e.g., contestant, restorative, performance, etc.) to compare to other polysyllabic words (e.g.,

[contestant] condensation, pretest, informant; [restorative] inactive, reactor, storage; [performance] formation, perplexing, annoyance). Many of the polysyllabic words suggested by Cunningham both as unfamiliar starter words (e.g., **sentimental, depressive, calculate**) and as familiar tangible word store (**sensitive, detrimental, politica; dependable, expensive, impressive; curiosity, calisthenics, emulate**) may not be part of adolescent remedial readers' sight vocabulary; consequently, they may not be able to compare parts of unfamiliar polysyllabic words to familiar sight words. Compare/contrast strategy therefore may not be effective in improving adolescent remedial readers' ability to decode polysyllabic words.

The present study aimed at strengthening adolescent disabled readers' word identification skills by engaging them in a multi-step word decoding process. In the multi-step word decoding process, adolescent disabled readers: (1) read a multisyllabic word (**entertainment**); (2) divided the word's pronunciation into syllables, counted the number of syllables, and then pronounced and identified the spelling corresponding to the spoken syllables in print (**en-ter-tain-ment**); and (3) recombined the syllables to read the whole word (**entertainment**). Participants decoded each multisyllabic word during four separate practice trials, analyzing the words following the process specified above. Repeated practice decoding multisyllabic words was expected to enable adolescent disabled readers to attend to letters and letter clusters within words and to build up a lexicon of sight words by forming and storing complete letter-sound connections in memory. The lexicon of sight words was expected to serve as the tangible word store against which adolescent disabled readers could compare and contrast parts of unfamiliar multisyllabic words. In

sum, the ability to segment and blend words is assumed to be essential for accurate and instantaneous identification of multisyllabic words.

In an attempt to address some of the theoretical and practical problems identified by Canney and Schreiner (1976-77) and Cunningham and her colleagues (Cunningham, 1975-76, 1979; Cunningham, et al., 1981), Shefelbine (1990) developed and tested an approach to syllabication instruction. His syllabication instruction emphasized: (1) syllable automaticity - the ability to identify individual syllables accurately and rapidly, and (2) syllable pattern identification - identification of letter clusters or subsyllabic units within polysyllabic words. Fourth- and sixth-grade disabled readers were randomly assigned to a syllabic-unit instruction treatment condition or no special instruction control condition. Over a 6-week period, disabled readers in the syllabic-unit group were taught to decode familiar and unfamiliar real words with a syllable segmentation approach. Shefelbine's syllabication program included four core processes: transformation (i.e., ability to read open and closed syllable units [e.g., om and mo presented in sets such as og-mog-mo]); sight syllable practice (i.e., ability to identify at sight affixes and Latin roots); practice with real words (i.e., ability to read polysyllabic words [e.g., reconstruction] syllable-by-syllable and as a whole-word); and division practice (i.e., ability to decode unfamiliar polysyllabic words by analyzing syllabic-units in words). Control participants remained in their regular language arts classes and received no special instruction. Comparison of participants' performance on the word identification subtest of the Woodcock Reading Mastery Tests – Revised (Woodcock, 1987) and the San Diego Quick Assessment (La Pray & Ross, 1969) indicated that syllabication participants made significantly greater progress in their

ability to identify polysyllabic words than the control participants who received no special instruction.

Results from the Shefelbine (1990) study are encouraging because even though disabled readers received only five hours of syllable-unit instruction they were able to decode unfamiliar polysyllabic words that were neither directly taught nor patterned after words that were taught. Based on the results derived from his experimental treatment, Shefelbine contends, "Directly teaching students how to pronounce and identify syllable units and then showing them how such units 'work' in polysyllabic words appears to be a worthwhile component of syllabication instruction and should help reduce or remediate this source of reading difficulty among intermediate students" (p. 228).

In another experimental training study, Scheerer-Neumann (1981) also reported on the positive effect of a syllabication instruction program focused on improving third grade poor readers' ability to decode long words. Fifteen third-grade poor readers who were proficient at phoneme blending but deficient in decoding polysyllabic words participated in 12 sessions of a syllable segmentation program. A reading-level-matched group of fifteen third-grade children were assigned to a non-training control condition. During the first four sessions, experimental group participants learned to segment spoken words into syllables through a variety of different responses and games (e.g., hand clapping, speaking in syllables, writing bows for syllables, writing vowels in the syllable bows). In sessions 5 and 6, participants learned to segment both spoken as well as written words. In sessions 7 and 8, participants learned to use the vocalic centers to identify syllables. In the remaining four sessions, 9 through 12, participants learned two formal syllable segmentation rules. Analysis of participants' pre- and post-test performances on real word and pseudoword

reading measures indicated that syllable training participants' ability to read polysyllabic words and pseudowords showed significant gains compared to the untrained control participants. Like results from Shefelbine (1990) study, the present study also revealed positive effect of syllabication instruction after only 12 training sessions of 30 minutes each. Participants exhibited significant transfer of training through their ability to recognize untrained words presented in isolation and in context. Findings from the study suggest that syllable segmentation training can have positive effects on disabled readers' acquisition of word recognition skills.

The effectiveness of syllabication training was also investigated in a series of experiments conducted by Van Daal et al. (1994) in the Netherlands. These researchers explicitly trained disabled readers to use multiletter within-word units in reading Dutch words. In one of their experiments (i.e., experiment 3), Van Daal and his colleagues taught 32 (nine year-old) disabled readers to analyze multiletter units within words and synthesize them into whole-word sound. Practice words were divided into onset-rime (i.e., C-VC, C-VCC, and CC-VC) and postvowel (i.e., CV-C, CV-CC, and CCV-C) segmentations. Some children practiced analyzing and synthesizing words with onset-rime segmentations, and others with postvowel segmentations.

Thirty-six words (i.e., 12 CVC, 12 CVCC, and 12 CCVC) and 18 letter clusters (i.e., 3 CV and 3 VC; 3 CV and 3 VCC; and 3 CCV and 3VC) were practiced in 10 consecutive training sessions of approximately 15 minutes each.

Disabled readers in the Van Daal et al. (1994) study practiced analyzing and synthesizing each of the 54 items (i.e., 36 words and 18 letter clusters) through individualized computer-assisted instruction. During the first seven sessions, disabled

readers were shown CVC, CVCC, and CCVC words divided either into onset-rime segments (e.g., m-ap, p-ond, and st-ep) or postvowel (e.g., ma-p, po-nd, and ste-p) segments. Each written word was presented on the computer screen with the segments separated with a space, and the segments were pronounced for the disabled readers. After a segmented word had been introduced with speed feedback on the computer, the segmented word was replaced by the whole word and the disabled readers blended and said the word aloud. During the last three sessions, segmented words were presented on the computer screen, but without speech support. The disabled readers were required to say aloud the visually presented segments of each word, and then blend and say each word on their own. The experimenter corrected error responses and provided additional support if needed.

Effectiveness of the Van Daal et al. (1994) training was investigated through disabled readers' ability to read practiced words, unpracticed words with similar multiletter units, and unpracticed words with nonsimilar multiletter units. Analyses of pretest and posttest performance indicated that explicit instruction analyzing and synthesizing isolated words and word parts improved disabled readers' ability to read practiced and unpracticed words accurately. The position of multiletter within-word units (i.e., onset-rime or postvowel segments) did not affect word reading performance of disabled readers. Study findings suggest that explicit training of sound analysis and synthesis skills, rather than the position of multiletter units in words, are relevant for improving the word reading skills of disabled readers.

The present study, like the Van Daal et al. (1994) study, explicitly trained adolescent disabled readers to analyze and synthesize multiletter units within multisyllabic

words. Disabled readers practiced reading words by segmenting and blending multiletter units within words. Disabled readers were allowed to segment word into various orthographic segments. The word, transportation, could be segmented as tran-sport-a-tion; trans-port-a-tion; trans-por-ta-tion; or tran-spor-ta-tion. It was reasoned that dividing words in multiple ways would facilitate accurate recognition of multisyllabic words because disabled readers would have the option of analyzing and synthesizing flexible multiletter units rather than rigid rule-based word segments.

The effectiveness of syllabication training in improving decoding skills of disabled readers has also been demonstrated in two microcomputer word recognition programs conducted by Roth and Beck (1987). One hundred and eight fourth grade students whose reading performance was substantially below average were selected for the microcomputer word recognition programs. The participants were selected from two elementary schools. One school served as the training group and the other as the control. Fifty-nine students from the training school received computer-assisted reading instruction, and 49 students from the control school did not receive any supplemental reading instruction. Students in the training and control conditions were classified into three groups, low, medium and high, based on pretest performance on the Woodcock Word Attack subtest. Students from the training school participated in two microcomputer word recognition program, Construct-A-Word (CAW) and Hint-And-Hunt (HH). The CAW program was conducted for approximately 10 weeks in the fall, and the HAH training for 10 weeks in the spring. Students received three individualized 20-minute computer-based word recognition training per week outside of their regular classroom.

The CAW computer program in the Roth and Beck (1987) study trained disabled readers to form real English words by selecting appropriate word beginnings and endings (i.e., consonants, consonant clusters, and phonograms) from letter strings presented on the computer screen. For example, on one round of the CAW activity, the computer presented three letter strings (e.g., l, p, st) representing word beginnings and nine letter strings (e.g., ife, and, ot, og, em, one, ime, in, ake) forming word endings on the screen. The student had to select a beginning letter string and an ending letter string (e.g., st and and) to form a real word (e.g., stand). The student practiced combining beginning and ending letter strings to form as many real words as possible within a short time duration (e.g., stem; stand; stone; etc.). Two forms of speech support, corrective feedback and HELP, were provided to facilitate accurate and rapid formation of real words. When a student formed a pseudoword (e.g., stot) instead of a real word (e.g., stand), the computer provided corrective feedback by displaying the pseudoword, pronouncing the pseudoword, and informing the student that the letter string was not a real word. A student could request HELP when he or she was unable to form of a real word. The computer provided assistance to proceed by pronouncing a word not used by the student and flashing the correct beginning and ending of a word.

In the HH program (Roth & Beck, 1987), on the other hand, students were trained to attend to subword letter strings (i.e., vowels and vowel combinations) to recognize words. The HH program included two separate phases, HINT and HUNT. The HINT phase involved changing the vowel or vowel combinations while keeping the initial and final consonant or consonant clusters unchanged in words. For example, at the start of the HINT phase of the HH program, students saw a word from a set of words (e.g., bat, bait,

bet, beet, bot, boat) displayed on the screen and pronounced aloud, **bat**. The student then saw the letter **j** inserted after the letter **a**, and the words, **bait**, displayed on the screen and spoken aloud. Vowel combination **ai**, in **bait**, was then substituted with **ee**, and **beet** was displayed and pronounced. After several substitutions and alterations of vowel and vowel combinations, the students saw the word **bat** displayed on the screen without the vowel or vowel combinations, **b t**. A word was then pronounced and the student had to select a vowel or a vowel combination from several displayed alternatives to complete the words. The HUNT phase of the HH program involved matching the spoken version of a word or nonword to a printed version displayed on the computer screen. For example, students had to select the word **bait** from the screen when the word **bait** was spoken aloud. Repeated practice match spoken and written words was provided. The computer provided corrective feedback by displaying and pronouncing both the error and the correct response.

A standardized reading achievement test (i.e., Word Attack subtest of the Woodcock Reading Mastery Tests) was administered to measure effectiveness of Roth and Beck's (1987) computer word recognition programs on disabled readers' decoding skills. Decoding skills of treatment participants in the low and medium groups improved following treatment. Fourth grade students in the low group were performing over two years behind national average on the pretest administration of the Woodcock Word Attack subtest. Their decoding skill, which was at 1.7 grade-equivalent level at pretest, advanced to 3.0 after CAW and HH treatments. Medium group treatment participants' decoding performance advanced from 3.1 to 4.4 grade-equivalent level.

Although the CAW and HH programs produced substantial improvement in the decoding performance of low level readers, Roth and Beck (1987) contend that the effectiveness of the programs was restricted owing certain pedagogical issues affiliated with the study design. The nature of decoding instruction included in the study was identified as a factor limiting the effectiveness of the word recognition programs. All activities in the two computer programs focused on manipulating and attending to the letter patterns in single-syllable words. Although decoding instruction focused on single-syllable words increase orthographic knowledge, they do not allow disabled readers to learn the process of segmentation and pronunciations of syllables that appear only in multisyllabic words. The programs probably would have been more effective if decoding instruction had focused on multisyllabic words.

The present study was designed to treat the word recognition difficulties of disabled readers. Disabled readers practiced reading multisyllabic words by segmenting and blending multiletter units in words. This decoding instruction, like the Roth and Beck (1987) programs, provided disabled readers the opportunity to identify and combine subword patterns and to match aural and visual representations of words by attending to the orthographic properties of multisyllabic words rather than single-syllable words. Substantial improvement in the decoding skills, either comparable to or greater than those obtained from the CAW and HH programs, were anticipated from the low level readers in the present study.

Whole Word Training

Although accurate identification of printed words is essential for becoming a proficient reader (Wagner & Torgesen, 1987), most reading disabled children experience

significant difficulty in acquiring adequate word identification skill (Manis, 1985; Vellutino & Scanlon, 1986). Results from recent treatment studies (e.g., Van Daal & Reitsma, 1990; Vellutino & Scanlon, 1986, 1987; Wise, 1992) suggest that presenting words as wholes facilitates disabled readers' ability to recognize words rapidly and accurately.

Van Daal and Reitsma (1990) investigated the effectiveness of whole word and segmented speech feedback on the word identification skill of disabled readers. Thirty-one disabled readers from elementary schools were selected for this study. The selected children were randomly assigned to one of three experimental conditions, segmented-sound condition, whole-word sound condition, and no-sound condition. Each student received 10 to 16 independent word reading practice trials for a period of three to four weeks. The pace of practice was set individually by the student in each condition. Each student practiced reading 50 words for approximately 10 minutes each day. Each cycle of 50 words was presented in a random order. Words were presented in black on a white background in the center of a computer screen. Children used a mouse to press the "next" button to obtain a new word on the screen, and the "headphones" button to receive speech feedback corresponding to the word. In the segmented-sound condition, students first saw a word presented on the screen. The segments within the word were then presented visually followed by speech feedback, one at a time. When the headphone button was pressed, the first segment turned gray and the corresponding sound segment was delivered. All succeeding segments were presented in the same way. In the whole-word condition, students saw the word presented on the screen and pronounced by the computer. Students in the no-sound condition only saw the word presented on the screen and received no speech feedback. Effects of whole-word and segmented speech feedback

were measured through students' performance on the posttest words reading task. Results indicated that whole-word and segmented speech were equally beneficial in improving the word identification skills of nine-year-old disabled children. This suggests that repeated practice reading words as wholes with speech feedback can enhance disabled readers' ability to identify words accurately.

Comparable results pertaining to the effectiveness of whole-word and segmented speech feedback have also been reported in a training study conducted by Wise (1992). Fifty-six low-ability and 56 high-ability readers in first and second grade classrooms learned to read 36 words with speech feedback. The 36 words were divided into four nine-item blocks each containing three one-, two-, and three-syllable words. Selected children were divided into four groups for counterbalancing based on similarity of age and reading ability. Each group learned one block of words with whole word, one with syllable, one with subsyllable, and one with single grapheme-phoneme segmentation. Each student practiced reading the 36 words over two training sessions of approximately 25-30 minutes each, with pretests, training, and posttests of four blocks of nine words, followed by a final test of all 36 words on each day. Effectiveness of whole word and segmentation speech support was determined by analyses of word reading performance on the pretest and posttests of four blocks of nine words, two final tests of 36 words, and training trials of four blocks of nine words over two sessions.

In the training phase of the "talking-computer" system (Wise, 1992), the computer presented the each word from a given block of nine words on the screen, one at a time. The student was instructed to touch the word when they appeared on the screen. The computer pronounced the whole word, syllable, subsyllable, or single grapheme-phoneme

segmentation according to a predetermined counterbalanced assignment of blocks. For example, Group A learned words in block 1 with phoneme segmentation, block 2 as whole word, block 3 by syllable segmentation, and block 4 by subsyllable segmentation. Group B were presented block 1 by subsyllable segmentation, block 2 by syllable, block 3 as whole word, and block 4 by phoneme segmentation. Similarly, Groups C and D practiced the 36 words based on their counterbalanced assignment of blocks. After the word or segment was spoken by the computer, the student either read the whole word presented on the screen or orally repeated the segments, blended the segments into a real word, and read aloud the word. Each word was practiced three times by the students with whole word or segmented speech feedback. A tester scored students' responses. No feedback was provided for incorrect responses.

For the pretest and posttests, students were presented with each word from each of the 4 blocks of nine items, one at a time, without segmentation or speech feedback. The students were instructed to read aloud each word when it was presented on the computer screen. The tester scored students' responses without providing any feedback.

The purpose of the "talking-computer" system (Wise, 1992) was to determine whether there were advantages to learning words by reading them as whole words or by breaking them into segments. Posttest performance indicated that whole word, syllable, and subsyllable speech feedback were equally effective in improving the word recognition skills of low- and high-ability readers. All children blended syllables into words as easily as they recognized words pronounced as wholes. Children learned most words from syllabic and whole-word units. The results suggests that presenting words as wholes can be as

helpful as presenting words as syllable segments for short-term learning of monosyllabic and multisyllabic words.

Vellutino and Scanlon (1986) evaluated the effectiveness of whole-word and phonics methods of instruction, used as complements of one another, and as independent methods, in teaching word identification skills to normal and poor readers. Second and sixth grade poor and normal readers were randomly assigned to one of five treatment conditions, phonemic segmentation training (PS), whole word training (WW), phonemic segmentation and whole word training (PSWW), Control-1 condition (C-1), and Control-2 condition (C-2).

Students in the PS condition of the Vellutino and Scanlon (1986) study received one-half hour phoneme segmentation training for five or six consecutive days. A “word identification” task was used to provide phonemic segmentation training. The word identification task consisted of a training component and a transfer component. In the training component, children practiced reading four pseudo words containing invariant units (e.g., sif, duf, dif, and suf). This training was expected to facilitate children’s ability to read new pseudowords during the transfer component of the word identification task. Students read the four pseudowords using various phoneme segmentation skills over 15 practice trials. The pseudowords were printed on four index cards and were presented one at a time as whole words. Children were instructed to read the word and were then taught to count phonemes, vocalize phonemes, locate the position of given phonemes, and detect grapheme-phoneme correspondences. Corrective feedback was given for error responses. In the transfer component, students read pseudowords that were derived from those used on the training component of the word identification task (jid, juf, sif, duj). The

pseudowords were presented as whole words and children were asked to read them aloud. Corrective feedback was not provided for error responses.

In the WW condition of the Vellutino and Scanlon (1986) study, students were familiarized with the four pseudowords words included in the code acquisition training test (gov, goz, vab, zab). Familiarization training consisted of two different tasks. On the first task, each student heard all four pseudowords pronounced aloud. After a wait time of 6 seconds, students were asked to say aloud each of the four words. Twenty practice trials were provided to learn the words. On the second task, a name-learning task, students were taught to match the spoken pseudowords with novel cartoon-like animal pictures. Fifteen practice trials were provided using the same “look-say” presentation format included in the practice word identification task on the PS condition.

Students in the PSWW in the Vellutino and Scanlon (1986) study received both phonemic segmentation and whole word training. C-1 and C-2 students were not provided any word reading training.

Effectiveness of the PS, WW, and PSWW instruction was measured with students' performance on a word identification/code acquisition test. This posttest included training and transfer subtests. Students were asked to read pseudowords during the training (gov, goz, vab, and zab) and transfer (vog, zog, baz, bav) subtests. PS and WW training were both effective in improving poor and normal readers' ability to decode pseudowords on the code acquisition tests. Subjects who received both PS and WW training performed significantly better than subjects in all other groups. This suggests that complementary use of both PS and WW method of teaching word identification may be more effective than exclusive use of either one or the other of these methods.

Findings from the Van Daal and Reitsma (1990), Wise (1992), and Vellutino and Scanlon (1986) training studies suggest that whole word reading instruction can be used to improve the word identification skills of poor and normal readers. The present study was designed to provide two forms of word reading training, whole word and syllable segmentation. Participants in both conditions practiced reading words as whole units. The benefit of attending to whole units was expected to facilitate word identification skills of adolescent disabled readers. Repeated reading of multisyllabic words during the whole word and syllable training was expected to improve adolescent disabled readers' decoding of unpracticed real words as well as pseudowords.

Chapter 3

Rationale and Hypotheses

Although disabled readers have weak phonological recoding and sight word reading skills, their word identification deficits are amenable to remedial training. Findings from several training studies (e.g., Das-Smaal et al., 1987; Lovett, et al., 1989, 1990; Roth & Beck, 1987; Scheerer-Neumann, 1981; Shefelbine, 1990; Van Daal et al., 1994; Wentink et al., 1997; Wise et al., 1990) suggest that instructional approaches focused on strengthening decoding skills are effective in remediating the word identification deficits of disabled readers. The present study extended the exploration of ways to strengthen the decoding skills of adolescent disabled readers. Two types of training were compared. In one condition, participants learned to read multisyllabic words by segmenting them into their constituent parts (e.g., fin-ish). In another condition, participants learned to read the same words but as whole units (e.g., finish) rather than as words having syllabic components. Also, a no-treatment control condition was included. It was hypothesized that the word reading skill of disabled readers who received either syllable segmentation training or whole word training would show improvement over the course of learning to read four sets of words as indicated by greater success decoding words on successive lists. Training effects favoring both the treatment groups over the no-treatment control group were also anticipated on several posttests assessing participants' word reading, nonword reading and spelling skills although syllable segmentation training was expected to exert a stronger effect than whole word training.

An essential ingredient in the process of reading and comprehending text is the ability to recognize individual words in and out of context (Ehri, 1987; Stanovich, 1980).

Words can be recognized in various ways by readers based on their knowledge of the alphabetic system and familiarity with printed words (Ehri 1991, 1994). Skilled readers generally recognize familiar words by accessing them in memory, and they utilize phonological recoding, or analogy, or orthographic generalization or contextual information or a combination to recognize unfamiliar words (Ehri & Saltmarsh, 1995). Findings from empirical studies (e.g., Bruck, 1990; Greenberg et al., 1997; Manis et al., 1986; Marsh et al., 1981; Santa, 1976) indicate that disabled readers generally exhibit significant deficits in their ability to use phonological recoding, analogy, and orthographic properties in the process of recognizing unfamiliar words. Disabled readers often rely on contextual information because they cannot effectively utilize phonological and orthographic strategies to recognize words (Stanovich, 1980, 1986). Reliance on contextual information, however, does not adequately compensate for disabled readers' phonological and orthographic processing deficits; consequently, disabled readers' recognition of unfamiliar words remains slow and inaccurate and interferes with text comprehension (Bruck, 1990; Stanovich, 1984; Stanovich et al., 1981). The present study attempted to remediate the word recognition deficits of disabled adolescent readers through direct instruction in either syllable segmentation or whole-word practice. It was reasoned that participation in either form of word recognition training would strengthen disabled readers' ability to recognize familiar words by sight and unfamiliar words by phonological recoding and orthographic analogy.

Good readers are thought to recognize words by storing and retrieving fairly complete letter-sound connections established in memory. In contrast, poor readers generally read words by storing and retrieving partial connections between letters and

sounds in memory (Ehri, 1992). Syllables and letters at the beginning and ending of words are attended to and stored more effectively than those in the middle of words. The majority of omissions and additions involve syllables, consonants, and vowels in the middle of words (Shefelbine & Calhoun, 1991; Ehri & Saltmarsh, 1995). Disabled readers' difficulty recognizing words also results from their difficulty parsing words into smaller syllabic and sub-syllabic units (Bruck, 1990; Lovett, 1989, 1990; Santa, 1976-77; Shefelbine, 1990; Shefelbine et al., 1989).

In recent years, a number of studies have been designed to treat the word recognition deficits of disabled readers (e.g., Levy, et al., 1999; Lovett et al, 1989; Vellutino & Scanlon, 1986, 1987; Scheerer-Neumann, 1981; Shefelbine, 1990; Van Daal et al., 1994; Wentink et al., 1997; Wise, 1992, Wise et al., 2000). In a study comparing the effectiveness of four types of orthographic segmentation feedback, Wise (1992) found that computerized whole word and syllable feedback were equally effective in improving word recognition skills of low and average ability readers. Findings from the Lovett et al. (1989) study indicated that disabled readers' memory for spellings of words could be improved through word decoding training. Disabled readers who participated in Lovett et al.'s Decoding Skills Program (i.e., letter-sound and whole word treatment condition) exhibited significant improvement in their ability to spell regular as well as exception words compared to the control participants.

The present study, like the treatment studies cited above, was designed to treat the word recognition and spelling deficits of disabled readers using the syllable and whole word instructional approaches. It was anticipated that both instructional approaches would result in greater gains in the word reading and spelling performance of treatment

participants than the no-treatment control participants. Treatment participants who practiced reading words by dividing them into multiletter units or as whole word units were expected to show greater gains in their ability to read words and nonwords and spell words than the no-treatment control participants.

Although both training approaches in the present study were expected to improve disabled readers' ability to read words and nonwords and spell words, syllable training was expected to be more effective than the whole word training. Syllable training was expected to strengthen disabled readers' ability to attend to all letters rather than just boundary letters in the process of learning to read words. It was anticipated that syllable segmentation training would promote disabled readers' transition from the partial cue reading phase to the full and consolidated phases of sight word reading conceptualized by Ehri (1992). Movement beyond the partial cue phase was expected to improve disabled readers' ability to recognize multisyllabic words by analyzing individual letters and orthographic spelling patterns (e.g., ed, on, ance, sion, tain, tion) into syllabic units. Since syllable segmentation training was aimed at providing disabled readers practice reading multisyllabic words by dividing each word into syllables and then blending the syllables to read the whole word, syllable-trained participants were expected to read word and nonwords and spell words better than the word-trained participants.

In contrast, whole word training procedure was aimed at increasing adolescent disabled readers' ability to recognize familiar words by building up their sight vocabularies, and providing immediate access to the pronunciations and meanings of printed words through repeated practice reading multisyllabic words. It was not designed to strengthen disabled readers' ability to read words and nonwords and spell words by

segmenting and attending to multiletter units in words. Word-trained participants therefore were not expected to read and spell words as well as syllable-trained participants.

Since the syllable segmentation treatment group was the only group taught explicitly to segment words into syllables, they were expected to outperform the whole word-trained and no-training control participants in their ability to segment unfamiliar words into syllables on the syllable segmentation posttest measure. The syllable segmentation measure was included to verify the effectiveness of the syllable training procedure.

The present study tested the following three hypotheses.

1. Adolescent disabled readers who receive either syllable segmentation training or whole word training will show greater improvement in their ability to read multisyllabic words, decode phonetically regular nonwords, and spell familiar words from memory than the no-treatment control group.
2. Adolescent disabled readers who receive syllable segmentation training will read multisyllabic words, decode phonetically regular nonwords, and spell familiar words from memory better than the whole word trained disabled readers.
3. Adolescent disabled readers who receive syllable segmentation training will be able to segment multisyllabic words into syllables better than the whole word trained and the no-training control participants.

Chapter 4

Method

Participants

The sample of participants consisted of 60 adolescents with reading and spelling difficulties. The ages of the participants ranged from 12 to 17 years. The participants were selected from New York City (NYC) Intermediate, Junior High, and High Schools. A proposal to conduct research in the NYC public schools was approved by the Division of Assessment and Accountability of the Board of Education of the City of New York. Superintendents of four school districts in Brooklyn, Manhattan, and Queens granted permission to conduct research in the schools in their districts. Permission was obtained from principals of two intermediate schools (i.e., grades 6 – 8) in Queens, two junior high schools (i.e., grades 6 – 8) in Manhattan, and one high school (i.e., grades 9 – 12) in Brooklyn to conduct research in their schools. Appointments were scheduled with reading teachers to describe the study and discuss issues such as criteria for selecting students, obtaining informed consent from parents, scheduling students for participation in the study, and acquiring space for conducting the study.

Five reading classes were assigned to this research study at each of the five selected schools. Each reading class consisted of approximately 15 poor readers whom the reading teachers believed would score between the third and fifth grade levels on a word identification test. The investigator visited the reading classes, explained the nature of the study, clarified the informed consent procedure, and distributed the informational letters and informed consent forms to the students (see Appendix A). Approximately 375 informed consent forms were distributed. One hundred and fifty students returned consent

forms signed by their parents. Only students who returned the consent forms signed by their parents or guardians were given the pre-treatment alphabetic processing tasks. Prior to administration of the pretests, students signed assent forms (see Appendix B).

The word identification subtest of the Woodcock Reading Mastery Tests – Revised (Woodcock, 1987), a standardized test of word reading, was used to select participants for the study. Test scores were used to divide the participants into reading levels and to match participants before randomly assigning them to three treatment conditions. Sixty students who scored between the 3rd and 5th grade-equivalent levels were chosen for the study. Students were classified as reading at the 3rd, 4th, and 5th grade-equivalent levels based on their word identification scores. There were 30 students at the 3rd grade-equivalent level, 21 students at the 4th grade-equivalent level, and 9 students at 5th grade-equivalent level. Matched triplets were then formed. For example, a participant with a third grade-equivalent score on the word identification subtest was grouped with two other participants with similar scores to form a matched triplet. The three matched participants were randomly assigned to the three groups: syllable segmentation, whole-word reading, and no-treatment control. There were 10 matched triplets at the 3rd grade-equivalent level, 7 matched triplets at the 4th grade-equivalent level, and 3 matched triplets at the 5th grade-equivalent level in each treatment condition. Participants were grouped into two reading levels: low and high reading levels. Readers at the 3rd grade-equivalent level were labeled as lower level readers. Readers at the 4th and the 5th grade-equivalent levels were labeled as higher level readers.

The three treatment groups consisted of 20 participants each. There were 33 males (8 syllable, 12 word, and 12 control) and 27 females (12 syllable, 8 word, and 7 control) in

the study. There were 28 students from sixth grade, 11 students from seventh grade, 18 students from eighth grade, and 3 students from the ninth grade in this study. The ethnic composition of participants was 5 Asians (2 syllable, 2 word, and 1 control), 18 African-Americans (5 syllable, 6 word, and 7 control), 12 Caucasians (4 syllable, 3 word, and 5 control), and 25 Latin-Americans (9 syllable, 9 word, and 7 control).

The 60 participants were proficient speakers of English, and were without any severe emotional problems, uncorrected vision problems, speech and hearing impairment, or intellectual deficits. Information regarding participants' English language proficiency and emotional, visual, speech, auditory, and intellectual abilities was obtained from reading teachers. Information from the teachers indicated that none of the participants were in a special education program, Bilingual program, or English as a Second Language (ESL) program. Although many of the participants were not native speakers of English, they had attended NYC public schools since elementary grades and had received instruction in English for all academic subjects. Many of the selected participants were bilingual with proficiency in their native language as well as English. Reading teachers were also consulted to ascertain that selected participants were not receiving specific instruction in word reading and spelling skills during their classroom reading instruction or in an after school remedial reading program. Conversations with reading teachers indicated that reading instruction in intermediate, junior high, and high school grades focused on improving comprehension of connected text rather than reading and spelling of words taken out of context.

Measures

Pretests: The following alphabetic processing measures were administered individually to all participants in the order listed below. Participants' responses were recorded on a data sheet during administration of each of the seven alphabetic processing tasks. A check was placed for correct responses, incorrect responses were written verbatim, and items not attempted were recorded as DK (i.e., "Don't know."). Correct responses were scored and analyzed to determine participants' alphabetic processing skills.

1. **Naming Letters.** The letter naming pretest assessed participants' ability to name letters of the alphabet accurately and quickly. Two alternate sets (i.e., Set A and Set B) were administered consecutively to determine participants' accuracy and latency in seconds to name letters of the alphabet. Participants were presented with five rows of 10 randomly arranged lowercase letters and they were asked to name them as rapidly and as accurately as possible. The letters were printed on 8½ x 11 inch white paper in Courier font (size = 24). Participants' letter knowledge was analyzed based on accurate letter naming responses. Letter naming speed was timed with a stopwatch to the nearest second and the cumulative times for both trials were used in analyses of letter naming speed (see Appendix C).

2. **Decoding Subtle Misspellings of Real Words.** A decoding task in which participants were asked to read slight misspellings of real words was given to assess participants' ability to process letters fully in the spellings of words being read. Participants were shown cards of 15 nonwords that resembled second and/or third grade level real words except for a single misspelling buried in the word (e.g., somehthirg [something]; teacker [teacher]; mounfain [mountain]). They were told to read the cards, one at a time, the way they were

printed. Participants' responses were analyzed to determine the extent to which they decoded the misspelled words accurately as nonwords (see Appendix D).

3. Letter-Sounds in Nonwords. This grapheme-phoneme correspondence task measured participants' knowledge of letter-sound relations, particularly vowel relations. Participants were shown a list of 30 regularly spelled nonwords including monosyllabic words, consonant-vowel-consonant patterns, and nonwords containing digraphs and consonant clusters. Initial letters (e.g., citless, genket, yalk, wert), medial letters (e.g., bine, skown, pight, rupe), or final letters (e.g., freng, sibby, faid, bick) were underlined and participants were asked to pronounce the sounds that the underlined letters represented in the nonwords. Participants' ability to accurately pronounce the sounds of letters and letter clusters in nonwords were analyzed to determine their knowledge of grapheme-phoneme relations (see Appendix E).

4. Word Identification. The word identification subtest of the Woodcock Reading Mastery Tests – Revised (Woodcock, 1987) assessed students' level of reading development. Two alternate forms (Form H and Form G) were administered and participants were instructed to read the words out loud. Testing was discontinued when participants failed to read six items in a row. Participants whose scores fell between the 3rd and 5th grade-equivalency reading levels were selected for the study (see Appendix F).

5. Word Attack. Form G of the word attack subtest of the Woodcock Reading Mastery Tests – Revised (Woodcock, 1987) was administered to assess participants' phonological recoding skill. Participants were asked to read 45 phonetically regular non-words beginning with monosyllabic words presented in order of increasing difficulty, ranging from simple consonant-vowel-consonant patterns (e.g., fay, gat, pog) to blends, digraphs,

and vowel variations (e.g., plip, laip, gouch). Testing was discontinued when the participants failed to provide correct responses to six items in a row. Correct decoding of nonwords were analyzed to determine participants' phonological recoding skill (see Appendix G).

6. **Word Learning Task.** The word learning task was used to measure participants' ability to read words, to spell words, and to read nonwords by analogy to real words. The word learning component assessed participants' ability to learn to read 16 regularly spelled words (e.g., professor; graduation; comparison) that were practiced over three trials. The spelling component assessed participants' memory for spellings of eight words selected from the 16 words they had learned to read. The analogy component assessed participants' ability to read eight nonwords that were spelled analogously to eight real words they had practiced reading (e.g., krofessor derived from professor). Each of the three components of the word learning task is described below.

a. **Reading Words.** Two alternate sets (i.e., Set A and Set B), consisting of 16 regular words (i.e., frequently occurring words with regular spellings and known meanings), were used for this task. The words included in Set A and Set B were selected from the Basic Elementary Reading Vocabulary: Core Sixth Reader list (Harris & Jacobson, 1972). Set A and Set B were counterbalanced across participants for the pretest and the posttest. Some participants practiced reading Set A words for the pretest and Set B words for the posttest while other participants read Set B words on the pretest and Set A words on the posttest. Words selected for this task were different from the words used during the syllable and whole word instructional phase of this study. In a pilot administration of this task, it was evident that three practice trials enabled participants to

read each word accurately. A total of three practice trials therefore were provided to read the words. The 16 words were presented in a different order on each practice trial.

Corrective feedback was provided for incorrect readings and for words not attempted. Each word was printed in lowercase letters (Courier font; size = 24) on a (3 x 5 inch) white index card. Words decoding accurately on the first trial were analyzed to assess participants' ability to read words independently without feedback (see Appendix H).

b. Spelling Words. After students completed three trials of the word learning task, they were asked to spell eight of the 16 words they had learned to read. Participants who had learned to read words included in Set A spelled words in Set A. Likewise, participants spelled words included in set B if they had learned to read words in Set B. Participants recalled and wrote out correct spellings of the words they learned to read. Participants listened to each of the eight words orally dictated out loud, they repeated the word, and then wrote its correct spelling. Words spelt accurately were analyzed to determine participants' memory for spellings of words they had learned to read (see Appendix I).

c. Reading Nonwords by Analogy. After students completed three trials of the word learning task and the spelling task, they were shown eight pronounceable nonwords written analogously to real words that they had learned to read in the word learning task. These were not the same words they had spelled in the preceding task. The initial consonants, consonant clusters, or digraphs of the eight real words were changed to derive the nonwords, for example krofessor derived from professor. Accurately decoded nonwords were analyzed to assess participants' ability to read nonwords by analogy to familiar real words (see Appendix J).

7. Spelling Treatment Words. Ten words were randomly selected from the 25 words to be taught during the final session of the word reading treatment. Participants listened to each of the 10 words orally dictated out loud, they then repeated the words and wrote the spellings from memory. Words spelt accurately were analyzed to assess participants' ability to correctly spell words from memory (see Appendix K).

Treatment:

Two types of word reading treatments were compared: a syllable segmentation treatment procedure and a whole word reading treatment procedure.

Syllable Segmentation Treatment. A flash card method was used for the syllable segmentation treatment procedure. One hundred frequent, regularly spelled words (thought to be semantically familiar to students) were selected from the Basic Elementary Reading Vocabulary: Core Sixth Reader list (Harris & Jacobson, 1972). The words were slightly above the reading level of the participants. Each word was printed in lowercase letters (Courier font; size = 24) on a (3 x 5 inch) white index card. The syllable treatment program consisted of four individually administered sessions each lasting approximately 30 minutes. In each treatment session, the participants were taught to read and analyze the syllables of 25 words, one at a time. A total of four practice trials were provided to read and analyze each word. Presentation order of the words was randomized on each of the four trials.

During each treatment session, syllable participants were shown index cards displaying 25 regularly spelled words, one at a time. First, they read aloud each word (e.g., finish) as a whole word. They then explained the word's meaning (e.g., "Finish means to complete a job."). Meanings of words were explained during the first trial of

each session only. Next, they divided the spelling and pronunciation into its syllables or beats (e.g., fin – ish) so that the spelling of each beat matched its pronunciation. The participants learned to analyze words by saying the beats in each word, raising their fingers to count the beats, and stating the number of beats. They found the spelling beats that matched the sound beats by saying each beat and exposing the letters for that beat with their thumbs (e.g., for fin – ish, participants used their thumbs to expose that part of the spelling that correspond to the beat that they orally pronounced). Finally, they read the spelling beats together to say the whole word. During the first trial of each session, participants were instructed to practice reading words following all of the steps described above. For the next three trials of each session (i.e., 2nd, 3rd, and 4th trials), participants practiced reading each of the 25 words following all of the steps described above, but without explaining the meanings of the words. Corrective feedback was provided for error responses and for the steps not attempted. A total of four practice trials was provided to read and analyze the 25 words. Participants' correct responses for reading words, counting syllables, and identify syllables during the first trial of each session were analyzed to monitor progress over the course of training and to assess effects of syllable segmentation treatment on participants' abilities to read successive sets of words (see Appendix L).

Whole Word Reading Treatment. A flash card method of reading words was used to teach participants to read whole words. They learned to read the same 100 words taught to the syllable participants. They completed four individually administered sessions each lasting approximately 30 minutes. The 100 words were printed, individually, in (Courier font; size = 24) lowercase letters, on (3 x 5 inch) white index cards. Participants

were shown 25 words, presented in a randomized order, during each session, and they were asked to read each word by looking at the word printed on the card. First, they read aloud each word (e.g., finish) as a whole word. Next, they explained the word's meaning (e.g., "Finish means to complete a job."). Meanings of words were explained during the first trial of each session only. Finally, they read the word as a whole again (e.g., finish). Thus, whole word participants learned to read the words as whole words (e.g., finish) rather than breaking them into syllables or beats. A total of six practice trials with corrective feedback was provided for each set of 25 words. For the first trial of each session, participants read aloud a word, explained the word's meaning, and read the word again. For the next three trials (i.e., 2nd, 3rd, and 4th trials) of each session, participants were asked to read aloud each word twice, without explaining the meanings of the words. For the last two trials, 5th and the 6th trials, participants were instructed to read aloud each of the 25 words once as quickly and correctly as possible without explaining the words' meanings. Participants' word reading speed during the last two trials was timed with a stopwatch and the total time for each trial was recorded in seconds. Whole word participants received more trials to read the words than syllable segmentation participants to compensate for the fact that syllable treatment students read the words one more time than whole-word students during each trial. Participants' correct responses during the first trial of each session were analyzed to assess effects of treatment on reading ability of the whole word participants as treatment proceeded (see Appendix M).

Posttests:

The following posttests were administered to all participants in the order listed below.

1. **Word Learning Task**. The word learning posttest, like the pretest, assessed participants' ability to learn to read a set of 16 words and then, to spell eight of the words and to read eight nonwords by analogy to the words learned.
 - a. **Reading Words**. Two sets of multisyllabic words (i.e., Set A and Set B), used in the pretest, were again used for this posttest. The two sets of words were counterbalanced across participants. Participants read the set of words they did not read during the pretest, either Set A or Set B. Participants practiced reading the words on three trials. The posttest procedure was like the pretest procedure (see Appendix H).
 - b. **Spelling Words**. Half of the words that participants had practiced reading were used to assess their memory for spellings. The posttest procedure was identical to that of the pretest procedure (see Appendix I).
 - c. **Reading Nonwords by Analogy**. Half of the words from the word learning task were used to assess participants' ability to read nonwords by analogy. The initial letters of words were altered to create nonwords (e.g., rependent derived from dependent). The procedure for the posttest was identical to that of the pretest (see Appendix J).
2. **Spelling Treatment Words**. This posttest was identical to the pretest. Its purpose was to assess treatment students' memory for the spellings of words they had learned to read during syllable or whole word instruction (see Appendix K).
3. **Decoding Misspellings of Real Words**. The procedure for this posttest was identical to that used for the pretest. The misspelled words included in this task were different from those in the pretest (see Appendix D).
4. **Word Attack**. Form H of the word attack subtest of Woodcock Word Reading Tests – Revised (Woodcock, 1987), an alternate of Form G used during pretest, was administered

as the posttest. The posttest procedure was same as the pretest procedure (see Appendix G).

5. **Syllable Segmentation Task**. A syllable segmentation task was given to measure participants' ability to divide the spellings and pronunciations of words into syllables or beats (e.g., fin-ish) so that the spelling of each beat matched its pronunciation. Prior to beginning of the task, the investigator modeled the process of decoding multisyllabic words by segmenting them into syllables. Participants were shown a multisyllabic word, excellent, printed on a card. The investigator read aloud the word and analyzed the word by saying the beats (e.g., ex-cell-ent), raising her fingers to count the beats, and stating the number of beats (e.g., three). The investigator then drew circles around the beats in the printed word, and recorded the number of beats in the blank space provided on the card. After the demonstration, participants practiced segmenting two sample multisyllabic words (e.g., telephone and television) with the investigator's guidance. Participants were then presented with a sheet consisting of three-syllable, four-syllable, and five-syllable words. There were a total of 12 regularly spelled words on the sheet. First, participants were asked to read aloud each word (e.g., computer) as a whole word. If incorrect, the correct word was identified. Next, they were instructed to analyze each word by saying the beats (e.g., com-put-er), raising their fingers to count the beats, and stating the number of beats (e.g., three). Finally, they were asked to draw circles around the beats in each printed word, and record the number of beats in the blank space provided on the sheet. Correct responses were analyzed. The purpose of this task was to verify that the syllable treatment was effective in teaching students to divide words into syllables (see Appendix N).

6. Motivation Questionnaire. The motivation questionnaire was administered to assess the usefulness of the word reading treatment for syllable and word participants. The questionnaire consisted of five questions each accompanied by a 5-point scale which participants used to indicate their opinion about the usefulness of the word reading treatment. The five questions that assessed participants' attitude were: (1) How much did you enjoy participating in the word reading project? (2) How much has practicing all these words helped you to read words in class or at home? (3) How much has practicing all these words helped you to spell words in class or at home? (4) How much have you used the word reading method to read words in class or at home? (5) How much have you used the word reading method to spell words in class or at home? The investigator read aloud the directions and questions and explained the procedure for completing the questionnaire to participants. Participants were then provided privacy to complete the questionnaire. Participants indicated their opinion by circling a number for each question on a 5-point scale (i.e., 1 = not at all, 2 = very little, 3 = some, 4 = a lot, 5 = a great deal). All responses were analyzed to assess students' attitude and opinion about whether the word reading treatment improved their word reading and spelling skills (see Appendix O).

Procedures

The students were seen from one to six times in a quiet room within the school during school hours. Each session lasted up to 30 minutes. All tests and treatments were administered individually to students during reading periods only. The students did not miss classroom instruction in any academic subjects.

During the first session, seven literacy pretests were administered to assess students' reading and spelling skills. The pretest measures focused on: naming letters,

decoding misspellings of real words, identifying letter-sounds in nonwords, word identification, word attack, word learning (i.e., reading words, spelling words, and reading nonwords by analogy), and spelling treatment words.

Students who scored between the third and fifth grade-equivalent levels on the word identification subtest of the Woodcock Reading Mastery Tests – Revised (Woodcock, 1987) were chosen for the study. The word identification scores were used to match students before randomly assigning them to one of the three groups: a syllable segmentation treatment group, a whole word treatment group, or a no treatment group. The test scores were also used to divide the participants into two reading levels: lower level readers (3rd grade-equivalent) and higher level readers (4th and 5th grade-equivalent).

Students assigned to treatment groups participated in syllable segmentation treatment or whole word treatment for four sessions. Treatment participants practiced reading 100 regularly spelled words, four sets of 25 words taught over four days. Words in each set were practiced four times by the syllable participants and six times by the whole word participants. In the syllable segmentation condition, participants practiced reading words by breaking words into their syllables (e.g., fin-ish) and then reading them as whole words (e.g., finish). In the whole word reading condition, participants practiced reading words as whole words (e.g., finish) rather than breaking them into syllables. Corrective feedback for error responses and for words not attempted was provided to participants in both treatment conditions. Participants in the no-treatment control group remained in their classrooms and received the regular reading instruction provided by the school. They only completed the pretests and the posttests.

Upon completion of treatments, all participants were given five posttests to assess their alphabetic processing skills, including: word learning (i.e., reading words, spelling learned words, and reading nonwords by analogy), spelling treatment words, decoding misspellings of real words, word attack, and syllable segmentation. A motivation questionnaire was administered to syllable and word participants at the end of the posttest.

Statistical Analyses

A randomized block design procedure was used to statistically analyze participants' mean performance in order to uncover the processes used by the three groups to read and spell words. A randomized block design approach was used because triplets of students had been matched and assigned randomly to the three groups. Performance of the three groups on the various pretest measures was compared with several ANOVA tests. The independent variables were the treatment group (syllable vs. word vs. control) and reading level (low vs. high), and the dependent variables were the various pretest scores. When significant interactions were detected, ANOVAs were performed at each reader level to pinpoint significant pairwise differences. Pretest analyses were used to verify that the treatment groups did not differ in demographic characteristics and in alphabetic, word reading, and spelling skills prior to treatment.

To examine the effectiveness of the two instructional approaches on word reading, the reading skill of students across learning sessions was compared with a randomized block design procedure. Performance was compared with an ANOVA. The independent variables were reading level (low vs. high), treatment group (syllable vs. word), and treatment session (1 vs. 2 vs. 3 vs. 4). The dependent variable consisted of the number of

words read correctly during the first trial across learning sessions. To pinpoint significant effects, ANOVAs were performed at each reader level.

Syllable-trained participants' ability to count syllables and identify syllables in words over the course of training was analyzed with the randomized block design procedure. Ability to count and identify syllables was compared with an ANOVA. The reading level (low vs. high) and treatment session (1 vs. 2 vs. 3 vs. 4) were independent variables. The dependent variable consisted of the number of syllables counted and identified correctly during the first trial across the learning sessions. Tukey's comparison procedure was conducted to pinpoint the source of main effects.

Performance of participants on the syllable segmentation posttest was subjected to a randomized block design procedure with treatment group (syllable vs. word vs. control) and reading level (low vs. high) as the independent variables, and scores on the syllable segmentation task as the dependent variables. Scores on the syllable segmentation task included participants' accuracy in reading words, in counting syllables in words, and in circling syllables in words. Tukey's post hoc comparison procedure was conducted to determine whether pairs of means differed statistically. When a significant interaction was detected, ANOVAs were conducted on lower and higher level readers separately to pinpoint significant pairwise differences.

Performance of participants on the other posttest measures was subjected to several ANOVAs. The treatment group (syllable vs. word vs. control) and reading level (low vs. high) were independent variables, and the gain scores from pretest to posttest were the dependent variables. All hypothesis were tested at $p < .05$. Tukey's post hoc comparison procedure was conducted to determine whether pairs of means differed

statistically. When a significant interaction was detected, ANOVAs were conducted on lower and higher level readers separately to pinpoint significant pairwise differences.

Syllable- and word-trained participants' responses to the motivation questionnaire were compared with the ANOVA procedure. The reading level (low vs. high), treatment group (syllable vs. word), and the questionnaire items (enjoyment vs. reading utility vs. spelling utility) were independent variables. The dependent variable consisted of participants' responses to the questionnaire items. To localize significant effects, separate ANOVAs were performed at the lower and higher reader levels.

Chapter 5

Results

Characteristics of Groups

The participants in this study were all poor readers. As evident in Table 1, although the children were in Grades 6 through 9, they were reading words at the third, fourth, and fifth grade levels as measured on the word identification test of the Woodcock Reading Mastery Test – Revised (Woodcock, 1987). This test was used to match participants before randomly assigning them to the three treatment groups (i.e., syllable, word, and control) and to divide the participants into two reading levels (i.e., low and high). Thus, 10 matched triplets were randomly assigned to the low and high reading levels within treatment groups. Performance on the word identification test was analyzed using the SPSS Analysis of Variance (ANOVA) procedure with treatment group (syllable vs. word vs. control) and reading level (low vs. high) as independent variables, and the word identification scores as the dependent variable. From mean performance in Table 1, it is evident that the groups were well matched. Test statistics in Table 2 indicated a significant main effect for reading level ($p < .01$), but no significant main effect or interaction involving treatment group ($p > .05$). The mean grade-equivalent was 3.4 for low (3rd grade-equivalent) level readers and 4.7 for high (4th - 5th grade-equivalent) level readers. These results reveal that the word identification skills of participants were on average three grade levels below their school grade level (see Table 1).

Background information about participants was obtained from consent forms completed by parents or guardians (see Appendix A), and from reading teachers.

Demographic characteristics and educational information was gathered to provide a

Table 1

Means and Standard Deviations on Characteristics of Participants as a Function of Treatment and Reading Level Prior to Treatment

| <u>Characteristics</u> | <u>Treatment</u> | | | | | |
|---|------------------|-------------|-------------|-------------|----------------|-------------|
| | <u>Syllable</u> | | <u>Word</u> | | <u>Control</u> | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Word Identification | | | | | | |
| (Maximum = 212) | | | | | | |
| Accuracy | | | | | | |
| Low (3 rd) Readers | 115.50 | (6.98) | 116.00 | (7.00) | 116.50 | (7.56) |
| High (4 th - 5 th) Readers | 137.80 | (6.68) | 138.70 | (6.54) | 138.40 | (6.81) |
| Grade Equivalent | | | | | | |
| Low (3 rd) Readers | 3.4 | (0.33) | 3.4 | (0.35) | 3.5 | (0.36) |
| (Range = 3.0 - 3.9) | | | | | | |
| High (4 th - 5 th) Readers | 4.7 | (0.40) | 4.7 | (0.42) | 4.7 | (0.42) |
| (Range = 4.2 - 5.6) | | | | | | |
| Age in Years | | | | | | |
| (Range = 12.0 - 17.5) | | | | | | |
| Low (3 rd) Readers | 13.7 | (21.36) | 14.0 | (21.29) | 13.7 | (18.61) |
| High (4 th - 5 th) Readers | 12.7 | (11.41) | 12.98 | (12.01) | 12.5 | (5.37) |

(table continues)

Table 1. (continued)

| <u>Characteristics</u> | <u>Treatment</u> | | | | | |
|---|-----------------------|-------------|-------------------|-------------|----------------------|-------------|
| | <u>Syllable Group</u> | | <u>Word Group</u> | | <u>Control Group</u> | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Gender (Male; Female) | | | | | | |
| Low (3 rd) Readers | (M = 3; F = 7) | | (M = 6; F = 4) | | (M = 6; F = 4) | |
| High (4 th - 5 th) Readers | (M = 5; F = 5) | | (M = 6; F = 4) | | (M = 7; F = 3) | |
| School Grade | | | | | | |
| (Range = 6th - 9th Grades) | | | | | | |
| Low (3 rd) Readers | 7.10 | (1.19) | 7.20 | (1.13) | 7.30 | (1.05) |
| High (4 th - 5 th) Readers | 6.60 | (0.84) | 6.70 | (0.82) | 6.50 | (0.70) |

Note. There were 20 students in each treatment condition, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level.

Table 2

ANOVA Test Statistics on Characteristics of Participants as a Function of Treatment and Reading Level Prior to Treatment

| Characteristics | Main Effect | | Interaction |
|---|-------------|------------|-------------|
| | Group (G) | Level (L) | G x L |
| | F (2, 36) | F (1, 18) | F (2, 36) |
| Word Identification (Maximum = 212) | 0.68 n. s. | 55.90 * | 0.14 n. s. |
| Age in Years (Range = 12.0 – 17.5) | 1.61 n. s. | 3.76 n. s. | 0.21 n. s. |
| Gender (Male; Female) | 2.77 n. s. | 0.28 n. s. | 0.39 n. s. |
| School Grade (6 th – 9 th Grades) | 0.42 n. s. | 2.05 n. s. | 1.26 n. s. |

Note. There were 20 students in each treatment group, 10 reading at the high (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level.

* $p < .01$; n. s. indicates that F value is not statistically significant at $p < .05$.

description of the participants, and to create matches before assigning them to the three treatment groups. Several ANOVA tests were conducted to verify that the groups did not differ with regard to age, gender, or school grade. Background information is displayed in Table 1 and 2.

The age range of participants was between 12 – 17 years. As evident in Table 2, neither the main effects nor the interaction involving treatment group and reading level were significant. Means from Table 1 indicate that groups did not differ significantly with regard to age although interestingly the 3rd grade-equivalent readers were slightly older than the 4th – 5th grade-equivalent readers.

Test statistics displayed in Table 2 indicate neither the main effects nor the interaction were significant with regard to gender. The groups did not differ significantly.

The actual grade level of participants in school ranged from 6th – 9th grades. As evident in Table 2, neither the main effects nor the interaction was significant. Means reported in Table 1 indicate that participants were on average at 7th grade level in terms of academic placement. Thus, the poor readers were reading on average three to four grades below their actual grade in school.

To summarize, information displayed in Tables 1 and 2 indicates that the three treatment groups were very similar with regard to pre-treatment characteristics. It is apparent from test statistics that the treatment groups were not significantly different in terms of their word reading skill, age, gender, or grade. The only significant difference occurred between low and high level readers in reading words ($F = (1, 18) = 55.90, p < .01$).

Pretest

Several pretests were given to assess participants' alphabetic, word reading, and spelling skills prior to treatment to verify that the groups did not differ in their level of literacy development, and to provide a basis for comparing gains in literacy skills as a function of the type of word reading instruction that was provided. Performance of participants on the various pretest measures was compared with several ANOVA tests. The treatment group (syllable vs. word vs. control) and the reading level (low vs. high) were independent variables, and the various pretest scores were the dependent variables. Mean performance is given in Table 3. Test statistics are given in Table 4.

The letter naming pretest measured participants' accuracy and latency in seconds to name two alternate sets of 50 letters of the alphabet. Test statistics in Table 4 indicate that neither the main effects nor the interaction was significant. Means in Table 3 show that low and high level readers' performance was very similar for accuracy as well as latency. Participants in the three treatment groups named on average 99 out of 100 letters within 50 - 58 seconds, indicating that they knew all the letters very well.

The subtle misspelling pretest measured participants' ability to detect that a familiar word had been subtly misspelled, as indicated by their attempt to decode the misspelling rather than to read it as the intended word and ignore the error. Participants read a list of 15 nonwords that resembled real words except for a single misspelling buried in the word (e.g., somehirc [something]; teacker [teacher]; mounfain [mountain]). Table 3 reports mean scores for accurately decoding the misspelling. In the ANOVA of scores, neither the main effects nor the interaction was significant. Test statistics in Table 4

Table 3

Mean Performance and Standard Deviations on Pretests as a Function of Treatment and Reading Level

| Dependent Measures | Treatment | | | | | |
|---|----------------|-------------|------------|-------------|---------------|-------------|
| | Syllable Group | | Word Group | | Control Group | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Naming Letters | | | | | | |
| (Maximum = 100) | | | | | | |
| Accuracy | | | | | | |
| Low (3 rd) Readers | 99.30 | (1.05) | 98.80 | (1.87) | 99.60 | (0.69) |
| High (4 th - 5 th) Readers | 99.20 | (0.91) | 99.20 | (0.78) | 99.10 | (1.10) |
| Latency in Seconds | | | | | | |
| Low (3 rd) Readers | 56.80 | (13.08) | 56.10 | (10.50) | 55.30 | (10.63) |
| High (4 th - 5 th) Readers | 50.60 | (9.69) | 54.60 | (14.99) | 58.90 | (10.92) |
| Subtle Misspellings | | | | | | |
| (Maximum = 15) | | | | | | |
| Low (3 rd) Readers | 6.30 | (2.71) | 5.70 | (2.83) | 5.10 | (2.68) |
| High (4 th - 5 th) Readers | 6.50 | (3.80) | 7.20 | (1.75) | 7.00 | (3.05) |

(table continues)

Table 3. (continued)

| Dependent Measures | Treatment | | | | | |
|---|----------------|-------------|------------|-------------|---------------|-------------|
| | Syllable Group | | Word Group | | Control Group | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Giving Letter-Sounds | | | | | | |
| (Maximum = 30) | | | | | | |
| Low (3 rd) Readers | 21.90 | (7.02) | 19.10 | (6.03) | 20.30 | (5.11) |
| High (4 th - 5 th) Readers | 20.90 | (5.55) | 20.90 | (6.57) | 19.90 | (5.13) |
| Word Attack | | | | | | |
| (Maximum = 45) | | | | | | |
| Low (3 rd) Readers | 22.00 | (3.68) | 24.90 | (9.55) | 25.70 | (3.26) |
| High (4 th - 5 th) Readers | 29.30 | (6.05) | 29.80 | (3.73) | 29.60 | (3.23) |

(table continues)

Table 3. (continued)

| Dependent Measures | Treatment | | | | | |
|---|----------------|-------------|------------|-------------|---------------|-------------|
| | Syllable Group | | Word Group | | Control Group | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Word Learning Task | | | | | | |
| Reading Words | | | | | | |
| (Maximum = 16) | | | | | | |
| Low (3 rd) Readers | 10.50 | (3.30) | 8.70 | (3.74) | 10.30 | (3.33) |
| High (4 th - 5 th) Readers | 12.30 | (1.49) | 13.60 | (1.64) | 13.30 | (1.82) |
| Spelling Words | | | | | | |
| (Maximum = 8) | | | | | | |
| Low (3 rd) Readers | 3.00 | (2.40) | 2.50 | (1.95) | 2.00 | (1.49) |
| High (4 th - 5 th) Readers | 3.90 | (1.91) | 3.80 | (1.68) | 3.70 | (1.33) |
| Analogy Nonwords | | | | | | |
| (Maximum = 8) | | | | | | |
| Low (3 rd) Readers | 4.30 | (2.00) | 4.60 | (2.06) | 5.00 | (1.82) |
| High (4 th - 5 th) Readers | 5.80 | (1.31) | 6.80 | (0.78) | 6.40 | (1.17) |
| Spelling Treatment Words | | | | | | |
| (Maximum=10) | | | | | | |
| Low (3 rd) Readers | 0.80 | (1.03) | 0.60 | (0.84) | 0.10 | (0.31) |
| High (4 th - 5 th) Readers | 2.30 | (2.11) | 3.80 | (1.81) | 2.60 | (1.83) |

Note. There were 20 students in each treatment condition, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level.

Table 4

ANOVA Test Statistics on Pretest as a Function of Treatment and Reading Level

| Dependent Measures | Main Effect | | Interaction |
|---------------------------------------|-------------|------------|-------------|
| | Group (G) | Level (L) | G x L |
| | F (2, 36) | F (1, 18) | F (2, 36) |
| Naming Letters (Maximum = 100) | | | |
| Accuracy | 0.54 n. s. | 0.04 n. s. | 0.84 n. s. |
| Latency in Seconds | 0.44 n. s. | 0.17 n. s. | 0.93 n. s. |
| Subtle Misspellings (Maximum = 15) | 0.11 n. s. | 2.55 n. s. | 0.48 n. s. |
| Giving Letter-Sounds (Maximum = 30) | 0.61 n. s. | 0.01 n. s. | 0.54 n. s. |
| Word Attack (Maximum = 45) | 1.00 n. s. | 10.25 ** | 0.66 n. s. |
| Word Learning Task | | | |
| Reading Words (Maximum = 16) | 0.58 n. s. | 10.58 ** | 3.31 * |
| Spelling Words (Maximum = 8) | 0.57 n. s. | 6.74 * | 0.25 n. s. |
| Analogy Nonwords (Maximum = 8) | 1.02 n. s. | 20.02 ** | 0.34 n. s. |
| Spelling Treatment Words (Maximum=10) | 1.70 n. s. | 46.37 ** | 1.57 n. s. |

Note. There were 20 students in each treatment group, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the (4th - 5th grade-equivalent) level.

** $p < .01$; * $p < .05$; n. s. indicates that F value is not statistically significant at $p < .05$.

indicate that the mean performance of low (3rd grade-equivalent) and high (4th - 5th grade-equivalent) level readers did not differ statistically ($p > .05$). All participants accurately decoded on average 6 out of 15 misspelled words. An ANOVA applied to error responses in this task revealed that participants mistakenly read on average 4 out of 15 misspelled words as the similarly spelled target words (e.g., mounfain as mountain). Neither the main effects nor the interaction were significant for the erroneous reading of words with subtle misspellings. Mean performance of low and high level readers did not differ statistically across treatment conditions ($p > .05$).

The letter-sound pretest measured participants' knowledge of letter-sound relations. Participants identified sounds of letters in the initial-, medial-, or final-positions in nonwords (e.g., yalk, rupe, bick). Mean performance in Table 3 show that participants accurately identified on average 19 to 20 out of 30 letter sounds, which is 6 to 7 out of 10 letter sounds for each position. An ANOVA was conducted with treatment group (syllable vs. word vs. control), reading level (low vs. high), and letter position (initial vs. medial vs. final) as the independent variables. As evident from Table 4, neither the main effects nor the interaction involving treatment group and reader level was significant. However, the main effect of letter position was significant, $F(2, 36) = 32.33, p < .001$, as well as the interaction between letter position and reading level, $F(2, 36) = 3.30, p < .05$, was significant. The three-way interaction was not significant ($ps > .05$). Post hoc Tukey tests in Table 5 show that readers more accurately identified initial and medial letter-sounds than final letter-sounds. Mean performance as a function of reading level and letter position is reported in Table 5. From means in Table 5, the likely source of interaction is apparent. Low level readers outperformed high level readers in identifying initial letter-

Table 5

Mean Performance and Standard Deviations on Letter-sounds Pretest as a Function of Reading Level and Letter Positions

| Reading Level | Position | | | | | | Tukey Contrast |
|---|----------|---------------|----------|---------------|----------|---------------|-------------------------|
| | Initial | | Medial | | Final | | |
| | <u>M</u> | (<u>SD</u>) | <u>M</u> | (<u>SD</u>) | <u>M</u> | (<u>SD</u>) | |
| Low (3 rd) Readers | 8.36 | (1.81) | 6.80 | (2.17) | 5.26 | (2.06) | I > F I = M M = F |
| High (4 th - 5 th) Readers | 7.56 | (1.43) | 7.06 | (2.39) | 5.93 | (1.92) | I > F I = M M = F |
| Mean | 7.96 | (1.62) | 6.93 | (2.28) | 5.59 | (1.99) | I > F I = M M = F |

Note. There were 30 students reading at the low (3rd grade-equivalent) level and 30 students reading at the high (4th - 5th grade-equivalent) level. There were 30 nonwords in the letter-sound pretest with 10 letters underlined in each of the three positions: initial, medial, and final position. I = Initial letter position; M = Medial letter position; and F = Final letter position.

sounds, whereas high level readers outperformed low level readers in identifying letter-sounds at the other two positions.

The word attack test of the Woodcock Reading Mastery Tests – Revised (Woodcock, 1987) measured participants' phonological recoding skill. Participants were asked to read 45 phonetically regular nonwords (e.g., fay, laip, gouch). Test statistics presented in Table 4 indicated a significant main effect for reading level ($p < .05$), but no significant main effect or interaction involving treatment group ($p > .05$). From means presented in Table 3, it is apparent that high level readers read more nonwords accurately, on average 29 out of 45 nonwords, than low level readers who read on average 24 nonwords. The grade-equivalent scores corresponding to these values are 2.9 for low level readers and 4.2 for high level readers. Thus, the decoding skill of the two levels differed substantially, with low level readers but not high level grade readers decoding nonwords below their grade level.

The word learning task was used to measure several capabilities: reading words, spelling words, and reading nonwords by analogy. The word reading component assessed participants' ability to read 16 regular words (e.g., professor; graduation; comparison). Although students practiced the words over three trials, the measure of word reading was the number of words read correctly on Trial 1. Test statistics on the word reading measure in Table 4 showed a significant main effect of reading level and a significant interaction but no significant main effect for treatment group.

Separate ANOVAs were performed at the two reader levels to pinpoint effects statistically. The ANOVA test statistics for low level readers indicated no significant difference in mean performance of the three groups on reading words, $F(2, 18) = 2.50, p$

> .05. Among high level readers, ANOVA test revealed no significant difference in the mean performance of syllable, word, and control groups on the word reading measure, $F(2, 18) = 1.39, p > .05$. These findings verify that the treatment groups did not differ in reading the words either at the low or high levels.

The significant main effect of reading level in the word reading task is explained by the fact that high level readers on average read more words than low level readers. The significant interaction requires a closer inspection of the means. From Table 3, it is evident that the superiority of high over low readers was somewhat greater for whole word students than for syllable and control students.

The spelling component assessed participants' memory for the spellings of eight words selected from the 16 words they learned to read. The analogy component assessed participants' ability to read nonwords that were spelled analogously to eight real words they had practiced reading (e.g., krofessor derived from professor). Results presented in Table 4 for the spelling task and analogy nonword task indicated significant main effects for reading level ($p < .05$), but no significant main effects or interactions involving treatment group ($p_s > .05$). From means in Table 3, it is apparent that high level readers on average spelled more words and read more nonwords than low level readers.

The spelling treatment words pretest measured participants' memory for spellings of 10 words randomly selected from 25 words to be taught during the last session of treatment. ANOVA test statistics in Table 4 indicated a significant main effect for reading level, but no significant main effect or interaction involving treatment group. From means presented in Table 3, it is apparent that high level readers on average spelled more words

than the low level readers. Groups on average spelled only 1 – 2 words accurately out of a maximum of 10 words.

To summarize, results from the pretests indicated that mean performance of the treatment groups was very similar for naming letters, giving sounds of letters, reading words and nonwords, and spelling familiar words prior to the onset of training. This verifies that the procedure of matching and random assignment yielded groups that did not differ statistically. Performance of participants, however, differed according to reading level. High level readers outperformed low level readers in reading words and nonwords and spelling words, but not in naming letters, giving sounds of letters, or decoding subtle misspellings of real words.

Learning to Read Words During the Syllable and Whole Word Treatments

Students received training in learning to read words with one or another of two instructional approaches, a syllable segmentation procedure, or a whole word reading procedure. Treatment groups participated in syllable segmentation or whole word treatment for four successive sessions of approximately 30 minutes each. They learned to read 100 regularly spelled words taught over four days. The two groups learned to read four sets of 25 specific words, each set during a separate session. In the syllable segmentation condition, participants learned to read words by breaking them into syllables. In the whole word condition, participants learned to read words as wholes rather than as words having syllabic components.

To examine the effectiveness of the two instructional approaches, students' ability to decode the words across the four treatment sessions was compared. The reading level (low vs. high), the treatment group (syllable vs. word), and treatment session (1 vs. 2 vs. 3 vs. 4) were independent variables. The dependent variable consisted of the number of words decoded correctly during the first trial of each learning session. Mean performance and standard deviations of the treatment groups are presented in Table 6 and Figure 1. Test statistics are reported in Table 7.

Test statistics in Table 7 indicate that the main effects for reading level and session were statistically significant ($p < .05$). The main effect for treatment group was not significant ($p > .05$), but an interaction between treatment group and reading level was statistically significant. The significant interaction is depicted in Figure 1. Separate ANOVAs were conducted on scores at each reader level to localize effects statistically.

Table 6

Mean Performance and Standard Deviations Reading Words During Treatment as a Function of Treatment Group and Reading Level

| Reading Level | Treatment Group | | | |
|---|-----------------|-------------|----------|-------------|
| | Syllable | | Word | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Low (3 rd) Level Readers | 18.67 | (3.94) | 15.82 | (5.74) |
| High (4 th - 5 th) Level Readers | 21.32 | (2.79) | 22.57 | (1.73) |

Note. There were 20 students in each treatment condition, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level.

Figure 1. Mean correct during the word reading treatments as a function of treatment and reading level

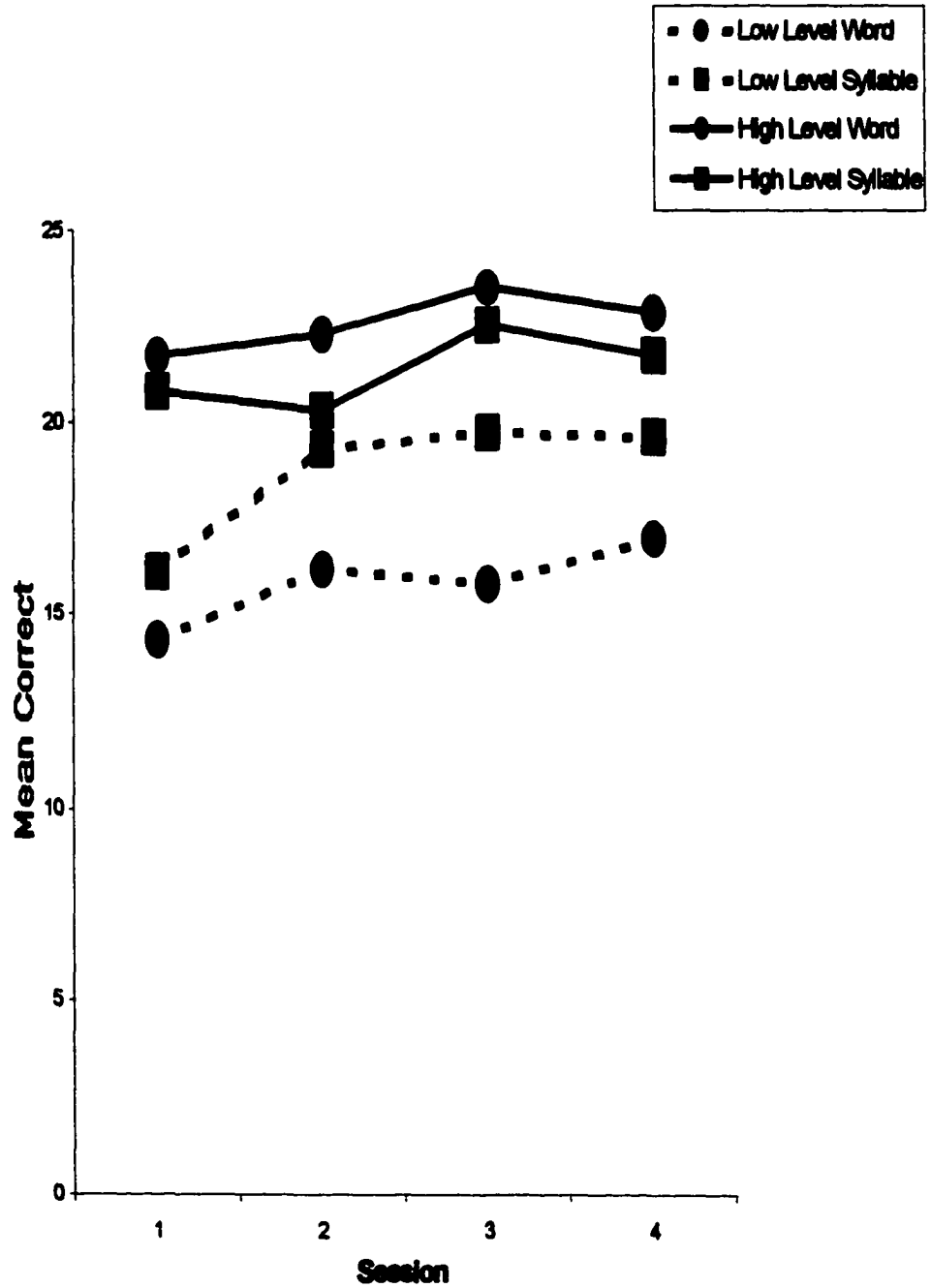


Table 7

ANOVA Test Statistics on Reading Treatment Words as a Function of Reading Level and Treatment Session

| Main Effects & Interactions | Df | Sum of Squares | Mean Square | F Value |
|-----------------------------|----|----------------|-------------|------------|
| Treatment | 1 | 25.60 | 25.60 | 1.75 n.s. |
| Reading Level | 1 | 883.60 | 883.60 | 10.79 * |
| Treatment x Level | 1 | 168.10 | 168.10 | 11.51 * |
| Error (Treatment) | 18 | 262.80 | 14.60 | |
| Session | 3 | 118.10 | 39.36 | 7.76 ** |
| Session x Level | 3 | 40.10 | 13.36 | 2.63 n.s. |
| Error (Session) | 54 | 273.80 | 5.07 | |
| Treatment x Session | 3 | 6.10 | 2.03 | 0.52 n. s. |
| Treatment x Session x Level | 3 | 9.40 | 3.13 | 0.80 n. s. |
| Error (Treatment x Session) | 54 | 210.00 | 3.88 | |

Note. There were 20 students in each treatment group, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level.

** $p < .01$; * $p < .05$; n. s. means F value is not statistically significant at $p < .05$.

At the low (3rd grade-equivalent) reader level, ANOVA statistics indicated significant main effects of treatment, $F(1, 9) = 6.14, p < .05$ and session, $F(3, 27) = 4.41, p < .05$, but no significant interaction involving the two variables, $F(3, 27) = 0.51, p > .05$. From means depicted in Figure 1 for low level readers, it is apparent that syllable students decoded more words than whole word students (see Appendix P). Performance increased over sessions, indicating that both treatments helped students learn to decode new words.

Among high (4th – 5th grade-equivalent) level readers, ANOVA test statistics indicated a significant main effect of treatment $F(1, 9) = 6.73, p < .05$ and session $F(3, 27) = 5.56, p < .01$, but no significant interaction involving the two variables, $F(3, 27) = 0.73, p > .05$. From means illustrated in Figure 1 for high level readers, it is evident that word participants decoded more words than syllable participants. Mean performance of both groups improved slightly over sessions but ceiling effects limited gains.

The significant main effect of reader level reported in Table 7 and displayed in Figure 1 indicated that high level readers accurately decoded more words than low level readers. The significant interaction between treatment and level occurred because the syllable group outperformed the word group at the low level, whereas the reverse occurred at the high level, with the word group decoding more words than the syllable group.

To summarize, participants' ability to read words improved over the course of treatment, with performance higher on later sessions than on earlier sessions. Participants who received syllable training outperformed whole word trained participants at the low reading level. In contrast, whole word trained participants accurately recoded more words than the syllable trained participants at the high reading level.

Effectiveness of Syllable Segmentation Training

Syllable-trained participants' ability to count spoken syllables and identify written syllables in words across the four treatment sessions was examined. Performance of participants was subjected to several ANOVAs with reading level (low vs. high) and treatment session (1 vs. 2 vs. 3 vs. 4) as independent variables. The dependent variable consisted of the number of syllables counted and identified correctly during the first trial of each learning session.

Test statistics for the syllable counting measure in Table 8 indicated a significant main effect for session ($p < .05$), but no significant main effect or interaction involving reader level ($p > .05$). Tukey's comparison revealed that participants counted significantly more syllables during the first, third, and fourth sessions than the second session. Mean performance for counting syllables was 23.55 (Session 1), 22.00 (Session 2), 24.40 (Session 3), and 24.45 (Session 4) out of a maximum of 25 words for each session. Low and high level readers' ability to count syllables across sessions was very similar and did not differ significantly. Mean values reveal that performance of participants was close to ceiling across sessions. Thus, both low (3rd grade-equivalent) and high (4th – 5th grade-equivalent) level readers had little difficulty counting spoken syllables correctly from the start of treatment.

Test statistics for the measure of identifying written syllables to match spoken syllables in Table 8 indicated a significant main effect of session ($p < .05$), but no significant main effect or interaction involving reading level ($p > .05$). Post hoc Tukey tests revealed that readers more accurately identified written syllables during the first, third

Table 8

ANOVA Test Statistics During Syllable Segmentation Training as a Function of Reading Level and Treatment Sessions

| Dependent Measures | Main Effect | Interaction | |
|--|-------------|-------------|------------|
| | Session (S) | Level (L) | S x L |
| | F (3, 54) | F (1, 18) | F (3, 54) |
| Syllable Segmentation (Maximum = 100) | | | |
| Counting Spoken Syllables | 26.16 * | 0.05 n. s. | 0.23 n. s. |
| Identifying Written Syllables | 7.93 * | 0.00 n. s. | 0.01 n. s. |

Note. There were 20 students in the syllable treatment condition, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level. Syllable participants counted and identified syllable within 25 multisyllabic words during each of the four treatment sessions.

* $p < .01$; n. s. means F value is not statistically significant at $p < .05$.

and fourth sessions than during the second session. Means for identifying written syllables were 23.20 (Session 1), 21.55 (Session 2), 23.65 (Session 3), and 22.80 (Session 4) out of a maximum of 25 words for each session. Mean performance of low and high level readers was close to ceiling across treatment sessions. Thus students were able to recognize syllables in written words and to match them to spoken syllables very well from the beginning of treatment. Why performance dropped during session 2 is unclear. Perhaps some of the words in Set 2 proved more difficult.

The syllable segmentation posttest assessed three aspects of participants' performance: their ability to read aloud each word, their ability to analyze each word by saying the separate syllables, and their ability to draw circles around the written forms of syllables they pronounced. The hypothesis tested in this analysis was that participants who received the syllable treatment would outperform participants in the other two groups who did not receive syllable treatment indicating that syllable segmentation training was effective.

Performance of participants on the syllable segmentation task was subjected to several ANOVAs with treatment group (syllable vs. word vs. control) and reading level (low vs. high) as the independent variables, and the syllable segmentation task scores as dependent variables. Mean performance and standard deviations are presented in Table 9 and ANOVA test statistics are presented in Table 10.

Results for accuracy in reading words shown in Table 10 revealed significant main effects of treatment and reader level, and a significant interaction between the two variables (all $p_s < .05$). From Table 9 and Figure 2, it is evident that high level readers read more words than low level readers except in one case involving the syllable

Table 9

**Mean Performance and Standard Deviations on Syllable Segmentation Posttest as a
Function of Treatment and Reading Level**

| Dependent Measures | Treatment | | | | | | Tukey Contrast |
|---|-----------|-------------|----------|-------------|----------|-------------|-------------------|
| | Syllable | | Word | | Control | | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | |
| Reading Words | | | | | | | |
| Low (3 rd) Readers | 9.10 | (1.59) | 5.50 | (2.75) | 5.00 | (2.98) | S>W=C |
| High (4 th - 5 th) Readers | 9.90 | (1.19) | 9.80 | (2.14) | 9.30 | (2.05) | S=W=C |
| Counting Syllables | | | | | | | |
| Low (3 rd) Readers | 10.50 | (1.17) | 8.50 | (2.50) | 5.70 | (3.30) | S>W=C |
| High (4 th - 5 th) Readers | 10.50 | (0.84) | 8.80 | (3.11) | 10.50 | (1.77) | S=W=C |
| Circling Syllables | | | | | | | |
| Low (3 rd) Readers | 10.40 | (1.26) | 7.10 | (1.79) | 5.30 | (2.79) | S>W>C |
| High (4 th - 5 th) Readers | 10.30 | (0.67) | 7.70 | (2.98) | 9.60 | (2.22) | S= W=C |

Note. There were 20 students in each of the three treatment conditions, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level. The maximum score for each of the three components of the syllable segmentation posttest was 12.

S = Syllable group, W = Word group, and C = Control group.

Table 10

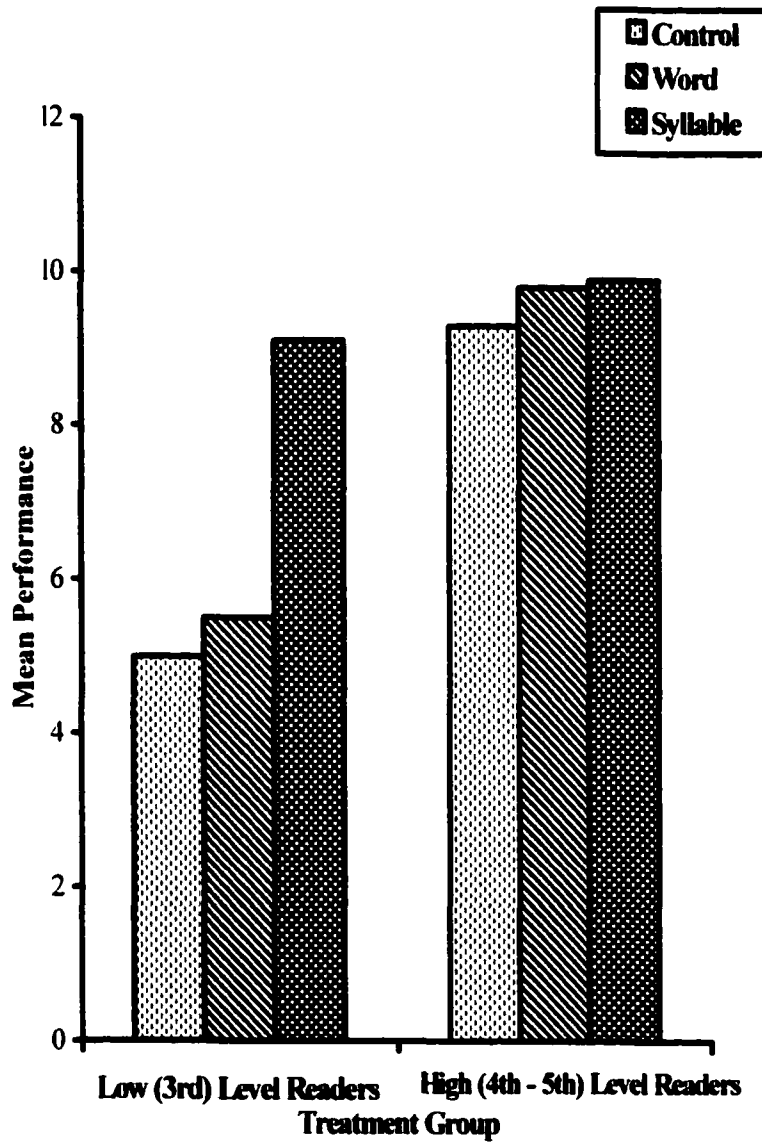
ANOVA Test Statistics on Syllable Segmentation Posttest as a Function of Treatment and Reading Level

| Dependent Measures | Main | Effect | Interaction |
|--------------------|-----------|-----------|---------------|
| | Group | Level | Group x Level |
| | F (2, 36) | F (1, 18) | F (2, 36) |
| Reading Words | 8.86 * | 19.00 ** | 5.90 * |
| Counting Syllables | 6.40 ** | 6.97 * | 7.31 ** |
| Circling Syllables | 12.08 ** | 9.60 * | 5.91 * |

Note. There were 20 students in each of the three treatment conditions, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th – 5th grade-equivalent) level. The maximum score for each of the three components of the syllable posttest was 25.

** $p < .01$; * $p < .05$; n. s. means F value is not statistically significant at $p < .05$.

Figure 2. Mean performance reading words in syllable segmentation posttest as a function of treatment group and reading level



treatment. Moreover, treatment effects appeared only among low level readers. To pinpoint the locus of effects statistically, separate ANOVAs were conducted on the two reader levels.

The ANOVA test conducted on low level readers indicated a significant main effect of treatment group on the word reading measure of the syllable segmentation posttest, $F(2, 18) = 12.29, p < .01$. Tukey's contrasts reported in Table 9 indicated that among low level readers, syllable participants read significantly more words than word and control participants who did not differ. In fact, low level readers in the syllable group on average read almost as many words as did high level readers.

Among high level readers, the ANOVA revealed no significant main effect of treatment group in reading words, $F(2, 18) = 0.36, p > .05$. High level readers' performance was close to ceiling, and equal numbers of words were read across treatment condition, as evident in Figure 2.

Test statistics reported in Table 10, on the syllable counting measure, indicated significant main effects of treatment and reader level and an interaction involving the two variables ($p < .05$). Means presented in Table 9 suggested that high level readers on average counted more syllables in words compared to low level readers. Effectiveness of treatment was limited to lower level readers. Separate ANOVAs were performed at each reader level to locate significant pairwise differences.

The ANOVA test statistics for low level readers revealed a significant main effect of treatment on the syllable counting measure, $F(2, 18) = 10.08, p < .01$. The Tukey pairwise contrasts reported in Table 9 indicated that low level readers receiving the syllable treatment were able to count significantly more syllables than the word and the no-

treatment control participants. The mean performance of word and control participants did not differ.

In the ANOVA of high level readers, the F value was $F(2, 18) = 2.34, p > .05$, indicating that the main effect of treatment group was not significant on the measure of counting syllables. Syllable, word, and control participants were equally skilled at counting syllables in words.

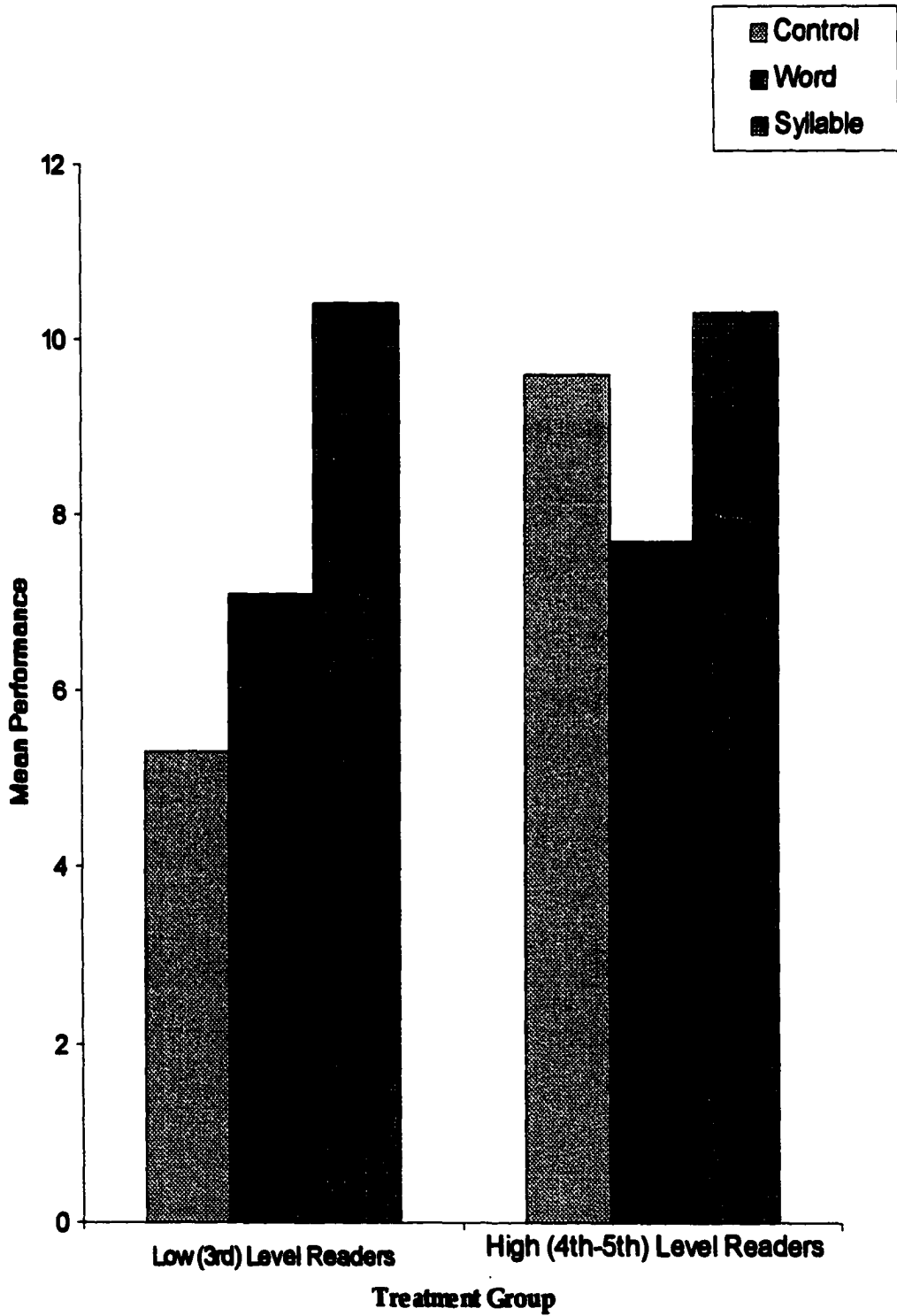
Test statistics reported in Table 10, for circling syllables, indicated significant main effects and an interaction involving treatment group and reader level ($p < .05$). Means reported in Table 9 indicated that high level readers on average circled more syllables in words compared to low level readers, except low syllable readers performed as well as high level readers. Treatment benefited low level readers more than high level readers, especially low syllable readers. To localize these effects, separate ANOVAs were conducted on scores at each reader level.

At the low, ANOVA statistics indicated a significant main effect of treatment groups, $F(2, 18) = 17.48, p < .01$. Results of Tukey's comparisons reported in Table 9 revealed that syllable-trained participants circled significantly more syllables in words than both word-trained and control participants whose performance did not differ.

Among high (4th – 5th grade-equivalent) level readers, ANOVA test results indicated no significant main effect of treatment group, $F(2, 18) = 3.22, p > .05$. Syllable, word, and control participants did not differ statistically in the number of syllables circled.

In sum, these findings show that the syllable treatment was effective in improving low level students' ability to divide words into syllables as well as to read the words before dividing them compared to the word and control groups. In fact low level readers

Figure 3. Mean performance circling syllables in words in the segmentation posttest as a function of treatment group and reading level



in the syllable treatment group performed as well as the high level readers receiving the syllable treatment. Treatment effects were not evident in the comparison of high treatment groups who performed closer to ceiling on the measures. These findings indicate that the syllable treatment benefited disabled readers at the 3rd grade-equivalent level but not those at the 4th – 5th grade-equivalent levels because the latter students already possessed these skills.

Transfer to Reading and Spelling

A major purpose of this study was to determine whether either of the two instructional approaches to word reading, a syllable segmentation method and a whole word method, would exert an impact on disabled readers' ability to remember how to read words, to decode words, and to read words by analogy. To assess effects of instruction, several posttests were administered one day after the end of treatment. The posttests were given in the following order: word learning task (i.e., reading words, spelling words, reading nonwords by analogy); spelling treatment words; subtle misspellings of real words; Woodcock (1987) word attack test; and syllable segmentation task. The general hypotheses tested were that disabled readers who received instruction in decoding syllables in words would outperform disabled readers who received practice reading whole words, and both of these treatment groups would outperform the no-treatment control group on posttest measures of reading and spelling words.

Performance of participants on the various posttest measures was subjected to several ANOVAs. Treatment group (syllable vs. word vs. control) and reading level (low vs. high) were independent variables. Gain scores from pretest to posttest were the dependent variables. All hypothesis were tested at $p < .05$. Tukey's post hoc comparison procedure was conducted to determine whether pairs of means differed statistically. When a significant interaction was detected, ANOVAs were conducted on low (3rd grade-equivalent) and high (4th – 5th grade-equivalent) level readers separately to pinpoint significant pairwise differences. Mean performance on the posttest, mean gains in performance from pretest to posttest, and standard deviations are presented in Table 11. ANOVA test statistics are presented in Table 12.

Table 11

Mean Performance on the Posttests, Standard Deviations, and Mean Gains from Pretest to Posttest as a Function of Treatment Group and Reading Level, with Gains as the Dependent Variable, and Results of Tukey Post Hoc Pairwise Comparisons

| Dependent Measures | Treatment | | | | | |
|---|----------------|-------------|------------|-------------|---------------|-------------|
| | Syllable Group | | Word Group | | Control Group | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Word Learning Task | | | | | | |
| Reading Words (Maximum=16) | | | | | | |
| Low (3rd) Level Readers | | | | | | |
| Posttest Mean | | | | | | |
| Mean Gain | 12.50 | (2.27) | 10.60 | (3.94) | 9.00 | (2.58) |
| High (4th - 5th) Level Readers | | | | | | |
| Posttest Mean | | | | | | |
| Mean Gain | 13.80 | (1.87) | 14.60 | (1.34) | 13.60 | (1.77) |
| | 1.50 | (1.77) | 1.00 | (2.21) | 0.30 | (2.75) |

(table continues)

Table 11. (continued)

| Dependent Measures | Treatment | | |
|---|------------------------|------------------------|------------------------|
| | Syllable Group | Word Group | Control Group |
| | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) |
| Word Learning Task | | | |
| Spelling Words (Maximum = 8) | | | |
| Low (3rd) Level Readers | | | |
| Posttest Mean | 5.50 (1.95) | 2.60 (2.11) | 1.40 (1.07) |
| Mean Gain | 2.50 (3.17) | 0.10 (2.28) | -0.60 (1.34) |
| High (4th - 5th) Level Readers | | | |
| Posttest Mean | 5.40 (2.41) | 5.60 (2.27) | 4.70 (1.94) |
| Mean Gain | 1.50 (3.77) | 1.80 (2.52) | 1.00 (2.16) |

(table continues)

Table 11. (continued)

| Dependent Measures | Treatment | | | Tukey Contrast |
|---|------------------------|------------------------|------------------------|-------------------|
| | Syllable | Word | Control | |
| | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) | |
| Word Learning Task | | | | |
| Reading Analogy Nonwords | | | | |
| (Maximum = 8) | | | | |
| Low (3rd) Readers | | | | |
| Posttest Mean | 6.10 (1.91) | 4.80 (2.39) | 4.30 (2.58) | |
| Mean Gain | 1.80 (2.39) | 0.20 (2.14) | -0.70 (1.63) | |
| High (4th - 5th) Readers | | | | |
| Posttest Mean | 7.10 (0.87) | 6.10 (0.87) | 6.50 (1.26) | |
| Mean Gain | 1.30 (1.15) | -0.70 (1.15) | 0.10 (1.96) | |

(table continues)

Table 11. (continued)

| Dependent Measures | Treatment | | | Tukey Contrast |
|---|------------------------|------------------------|------------------------|-------------------|
| | Syllable | Word | Control | |
| | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) | |
| Spelling Treatment Words | | | | S>W=C |
| (Maximum = 10) | | | | |
| Low (3 rd) Readers | | | | |
| Posttest Mean | 6.90 (1.91) | 3.80 (2.74) | 1.40 (1.77) | |
| Mean Gain | 6.10 (1.91) | 3.20 (2.25) | 1.30 (1.49) | |
| High (4 th - 5 th) Readers | | | | |
| Posttest Mean | 7.20 (2.20) | 5.70 (2.31) | 4.00 (2.82) | |
| Mean Gain | 4.90 (2.96) | 1.90 (1.44) | 1.40 (2.01) | |

(table continues)

Table 11. (continued)

| Dependent Measures | Treatment | | | Tukey Contrast | | | |
|---|-----------|-------------|----------|-------------------|-------------|----------|-------------|
| | Syllable | | Word | | Control | | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Subtle Misspellings of Real Words | | | | | | | S > C |
| (Maximum = 15) | | | | | | | S = W |
| Low (3rd) Level Readers | | | | | | | W = C |
| Posttest Mean | 12.40 | (2.27) | 9.80 | (4.28) | 7.00 | (4.16) | |
| Mean Gain | 6.10 | (2.76) | 4.10 | (2.37) | 1.90 | (3.31) | |
| High (4th - 5th) Level Readers | | | | | | | |
| Posttest Mean | 12.20 | (1.87) | 11.50 | (1.84) | 10.90 | (2.96) | |
| Mean Gain | 5.70 | (4.00) | 4.30 | (1.88) | 3.90 | (4.28) | |

(table continues)

Table 11. (continued)

| Dependent Measures | Treatment | | | Tukey Contrast |
|---|------------------------|------------------------|------------------------|-------------------|
| | Syllable Group | Word Group | Control Group | |
| | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) | <u>M</u> (<u>SD</u>) | |
| Word Attack | | | | |
| (Maximum = 45) | | | | |
| Low (3rd) Readers | | | | S>W=C |
| Posttest Mean | 36.70 (5.59) | 27.90 (9.02) | 26.20 (6.74) | |
| Mean Gain | 14.70 (5.14) | 3.00 (5.63) | 0.50 (5.38) | |
| High (4th - 5th) Readers | | | | S=W=C |
| Posttest Means | 38.10 (5.36) | 36.50 (3.89) | 32.90 (4.81) | |
| Mean Gain | 8.80 (4.47) | 6.70 (3.12) | 3.30 (5.14) | |

Note. There were 20 students in each of the three treatment conditions, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level.

S = Syllable group, W = Word group, and C = Control group.

Table 12

ANOVA Test Statistics on Mean Gains from Pretest to Posttest as a Function of Treatment Group and Reading Level

| Dependent Measures | Main | Effect | Interaction |
|---------------------------------------|------------|------------|---------------|
| | Group | Level | Group x Level |
| | F (2, 36) | F (1, 18) | F (2, 36) |
| Word Learning Task | | | |
| Reading Words (Maximum=16) | 3.19 n. s. | 0.13 n. s. | 0.96 n. s. |
| Spelling Words (Maximum=8) | 2.48 n. s. | 1.09 n. s. | 1.77 n. s. |
| Reading Nonwords (Maximum=8) | 5.11 * | 0.53 n. s. | 0.91 n. s. |
| Spelling Treatment Words (Maximum=10) | 19.53 ** | 2.67 n. s. | 0.65 n. s. |
| Subtle Misspellings (Maximum=15) | 5.68 ** | 0.35 n. s. | 0.98 n. s. |
| Word Attack (Maximum=45) | 19.40 ** | 0.02 n. s. | 5.33 ** |

Note. There were 20 students in each of the three treatment conditions, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th - 5th grade-equivalent) level.

** $p < .01$; * $p < .05$; n. s. means F value is not statistically significant at $p < .05$.

The word learning pretest and posttest assessed participants' ability to learn to read words, spell words, and read nonwords by analogy. Three word reading trials with corrective feedback were given. The reading words component measured participants' ability to read 16 regular words (e.g., industry; cemetery; simplify) on the first trial. The spelling component measured participants' memory for spellings of eight of the 16 words they had practiced reading for three trials. The reading analogy component measured participants' ability to read a list of eight nonwords by analogy to words they had practiced reading (e.g., rindustry derived from industry).

Test statistics presented in Table 12 on the word reading measure indicated no significant main effect or interaction involving group and reader level (all p s > .05). Mean gains are reported in Table 11. In contrast to significant effects of syllable training on word reading ability in the syllable posttest, these findings suggest that teaching disabled readers to read words by segmenting them into syllables did not strengthen their ability to read new multisyllabic words over that of whole word or control groups.

Test statistics for the spelling component indicated that neither the main effect nor the interaction involving treatment group and reading level was significant (all p s > .05). Mean gains are reported in Table 11. These findings indicate that the treatments did not improve students' memory for the spellings of words they practiced reading for three trials. This contrasts with findings in the other spelling posttest (see Table 1) where syllable training helped students remember the spellings of words they learned to read more than whole word training.

Test statistics for reading nonwords by analogy indicated a significant main effect of treatment, but no main effect or interaction involving reading level. Mean gains and

Tukey's tests reported in Table 11 show that syllable participants read significantly more nonwords than the word and control participants. Word and control participants did not differ in their ability to read analogy nonwords. This indicates that syllable training caused readers to pay attention to the full array of letters in nonwords to read them accurately.

The spelling treatment words posttest measured participants' memory for spellings of the same 10 words that were tested on the spelling pretest. These words were drawn from the set of 25 training words that were taught during the final session, so both syllable-trained and whole-word-trained students had learned to read the words but controls had not. Test statistics presented in Table 12 indicated a significant main effect for treatment group, but no significant main effect or interaction involving reader level. From mean gains and Tukey contrasts reported in Table 11, it is apparent that syllable-trained participants spelled significantly more words than word-trained and control participants. Gains in mean performance of word-trained and control participants did not differ. Also gains in mean performance of low and high level readers did not differ statistically. It is noteworthy that exposure to these words during training improved syllable-trained students' ability to spell the words but not whole-word-trained students' even though the two groups received as much exposure to the words. This indicates that in order for the experience of reading words to impact students' ability to spell words, they must focus their attention on letters in the words and how they map onto pronunciations of the words. This is consistent with Ehri's (1992) view of how the spellings of words are retained in memory.

Another pretest and posttest assessed participants' ability to detect subtle misspellings in words (i.e., hospita misspelled [hopsita]; museum misspelled [musuem];

friendly misspelled [friedly]). This was indicated by their correctly decoding the misspelling rather than reading the intended real word. Test statistics reported in Table 12 indicated a significant main effect for treatment group ($p < .01$), but no significant main effect or an interaction involving reader level ($p > .05$). Tukey's post hoc pairwise comparison procedure indicated that syllable participants decoded significantly more misspelled words than the control participants. No other differences were significant.

Analysis of error responses indicated that participants mistakenly read on average 4 out of 15 misspelled words as the intended target words. Chi-square tests indicated that the groups differed in the proportion of students committing this type of error at least once, $\chi^2(2) = 6.19, p < .05$. Sixty-five percent of the syllable-trained participants, 80% of the word-trained participants, and 95% of the control participants erroneously read at least one subtle misspelling of a word as a similarly spelled real word. A Z-test of proportions was conducted to see if the proportions differed significantly between treatment conditions. Results revealed that significantly fewer syllable participants read misspelled words as real words than word or control participants, $Z = 2.38, p < .05$, one-tailed (syllable vs. word) and $Z = 3.68, p < .05$, two-tailed (syllable vs. control). The word and control participants did not differ statistically, $Z = 1.08, p > .05$. These findings reveal that syllable training helped disabled readers detect subtle misspellings of real words. The likely explanation is that it taught them to pay more attention to all the letters in the spellings of words rather than to process only partial letter cues.

The Woodcock (1987) word attack posttest, like the pretest, measured participants' ability to read 45 phonetically regular nonwords (e.g., ift, laip, bufty). Test statistics in Table 12 indicated a significant main effect for treatment group and an

interaction between treatment and reader level ($p < .01$), but no significant main effect involving reader level ($p > .05$). Mean gains presented in Table 11 and Figure 4 show that the treatment groups differed in their ability to read nonwords. To localize these effects, separate ANOVAs were conducted on scores at the two reader levels.

At the low (3rd grade-equivalent) level, ANOVA statistics indicated a significant main effect of treatment group, $F(2, 18) = 21.31, p < .01$. Tukey's test revealed that syllable-trained participants decoded significantly more nonwords than both word-trained and control participants. The mean performance of the word and control groups did not differ. The grade-equivalent scores of low level syllable trained readers improved remarkably from a grade-equivalent 2.9 on the pretest to 12.7 on the posttest.

Among high (4th – 5th grade-equivalent) level readers, ANOVA test results revealed no significant main effect of treatment, $F(2, 18) = 2.98, p > .05$. The three treatment groups made equivalent gains from pretest to posttest in decoding nonwords. The significant interaction is explained by the fact that syllable treatment effects were detected among low level readers but not among high level readers.

To summarize, syllable training proved more effective than whole word training for enhancing disabled readers' word reading and spelling ability. On some reading and spelling outcomes, syllable training boosted the scores of readers at both reading levels. However, on other outcomes the benefits of syllable training were restricted to readers at the lower level. Results summarized in Table 13 report effect sizes produced by the two treatments on the posttest measures. According to Cohen's (1988) rule of thumb, an effect size of 0.20 is considered small, 0.50 is moderate, and 0.80 is large. Effects that proved statistically significant in the ANOVAs reported above are marked with an asterisk.

Figure 4. Mean gain in the word attack test as a function of treatment group and reading level

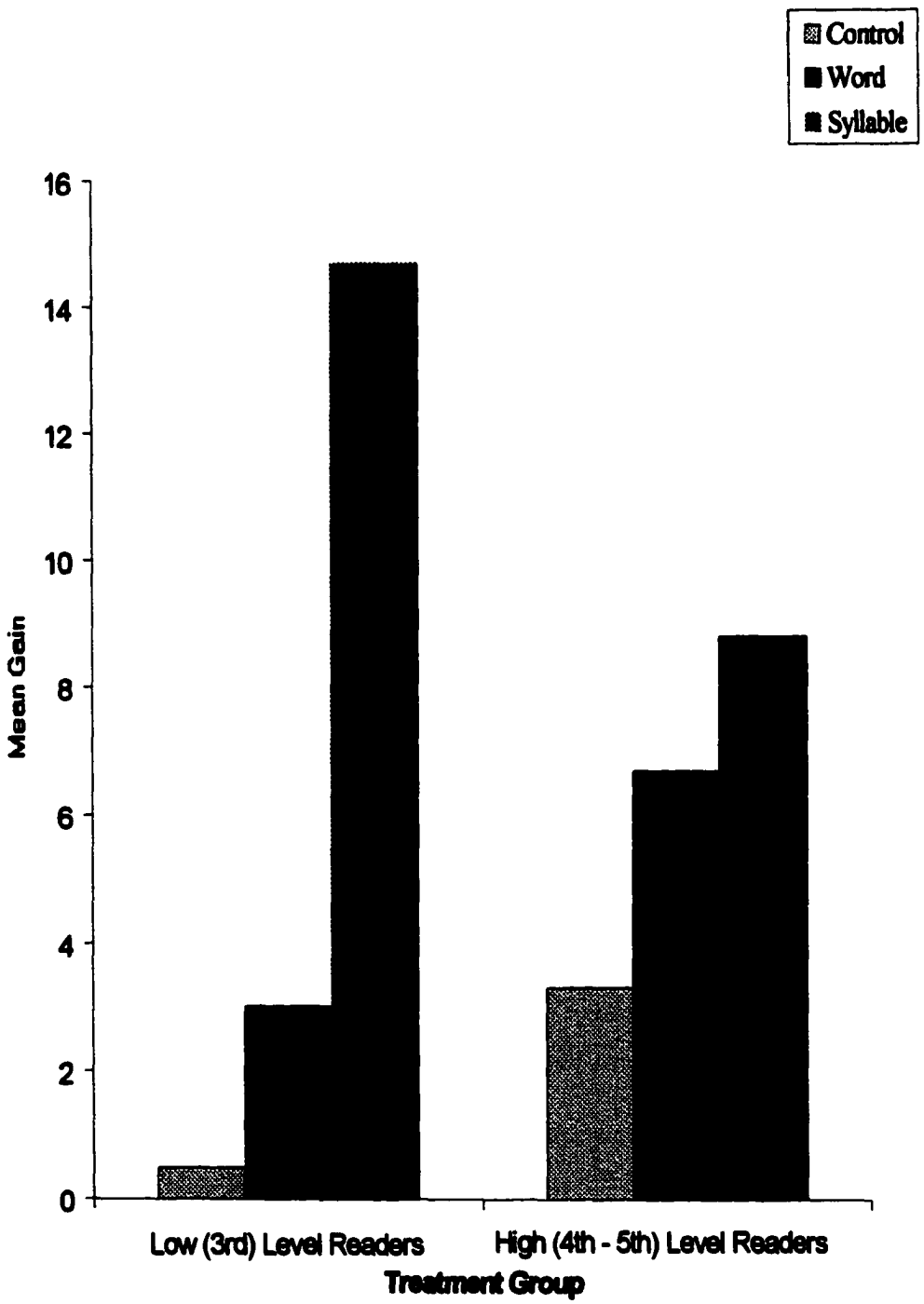


Table 13

Effect Sizes on Posttest Measures and Pretest to Posttest Gains for the Syllable Segmentation and Whole Word Training Groups

| Posttest Measures | Treatment Groups | | | |
|-----------------------------------|------------------|-----------------------------------|-----------------|-----------------------------------|
| | Syllable Group | | Word Group | |
| | 3 rd | 4 th – 5 th | 3 rd | 4 th – 5 th |
| Word Learning Task | | | | |
| Reading Words | 0.97 | 0.53 | 1.01 | 0.28 |
| Spelling Words | 1.38 | 0.16 | 0.39 | 0.34 |
| Reading Analogy Nonwords | 1.24 ** | 0.77 ** | 0.48 | 0.51 |
| Spelling Treatment Words | 2.82 ** | 1.41** | 1.01 | 0.29 |
| Subtle Misspellings of Real Words | 1.37 ** | 0.43** | 0.77 | 0.13 |
| Word Attack (Reading Nonwords) | 2.70 ** | 1.03 | 0.45 | 0.24 |
| Syllable Segmentation | | | | |
| Reading Words | 1.80 * | 0.37 | 0.17 | 0.24 |
| Counting Syllables | 2.15 ** | 0.00 | 0.96 | - 0.69 |
| Circling Syllables | 2.52 ** | 0.48 | 0.78 ** | - 0.73 |

Note. Effect size = \bar{M} (Treatment) minus \bar{M} (Control) / Pooled SD.

** $p < .01$, * $p < .05$ according to results of ANOVA and post hoc pairwise comparisons.

Across both reading levels, syllable training helped students spell familiar words they practiced reading during training more than whole word training or no training. Also syllable training helped students at both levels detect and decode subtle misspellings of real words better than no training; in fact syllable-trained students were deceived less often by these misspellings than whole word and control students, as indicated by their reading errors. In the word learning task, syllable-trained students at both levels accurately read more nonwords by analogy to learned words than both word-trained students and the no-treatment controls.

Significant effects of syllable training were observed among readers at the lower level but not the higher level on the syllable segmentation posttest and the word attack posttest. In the syllable task, syllable-trained students at the low level read more words prior to segmenting them than the other two groups. Also, they counted and circled syllables better than the other two groups. No differences were apparent among high level readers on these measures. On the word attack subtest of the Woodcock (1987), low level readers who received syllable training displayed huge gain compared to groups receiving word training or no training. In fact, their scores jumped from a grade equivalent of 2.9 on the pretest to 12.7 on the posttest. At the higher reading level, gains did not differ among the three groups.

In contrast to the positive effects of syllable training, whole word training made no contribution to students' performance on the word reading and spelling posttests. The only instance where whole word training boosted scores above controls was in the syllable segmentation task where whole-word students circled more syllable segments in words than students receiving no treatment. However, this effect was observed only among 3rd

grade-equivalent level readers. Why this happened is unclear because these students were not taught to circle syllables in words. Also they did not surpass controls in counting syllables. Thus, this is regarded as a chance finding.

Motivation Questionnaire

The motivation questionnaire was given to assess students' attitude and opinion about the effectiveness of the word reading treatments in improving their reading and spelling skills. Syllable- and word-trained participants' responses to the questionnaire items were compared with an ANOVA procedure. The reading level (low vs. high), treatment group (syllable vs. word) and questionnaire item (enjoyment vs. reading utility vs. spelling utility) were independent variables. The dependent variable consisted of participants' responses to the questionnaire items as indicated by the numbers circled on the five-point scale of the questionnaire.

Although treatment participants responded to five items on the motivation questionnaire, only three items were included in the analysis. Items 2 and 4 of the motivation questionnaire assessed participants' attitude and opinion about the usefulness of the treatment approaches for reading words in class or at home. Similarly, items 3 and 5 measured treatment participants' attitude and opinion about the usefulness of the treatment approaches for spelling words in class or at home. Participants' responses to items 2 and 4 were combined into one measure and likewise responses to items 3 and 5 were combined in the analysis. This yielded another independent variable consisting of participants' responses to three items, enjoyment from participating in training, usefulness of training for reading words, and usefulness of training for spelling words. Mean response ratings and standard deviations of the treatment groups are presented in Table 14. Test statistics are reported in Table 15.

Table 14

Mean Performance and Standard Deviations on Motivation Questionnaire as a Function of Treatment Group, Reading Level, and Questionnaire Items

| Dependent Measures | Treatment Group | | | |
|---|-----------------|-------------|----------|-------------|
| | Syllable | | Word | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Question 1 - Enjoyment | | | | |
| Low (3 rd) Level Readers | 5.00 | (0.00) | 4.20 | (0.83) |
| High (4 th - 5 th) Level Readers | 4.00 | (0.70) | 4.60 | (0.54) |
| Question 2 - Usefulness for Reading | | | | |
| Low (3 rd) Level Readers | 4.30 | (0.57) | 4.30 | (0.27) |
| High (4 th - 5 th) Level Readers | 4.30 | (1.44) | 4.00 | (0.50) |
| Question 3 - Usefulness for Spelling | | | | |
| Low (3 rd) Level Readers | 4.40 | (0.65) | 4.00 | (0.61) |
| High (4 th - 5 th) Level Readers | 3.70 | (0.75) | 4.40 | (0.41) |

Note. There were 10 students in each treatment condition, 5 reading at the low (3rd grade-equivalent) level and 5 reading at the high (4th - 5th grade-equivalent) level.

Maximum score = 5 for each question.

Table 15

ANOVA Test Statistics on Motivation Questionnaire as a Function of Treatment, Reading Level, and Questionnaire Items

| Main Effects & Interactions | Df | Sum of Squares | Mean Square | F Value |
|--|-----------|-----------------------|--------------------|----------------|
| Treatment | 1 | 1.66 | 1.66 | 0.03 ns |
| Reading Level | 1 | 0.60 | 0.60 | 0.45 ns |
| Treatment x Level | 1 | 2.01 | 2.01 | 4.06 ns |
| Error (Treatment) | 8 | 3.96 | 0.49 | |
| Question | 2 | 1.10 | 0.55 | 1.94 ns |
| Question x Level | 2 | 7.50 | 3.75 | 0.13 ns |
| Error (Question) | 16 | 4.56 | 0.28 | |
| Treatment x Question | 2 | 0.25 | 0.12 | 0.52 ns |
| Treatment x Question x Level | 2 | 2.05 | 1.02 | 4.18 * |
| Error (Treatment x Question) | 16 | 3.93 | 0.24 | |

Note. There were 10 students in each treatment condition, 5 reading at the low (3rd grade-equivalent) level and 5 reading at the high (4th - 5th grade-equivalent) level.

Maximum score = 5 for each of the three questionnaire items.

* $p < .05$; n. s. means F value is not statistically significant at $p < .05$.

Test statistics in Table 15 revealed a significant three-way interaction involving treatment group, reading level, and questionnaire item ($p < .05$). No main effects or other interactions were statistically significant ($p > .05$). To localize these effects, separate ANOVAs were conducted on scores at low and high reader levels.

The ANOVA test statistics for low level readers revealed no significant main effects of treatment, $F(1, 4) = 2.93$, or questionnaire items, $F(2, 8) = 2.12$, $p > .05$. The interaction between treatment and questionnaire items was also not significant, $F(2, 28) = 2.34$, $p > .05$. From means reported in Table 14, it is apparent that there were no differences in syllable and word participants' judgment regarding the usefulness or enjoyment of word reading treatment.

The ANOVA of high level readers indicated no significant main effects of treatment, $F(1, 4) = 1.42$, $p > .05$ or questionnaire items, $F(2, 8) = 0.43$, $p > .05$. The interaction involving treatment and questionnaire items was also not significant, $F(2, 8) = 2.36$, $p > .05$. Syllable and word participants' attitude and opinion about the usefulness of word reading treatment did not differ significantly. A closer inspection of the means reported in Table 14 reveals a possible explanation for the interaction. High level readers gave somewhat lower ratings involving the usefulness for reading or spelling than the other groups. Low level syllable readers uniformly gave the highest rating for enjoyment.

In sum, students displayed a positive attitude and opinion about the value of the instruction they received, with syllable trained low level readers uniformly judging the treatment to be highly enjoyable, and high level readers rating its utility for reading or spelling somewhat lower than others.

Chapter 6

Discussion

Findings of the present study confirmed some but not all of the hypotheses. Results supported expectations that training disabled readers to segment multisyllabic words into syllables would improve their ability to read words, to decode nonwords, and to spell words when compared to a control group receiving no special training. However, results did not support expectations that training disabled readers to read whole words accurately and rapidly would improve their reading and spelling skills when compared to no-treatment controls. Consistent with hypotheses, syllable training proved more effective than whole word training on some word and nonword reading and spelling outcomes. Sometimes these effects were limited to readers at the lower level. These findings indicate that simply giving disabled readers practice learning to read whole words is not sufficient. They must be required to fully analyze the words as they read them in order for their reading and spelling to benefit. In order to draw general conclusions, it is important to consider these findings in more detail, to evaluate alternative explanations, to compare findings to previous studies, and to consider their implications for theory and practice.

Why was syllable segmentation training more effective than whole word training or no training in benefiting performance on various reading and spelling measures?

The effectiveness of the two word reading treatments was investigated in three primary areas of literacy, reading words, decoding nonwords, and spelling words from memory. Of the two instructional approaches to word reading, syllable segmentation

method was more effective in improving adolescent disabled readers' ability to read and spell words accurately than the whole word method.

Word reading skills were assessed on two word recognition tasks, the syllable segmentation posttest and the word learning task. Syllable participants reading at the 3rd grade-equivalent level outperformed word-trained and no-treatment control participants in their ability to read words in the syllable segmentation task, but they did not differ from the word-trained and no-treatment control participants in their ability to read words on the word learning posttest.

Three literacy posttests assessed the effectiveness of treatments on disabled readers' nonword decoding skills, the Woodcock (1987) word attack test, the subtle misspellings of real words task, and the analogous nonword reading task. Syllable-trained readers accurately decoded more nonwords than the no-treatment control readers on all three nonword decoding measures. Syllable-trained readers outperformed word-trained readers on the Woodcock word attack and the analogous nonword reading task.

Spelling performance was measured with two spelling production tasks. The spelling treatment words posttest was a delayed spelling production task measuring participants' memory for the spellings of words they learned during the syllable or whole word reading treatment. In contrast, control participants had not practiced reading the words. The other spelling task measured participants' ability to recall spellings of words they had just learned during the word learning task. All three groups had practiced these words for three trials. Results showed that syllable participants outperformed word and control participants in their ability to spell treatment words. However, there was no

significant difference between the syllable-trained readers and the word-trained and no-treatment control readers on the other spelling task.

The significant improvement in syllable readers' ability to read words, decode nonwords, and spell familiar words on the posttest literacy measures could be explained with the amalgamation theory of sight word reading (Ehri, 1992). According to this theory, partial alphabetic readers remember how to read words by forming and storing in memory partial connections between some of the letters and sounds in printed words. Partial alphabetic readers, therefore, experience difficulty retrieving complete spellings of words from memory when they have to read and spell words (Ehri & Saltmarsh, 1995). In contrast, the full and consolidated phases involve forming complete connections of letters and sounds in words prior to storing them in memory. Treatment participants in the present study were disabled readers thought to be partial alphabetic readers. Syllable segmentation training produced significant improvement in the reading and spelling performance of these disabled readers by advancing their word recognition skills from the partial alphabetic phase to full or consolidated phases of reading.

Syllable readers in the present study practiced reading multisyllabic words by dividing them into letter-sound clusters. Having to fully analyze words by breaking them into letters and letter clusters forced syllable-trained readers in the partial alphabetic phase to form complete connections between letters and sounds in words and store them in memory. These complete connections were then retrieved from memory and enabled them to read and spell the words more accurately.

The ability to spell and the ability to read are two distinct skills, and ability to read does not guarantee ability to spell. Orthographic and morphological spelling strategies

facilitate development of spelling skills. Recent research studies imply that tasks that require children to attend to the spellings of words by copying the words, spelling aloud the words, or constructing words using letter tiles generally are more effective in developing spelling skills than tasks focused on reading aloud the words. Although syllable participants in the present study were not learning specific spellings strategies during syllable segmentation training, they were attending to the spellings of words by orally segmenting each word into syllables, counting the syllables on their fingers while orally segmenting them, and finger pointing syllables in printed words. This multi-stepped syllable segmentation strategy may have strengthened syllable readers' ability to implicitly use orthographic and morphological information retained in memory to write correct spellings of the words when they were orally dictated.

Compared to the syllable treatment, the whole word treatment was totally ineffective in improving the word reading, nonword reading, and spelling performance of word-trained participants. Word-trained participants practiced reading words as whole words without being taught to fully analyze the alphabetic components of words. As a result, their memory for words appeared to be no better than that of controls.

Why was syllable training more beneficial to low than to high readers on some of the word reading and nonword decoding posttest measures?

Comparison of posttest performance indicated that syllable treatment differentially influenced low and high level readers' ability to read words on the syllable segmentation posttest and to decode nonwords on the Woodcock (1987) word attack posttest. Low (3rd grade-equivalent level) readers in the syllable group accurately read more multisyllabic

words than the word-trained and no-treatment control readers, whereas high (4th – 5th grade-equivalent level) syllable-trained readers did not differ from the word-trained and no-treatment control readers. In fact, low syllable readers' word reading performance on the syllable segmentation task was similar to that of the high level readers, both of which was close to ceiling. Likewise, low syllable-trained readers outperformed the word-trained and no-treatment control readers in their ability to decode nonwords on the Woodcock (1987) word attack posttest, whereas no differences were detected among the high level readers. Readers at the 3rd grade-equivalent level increased their nonword decoding skill from a grade-equivalent level of 2.9 to 12.7 on the word attack test. These findings indicate that a major impact of syllable segmentation training was to improve low level readers' ability to decode nonwords.

An explanation for the fact that the effectiveness of syllable training was limited to low level readers on the word reading measure of the syllable segmentation posttest and the nonword decoding measure of the Woodcock (1987) word attack posttest, can be derived from Chall's (1983) theory of reading acquisition. In her theory, Chall describes Stage 2 as a time of "confirmation, fluency, and ungluing from print". This stage covers grades 2 – 3. Children in this stage utilize their basic decoding skills to read with fluency and speed. They tend to focus their attention on the printed words, usually the most common, high frequency words, to read fluently and rapidly. Low readers in the present study would fall in this stage. In contrast, Stage 3 is a period of "reading to learn the new." This stage begins around grade 4. Children at this stage read printed material to acquire knowledge of the world. They have moved beyond the need to improve their decoding skills. The high level readers in the present study would fall in this stage. This is

indicated by high readers' word reading performance during syllable segmentation training and on various posttest measures. Although high readers accurately decoded many of the multisyllabic words in the present study, they were poor readers, reading below their age appropriate grade level, probably because of underdeveloped vocabulary knowledge.

Readers in the syllable treatment practiced reading words by dividing and blending multi-letter units. Repeated practice attending to words with similar multi-letter patterns improved low level readers' ability to accurately read words over the course of training. Since low readers failed to read many of the treatment words on the first trial of the first training session, they had the opportunity to learn and apply the syllable segmentation strategy to accurately read words on subsequent trials and sessions. The syllable segmentation strategy learned during the initial training session and practiced over the course of training improved low readers' decoding skills and facilitated accurate reading of words on the syllable segmentation posttest and decoding of nonwords in the Woodcock (1987) word attack posttest. Syllable training therefore benefited low readers in Stage 2 of Chall's (1983) theory of reading acquisition to read words on the syllable segmentation task and decode nonwords on the word attack test.

In contrast, high syllable-trained readers accurately read most of the words during treatment and on the syllable segmentation posttest. This suggests that high syllable-trained readers in Stage 3 of Chall's (1983) theory of reading acquisition were "reading to learn the new" so they did not have to rely on a syllabication technique to read words accurately. Most of the nonwords on the Woodcock (1987) word attack pretest and posttest were also decoded accurately therefore benefits from training was not reflected as saliently for high readers as they were for low readers on the pretest to posttest word

attack difference scores. Likewise on the first trial of each of the four training sessions, high level readers on average read 21 – 23 out of 25 words indicating that they did not have to rely on segmentation strategy to accurately read words.

Why was syllable training in the present study more effective in improving disabled readers' performance on various literacy measures than in previous syllabication training studies?

Syllabication, the ability to divide words into pronounceable multi-letter units, is a strategy used by good readers to accurately recognize multiple syllable words. Disabled readers often experience difficulty reading multiple syllable words because of their inadequately developed syllabication skills. Although syllabication is recognized as an important word recognition strategy, few studies have been conducted to examine the effectiveness of syllabication instruction in treating the word recognition deficit of disabled readers (e.g., Levy et al., 1999; Canney & Schreiner, 1976-77; Cunningham et al., 1981; Shefelbine, 1990; Van Daal et al., 1994; Wentink et al., 1997; Wise, 1992). Findings from the few treatment studies investigating the effectiveness of syllabication instruction on the word recognition skills of disabled readers have also remained mixed. Some study findings support syllabication as an instructional strategy for improving word recognition skills of poor readers, while others do not.

Canney and Schreiner (1976-77) examined the effectiveness of rule-oriented syllabication instruction and of phonogram identification strategy to decode multiple syllable words. Second grade students divided into high, average, and low readers were randomly assigned to syllabication, phonogram, and no-treatment control groups.

Treatment participants received ten 25-minute lessons on application of four syllabication rules or use of phonogram patterns (i.e., ing, or, ent) to decode familiar and unfamiliar multiple syllable words. Effect of training was assessed through participants' ability to read 30 multiple syllable words presented in isolation or in sentence context. Analyses of post-treatment word reading performance suggested that neither the syllabication instruction nor the phonogram recognition strategy improved treatment participants' ability to decode multiple syllable words. Compared to the Canney and Schreiner study, the present study produced significant improvement in the reading and spelling skills of disabled readers at the 3rd – 5th grade-equivalent levels, slightly higher than 2nd grade.

The effectiveness of present study over the Canney and Schreiner (1976-77) study may be attributed to the syllabication instruction. Unlike the Canney and Schreiner study where participants learned to decode multiple syllable words by applying four syllabication rules, the present study taught participants to read words by dividing and blending multiletter units in multisyllabic words. Syllable participants were permitted to divide words in alternative ways (e.g., gen-er-a-tion; ge-ne-ra-tion; gen-e-ra-tion). They did not have to apply dictionary-based syllabication rules. Participants were allowed to vary the division of consonants between vowels as long as the vowel nucleus of the syllable was distinguished. Participants were not required to remember theoretical and practical criteria associated with syllabication rules. Rather their focus was on recognizing multisyllabic words by forming and retrieving complete letter-sound connections stored in memory.

The word reading procedure adhered to within the present study also may have contributed to superior word reading, nonword reading, and spelling performance of treatment participants. In their study, Canney and Schreiner (1976-77) treated the word

recognition deficits of children by asking them to read single syllable words, to isolate phonemes associated with a particular graphoneme, and then to transfer the same phonemic values to the graphoneme pattern in an unknown multisyllabic word. Children were told, “if you can read – fun her man – then you can read un der stand” (p. 111). Disabled readers were taught to recognize letter patterns in familiar words and utilize them to read unfamiliar words. Application of four dictionary based syllabication rules was also taught concurrent with the familiar-unfamiliar comparison strategy used to read words. Application of the phonogram identification strategy along with syllabication rules revealed no difference in the word reading skills of treatment participants. This suggests that recognizing and matching common letter clusters in familiar and unfamiliar words and applying dictionary based syllabication rules does not improve disabled readers ability to read multiple syllable words accurately.

The present study, in comparison to the Canney and Schreiner study (1976-77) facilitated disabled readers’ ability to read words through a multi-stepped syllable segmentation procedure. Syllable participants were taught to read words by orally dividing multiple syllable words into syllables, verbally-kinetically matching the sounds of syllables to the corresponding printed letter clusters in words, and then orally blending the letter clusters to pronounce the whole word. This multi-stepped word decoding procedure was used to read 100 treatment words. Each treatment word was analyzed four times. Repeated application of the syllabication strategy to read multiple syllable words may have stimulated treatment participants to attend to all letter clusters in words, and form and store complete letter-sound connections in memory. Storing completely analyzed words in

memory probably facilitated disabled readers' ability to read unfamiliar words and to decode nonwords.

Pre-treatment characteristics of participants also may have contributed towards the effectiveness of the syllabication instruction in this study. Participants selected for treatment were junior high and high school children reading at the 3rd - 5th grade-equivalent levels as determined by scores on the Woodcock (1987) word identification test. As a result, they probably had broader experience with printed words and were better suited for syllabication instruction than 2nd grade readers in the Canney and Schreiner (1976-77) study. Evidence supporting the suitability of the word analyses treatment for partial alphabetic readers can be derived from improved word reading and spelling performance of disabled readers in the present study compared to the Canney and Schreiner readers who demonstrated no gains in their word attack skills.

Why did syllable training fail to impact word reading and spelling performance in the word learning posttest?

The word learning task consisted of three literacy measures, reading words, spelling words, and decoding nonwords. Participants practiced reading 16 words in the word learning task. They then spelled 8 of the 16 multiple syllable words from memory, and decoded 8 nonwords that had been derived from the 16 multiple syllable words learned in the word learning task. Syllable participants accurately decoded more nonwords than the word-trained and the no-treatment control participants, but their performance on the first trial of the word reading task and spelling task did not reflect gains in comparison to the word-trained and no-treatment control participants. Syllable training therefore failed

to produce improvement in the word reading and spelling skills of disabled readers on the word learning task. Three explanations can be provided for the failure of syllable treatment to impact on the word reading and spelling performance of syllable-trained readers in the word learning task.

One explanation can be derived from the difference in the way the word reading tasks were conducted in the word learning and syllable segmentation measures. In the syllable segmentation task, readers were required to read words by segmenting them into syllables. In contrast, in the word learning task, participants were simply asked to read each of the 16 multisyllabic words with no reminder about the segmentation routine. Left to their own devices, syllable participants may not have applied the segmentation routine and may have reverted to whole word processing to read words. The fact that they performed no better than no-treatment controls in reading words in the word learning task supports the idea that syllable analysis was not applied to these words. Reading words as whole words, without direction to analyze letter units in words, probably limited syllable participants' ability to use the phonological and orthographic information stored in memory to accurately read and write out spellings of words. This suggests that having disabled readers practice reading words by segmenting them into syllable is not sufficient for generalization of decoding skills. The syllable segmentation routine may have to be taught as an explicit strategy with the multiple steps verbalized as a routine.

Another explanation for absence of gains in the reading and spelling performance of syllable-trained participants can be derived from the administration procedure of the word learning tasks. Syllable participants learned to analyze multiple syllable words by dividing and blending letter clusters in words during the syllabication treatment. This word

analyses strategy was demonstrated prior to training. Participants were also reminded to use the syllabication strategy to analyze the multiple syllable words on each of the four treatment sessions. Demonstration, practice, and verbal reminder related to syllabication strategy were also included in the syllable segmentation posttest. Demonstration of the syllable segmentation strategy, verbal prompt reminding participants to apply the strategy, and practice using the strategy to read words may have facilitated accurate reading of words on the first trial of each of the four treatment sessions and on the syllable segmentation posttest. In contrast, in the word learning task, treatment participants were asked to read the 16 multiple syllable words, without demonstration of any specific word analyses strategy or verbal instruction suggesting application of specific word analyses strategies. Syllable-trained participants therefore may have failed to use the syllabication strategy to read the words in the word learning task. Failure to generalize the knowledge of syllabication strategy to read unfamiliar words may have limited the impact of training on the word reading and spelling performance of syllable-trained participants.

A final explanation for syllable participants' failure to outperform the word and no-treatment control groups on the reading and spelling measures of the word learning task can be derived from research scientists' views about literacy instruction. Recent research indicates that repeated practice reading isolated words improves children's ability to read words. Reitsma (1983) and Wise (1992) were able to improve the word reading performance of students by providing three to four word reading trials. In contrast, Van Daal et al. (1994) findings indicated that a large number of practice trials is generally required to improve children's ability to accurately read words. Treatment participants in the present study were provided only three practice trials to read the 16

multiple syllable words on the word learning task because on a pilot administration of the word learning task it was evident that three practice trials were sufficient for reading each word accurately. Although three trials may have been sufficient to read words accurately, it may not have been sufficient to form and store complete connections between letters and sounds in words to remember the spellings of words from memory very well.

Significant differences in the spelling performance of treatment groups probably would have been noticed if more practice trials had been given because increased practice would have allowed participants to store in memory more complete letter-sound correspondences for the words studied.

What were the strengths of the present study?

The word reading, nonword decoding, and spelling skills of syllable-trained readers showed significant improvement after training. This suggests that syllabication training was effective in treating the word recognition and spelling deficits of disabled readers. A number of specific features constitute strengths of the syllabication training procedure.

First, syllable instruction was not lengthy. Participants in the present study received four 30-minute individualized lessons (i.e., two hours) on flexible application of the syllabication technique to read 100 multisyllabic words. Other treatment studies have improved the word reading and nonword decoding capabilities of disabled readers with extended syllabication instruction time (e.g., Shefelbine, 1990; Van Daal, 1994; Wentink et al., 1997). For example, Shefelbine (1990) provided 30 10-minute (i.e., five hours) small group syllabic-unit lessons to improve fourth and sixth grade disabled readers' ability to decode polysyllabic words. Similarly, Wentink et al. (1997) trained eight- to twelve-

year-old Dutch poor readers to read pseudowords in 16 individualized training sessions of approximately 30 minutes each (i.e., eight hours). This shows that although the present study required less time than other studies, it produced comparable gains.

Another strength of the present study is related to the type of participants selected for this treatment. Many of the recent treatment studies (e.g., Levy, et al., 1999; Van Daal et al., 1994; Wise, 1992) have focused exclusively on treating the word recognition deficit of children in first and second grades. The present study is among the few experimental studies (e.g., Lovett & Steinbach, 1997; Shefelbine, 1990; Wentink et al., 1997) treating the word recognition deficit of disabled readers in junior high and high school grades. Findings substantiate the effectiveness of the syllable segmentation approach in addressing the word recognition deficits of disabled readers in junior high and high school grades.

The present study, unlike some of the previous treatment studies (e.g., Cunningham, 1976-77; Shefelbine, 1990; Van Daal et al., 1994; Wentink et al., 1997), provided an alternate intervention to one of the control groups. Word participants received four 30-minute whole word reading treatment and practiced reading the same treatment words as the syllable participants. Since word-trained participants had received whole word reading treatment as an alternate intervention, novelty of the experimental intervention could be ruled out as an explanation for improved post-treatment performance of syllable-trained participants. Randomly assigning participants to the treatment condition and providing the control participants with an alternate treatment procedure thus enhanced the internal validity of the experiment.

An additional strength of the present study lies in the use of affordable materials for word reading treatment. The present study treated the word recognition deficit of

disabled readers with a flash card method of word reading. Multiple syllable words printed on index cards were used to provide word analyses treatment. This was an economical and cost-effective treatment procedure compared to computer-assisted instruction included in some treatment studies (e.g., Levy et al., 1999; Van Daal et al., 1994; Wentink et al., 1997; Wise, 1992).

Finally, instruction that focused on teaching disabled readers to read multisyllabic words was a strength. Treatment participants learned to read words that consisted of two to five syllables. Such instruction has greater applicability than the syllabication strategies in previous studies using monosyllabic words (e.g., Levy, et al., 1999; Van Daal et al., 1994; Wise, 1992).

What are the limitations of the present study?

Although the present study produced superior gains in the word reading, nonword decoding, and spelling skills of adolescent disabled readers, the effectiveness of the syllabication instruction in improving the word analyses skills of disabled readers was limited owing to three specific factors within the research design.

One limitation involved the external validity of the study. To find 60 junior high and high school students reading at 3rd – 5th grade-equivalent level on the Woodcock (1987) word identification test, it was necessary to screen 150 students whom teachers indicated had reading problems. Ninety of the 150 students scored either below the 3rd grade-equivalent level or above the 5th grade-equivalent level on the Woodcock word identification test and were excluded. Only 60 students, reading between the 3rd – 5th

grade-equivalent levels on the Woodcock word identification test, qualified for treatment. Thus, the generalizability of findings to other types of poor readers remains to be studied.

Another limitation of the present study relates to the selection of multiple syllable words for word analyses training. The words selected for treatment did not seem to be challenging enough and participants were able to accurately read and define many of the words. The 100 multiple syllable words included in this study were selected from the Basic Elementary Vocabulary: Core Sixth Reader List (Harris & Jacobson, 1972). Words were selected from the 6th grade readability level to ensure that they were slightly above the reading level of adolescents reading at the 3rd – 5th grade-equivalent levels. Analyses of word reading performance during treatment sessions indicated that adolescent disabled readers were able to accurately read most of the treatment words. Word reading performance of high treatment participants was close to ceiling and did not exhibit gains over the course of treatment. Higher level readers on average accurately read 21 – 23 out of 25 words on the first trial of the four treatment sessions. Lower level readers accurately read 15 – 18 words out of 25 words on the first trial of the four treatment sessions. Meanings of most of the treatment words appeared to be familiar to the participants as indicated by their ability to accurately define them. High level readers accurately defined on average 17 out of 25 words. Low level readers accurately defined on average 15 out of 25 words. This suggests that while the basic decoding skills of treatment participants were equivalent to Stage 2 of reading acquisition, their vocabulary knowledge was equivalent to those at higher stages of reading acquisition (see Chall, 1983). Since participants could read many of the words during treatment, repeated practice analyzing words using the syllabication strategy may not have been as beneficial as it would have been had the

treatment words been unfamiliar and challenging. Analyzing unfamiliar and challenging words might have advanced higher level readers' word analytic abilities and benefited their word reading skill more than was observed in the present study.

An additional factor restricting effectiveness of this study is related to the type of material used and the context within which word analyses treatment was provided. Treatment participants in the present study received four 30-minute (i.e., two hours) of individual word analyses training. Since treatment participants were 3rd – 5th grade-equivalent levels readers, the word analyses training was limited to decoding isolated multiple syllable words rather than decoding words in sentences and text passages. Whether word training would transfer to the reading of words in text awaits study.

What are the implications of present findings for instruction, classroom practice, and student learning?

Syllabication instruction in the present study improved word reading, nonword reading, and spelling performance of adolescent students reading at the 3rd - 5th grade-equivalent levels. This suggests that syllabication instruction can be implemented within the developmental reading programs in junior high schools and high schools to strengthen the word reading and spelling capabilities of adolescent disabled readers. Reading teachers could model application of the syllable segmentation strategy to analyze multiple syllable words. Adolescent disabled readers could be taught to recognize letter segments in words and match them with the corresponding letter-sounds through repeated practice reading multiple syllable words with corrective feedback from teachers. This repeated practice analyzing multiple syllable words would facilitate disabled readers' ability to form and

store complete letter-sound connection of words in memory. Knowledge of the syllabication strategy would facilitate disabled readers' ability to read and spell familiar words by retrieving consolidated letter-sound connections of words stored in memory.

Findings from the present study suggested that the basic decoding skill of beginning level readers could be strengthened with syllabication instruction. Syllabication instruction might be introduced in the 3rd grade classrooms to develop and strengthen the basic decoding skills of nondisabled readers. Repeated reading of multiple syllable words, using the analytic syllabication strategy explored in this study, might prepare elementary grade children to recognize unfamiliar words accurately and rapidly, thereby promoting reading and comprehension of familiar text. Syllabication strategy might be used to prepare children in elementary grades to advance them from the partial alphabetic phase to the full and consolidated phases of sight word reading (Ehri, 1992). Syllabication training might also facilitate transition of elementary children from the stage of "confirmation, fluency, and ungluing from print" to the stage of "reading to learn the new" (Chall, 1983).

Effective implementation of syllabication instruction would require that teachers carefully select the multiple syllable words to be used for analyses. The actual school grade, reading capability and vocabulary knowledge of students should be taken into account prior to selecting words for syllabication instruction. Easy words would not stimulate analyses of words and would restrict application of syllabication strategy for accurate reading of unfamiliar words. Ideally, words with three or more syllables should be selected. Words with three or more syllables would be challenging enough and require explicit application of syllabication strategy to analyze and store complete letter-sound connections in memory.

Each treatment participant in the present study received four 30-minute of individualized word reading lessons. Although word reading training, syllable method as well as word method, was provided on a one-on-one basis, reading teachers in elementary, junior high, and high schools could include syllabication instruction as whole class instruction. In the Shefelbine (1990) study, a group of 14 fourth grade and 15 sixth grade disabled readers received 30 10-minute syllabication group instruction. Shefelbine's group training procedure involved presenting unfamiliar multiple syllable words and asking students to identify multi-letter units. Teachers stimulated participants' syllable segmentation and word analyses efforts with modeling of thought processes and verbal prompt. Like the Shefelbine study, the multi-stepped syllable segmentation procedure included in the present study could also be introduced as whole class or small group teacher-directed instruction. Teachers could hold up each word card or write each word on the chalkboard and model the process of segmenting and matching multi-letter units and sounds in words. After initial demonstration, analyses of word components could be encouraged by asking students to respond as a group, by calling on students one at a time, by soliciting response from students who volunteer, or through independent desk work. Whole class or independent syllable segmentation and word analyses practice could be supplemented with teacher supervision, verbal prompts, and corrective feedback.

Treatment participants in the present study practiced application of syllabication strategy by analyzing multiple syllable words presented in isolation. Syllabication instruction, however, could be extended to analyses of multiple syllable words in sentences and text passages. Since reading instruction in junior high and high school grades emphasizes comprehension of printed material, disabled readers could be provided

opportunities to analyze words in content area textbooks and literary materials. Teachers could highlight specific multiple syllable words in text passages or individual sentences and instruct students to use the syllabication strategy to analyze the highlighted words while reading the passages or sentences. Repeated reading of text passages or sentences using syllabication strategy could promote accurate reading of individual words and comprehension of text information.

Findings from the present study indicated that repeated reading of multiple syllable words without having students analyze multi-letter components of words does not improve students' ability to read unfamiliar words. Teachers should emphasize repeated reading of multiple syllable words by encouraging students to locate syllabic units in words and matching and storing all letter-sound connections of words in memory. Students should be encouraged to locate multi-letter units through flexible segmentation and blending of multiple syllable words rather than rigid application of dictionary-based syllabication rules. Teaching students to memorize and apply dictionary-based syllabication rules does not appear to help them form and store complete letter-sound connections of words in memory, or to help them retrieve common multi-letter connections to read unfamiliar words (see Canney & Schreiner, 1976-77; Cunningham et al., 1981). Teachers might have to provide verbal prompts reminding students to use syllabication strategy every time an unfamiliar words is encounter in print. The syllable segmentation routine would have to be taught as an explicit strategy along with practice reading words by segmenting them into syllables.

How could future studies replicate and extend findings from the present study?

The present study examined the effectiveness of two instructional approaches, a syllable method and a whole word reading method on the word read, nonword decoding, and spelling skills of junior high school and high school students reading at the 3rd – 5th grade-equivalent levels. Results indicated that syllable training improved treatment participants' ability to read and spell words. Since syllable training was effective in treating the word reading, nonword reading, and spelling performance of adolescent students reading at the elementary grade levels, the study could be replicated to examine the effectiveness of syllable instruction at elementary grade level with nondisabled readers. Teaching elementary grade nondisabled children to read multisyllabic words may have a bigger payoff than teaching them to read single-syllable words because the majority of the words in English have more than one syllable.

Syllable training in the present study prepared treatment participants to read and spell words presented out of context. Treatment participants' ability to read and spell words was not assessed within the context of a sentence or text passage. Future research could examine the effectiveness of syllabication instruction on the oral text reading and reading comprehension of adolescent students reading at elementary grade-equivalent levels. Adolescent students reading at the 3rd – 5th grade-equivalent levels could be divided into high, average, and low reading level and randomly assigned to three treatment programs, a syllable condition, a read aloud condition, and a no-treatment control condition. Syllable participants could be taught to apply syllabication strategy to analyze multiple syllable words in text passages. Multiple syllable words could be highlighted in text passages and syllable participants could be instructed to apply the syllabication

strategy to read the highlighted words as they read aloud sentences within each text passage. Read aloud participants would read the same highlighted text passages as the syllable participants, but without applying the syllable strategy. The no-treatment control participants could stay in their regular classroom and not receive any treatment. Pretest and posttest literacy measures could include an oral read aloud task and a reading comprehension task. Pretest and posttest data could be analyzed to determine benefits of syllabication strategy on participants' ability to accurately read and comprehend text passages.

Although the present study findings validated the effectiveness of syllabication instruction in treating the word recognition deficit of disabled readers, it did not indicate which aspect of syllabication instruction made it an effective strategy, teaching students to segment spoken and written words into syllables, or applying this strategy in learning to read 100 words. Future research could assess whether segmenting words into syllables or segmenting and reading words are effective in remediating the word reading and spelling skills of disabled readers. Treatment participants could be randomly assigned to three treatment conditions, a syllable segmentation condition, a syllable segmentation plus word reading condition, and a no-treatment control condition. Participants in the syllable segmentation condition could learn to read words by segmenting them into syllables. They could receive one practice trial for reading words by segmenting them into syllables. Participants in the syllable segmentation plus word reading condition could practice reading words by segmenting them into syllables over four to five practice trials. The no-treatment control participants could remain in their regular class and receive no treatment. Post-treatment measures could assess effects of the two treatments on the word reading

and spelling skills of disabled readers. Findings would indicate whether one or both of these approaches improves disabled readers' ability to read and spell words accurately.

All pre- and post-treatment alphabetic processing measures as well as the word analyses training were administered individually. Individualized word analysis training produced noticeable gains in the word reading and spelling performance of syllable treatment participants. However, this one-on-one training program required a distraction free, separate space and an extensive amount of total instructional time. Eight hours of instructional time was expended to treat the word recognition deficit of 40 adolescent disabled readers. Although effective, this type of individualized treatment program may be difficult to implement in educational settings that are challenged with limited availability of space and personnel time. Future studies could explore effectiveness of syllabication instruction in a whole class as well as small group settings, thereby addressing the issue of scarce space and limited personnel in many of the public schools. Perhaps a whole class or small-group "guided discovery" instructional procedure like "reciprocal reaching" (Palincsar & Brown, 1984) or Glass Analysis (Glass & Glass, 1976) could be used to resolve the issue of limited space and time that might be encountered in the process of implementing syllable segmentation strategy.

Appendix A

Informational Letter and Parental Consent Form

To: Parents or Guardians of Students Enrolled in the New York City Public Schools
From: Dr. Linnea C. Ehri, Professor
Alpana Bhattacharya, Research Associate
Re: Invitation to Participate in a Research Project

We are conducting a research study with 12 to 18 year old Junior High and High School students and we are inviting your child to participate in this project. The purpose of our research is to study how adolescents learn to read words and whether learning to read words helps them to spell words accurately. Our research will examine: 1) several reading related capabilities to determine which ones give students difficulty, and 2) whether students' word reading and spelling skills improve when they are given practice reading words. The project has been approved by the New York City Board of Education, the superintendent of your child's school district, as well as your child's principal and teacher.

Each student will be seen from one to six times on the school premises during school hours. Students will work with a graduate student who is a trained teacher. Each session will last up to 45 minutes. During the first session, students' reading and spelling skills will be assessed. During the next four sessions, some students will learn to read a large number of words either by segmenting the words into syllables or by practice to improve their speed. In the final session, students' reading and spelling skills will be assessed again to see whether the training has improved their performance.

We have found that students enjoy the individual attention they receive while participating in the reading and spelling activities, and they look forward to them. Students who complete the training are expected to benefit by improving their reading and spelling skills.

All information on the reading and spelling tasks, even your child's name, will be kept totally confidential. Numbers will be used to identify students participating in this research. Students' responses will not be videotaped or audio taped. All materials related to this research will be securely stored at the Graduate School of the City University of New York. Only the primary researcher will have access to the information.

Participation in this research study is voluntary. Your child can stop participating at any time, and non-participation will not affect academic standing in any way. If you agree to participate, we are willing to share with you any information we obtain about your child on the reading and spelling tasks. When results of the study are analyzed and written up, we will provide a copy of the report to your child's school.

In order for your child to participate in this reading and spelling study, you need to give us written permission by initialing the bottom of this page, completing and signing the attached consent form, and returning them to the research associate.

If you have any questions regarding this research, please feel free to call us. You can reach Dr. Linnea Ehri at (212) 642-2260, or Alpana Bhattacharya at (718) 726-8821. If you have questions about your child's rights as a participant, please contact Ms. Hilry Fisher at (212) 642-2059. Thank you very much for considering this request.

CONSENT TO PARTICIPATE IN THIS RESEARCH STUDY

Please complete, sign, and return this form to the research associate.

Title of Study: The Benefits of Syllable Segmentation and Word Reading Practice for Adolescents with Reading and Spelling Difficulties

**Researchers: Dr. Linnea C. Ehri, Professor
Alpana Bhattacharya, Research Associate**

**Ph.D. Program in Educational Psychology
The Graduate School and University Center of CUNY**

I agree to let my son or daughter _____ (name)

participate in the research project described above. I have read the description of the study and am agreeable to all the terms and conditions.

(Student's Date of Birth)

(Name[s] of Parent[s] or Guardian[s])

(Signature[s] of Parent[s] or Guardian[s]) (Date)

(Signature of Researcher) (Date)

Appendix B

Informational Letter and Participant Assent Form

To: Students Enrolled in the New York City Public Schools

From: Dr. Linnea C. Ehri, Professor
Alpana Bhattacharya, Research Associate

Re: Invitation to Participate in a Research Project

We are conducting a research study with 12 to 18 year old Junior High and High School students and we are inviting you to participate in this project. The purpose of our research is to study how students learn to read words and whether learning to read words helps them to spell words accurately. Our research will examine: 1) several reading related skills to determine which ones give students difficulty, and 2) whether students' reading and spelling skills improve when they are given practice reading words. The project has been approved by the New York City Board of Education, the superintendent of your school district, as well as your principal and teacher.

Each student will be seen from one to six times on the school premises during school hours. Students will work with a graduate student who is a trained teacher. Each session will last up to 45 minutes. During the first session, students' reading and spelling skills will be examined. During the next four sessions, some students will learn to read a large number of words either by segmenting the words into syllables or by practice to improve their speed. In the final session, students' reading and spelling skills will be examined again to see whether the training has improved their performance.

We have found that students enjoy the individual attention they receive while participating in the reading and spelling activities, and they look forward to them. Students who complete the training are expected to benefit by improving their reading and spelling skills.

All information on the reading and spelling tasks, even your name, will be kept totally private. Numbers will be used to identify students participating in this research. Students' responses will not be videotaped or audio taped. All materials related to this research will be securely stored at the Graduate School of the City University of New York. Only the primary researcher will have access to the information.

Participation in this research study is voluntary. You can stop participating at any time, and non-participation will not affect your academic standing. If you agree to participate, we will share with you any information we obtain about your reading and spelling tasks. When results of the study are examined and written up, we will provide a copy of the report to your school.

In order for you to participate in this reading and spelling study, you need to give us written agreement by initialing the bottom of this page, completing and signing the attached assent form, and returning them to the research associate.

If you have any questions regarding this research, please feel free to call us. You can reach Dr. Linnea Ehri at (212) 642-2260, or Alpana Bhattacharya at (718) 726-8821. If you have questions about your rights as a participant, please contact Ms. Hilry Fisher at (212) 642-2059. Thank you very much for considering this request.

Appendix C**Naming Letters****MATERIALS:**

1. Two sets of letters - Set A and B (see Appendix C – Material A)
2. A sheet to cover letters
3. A stop watch
4. Two data sheets - Set A and B (see Appendix C – Material B)

DIRECTIONS:

The participants were told, "I am going to show you some rows of letters to read. I want you to name the letters aloud as quickly as you can but without making any mistakes.

Name each letter loud enough so I can hear you". The experimenter pointed to the cover sheet, ran a finger across from point X to X, and said, "The letters appear in a line beginning here and ending here. When I uncover the letters, begin naming them. Do the best you can." The experimenter uncovered the letters included in Set A, started the stopwatch as the first letter was named, recorded the responses on a data sheet, stopped the stopwatch as the last letter was named, and said, "Very good job. Now I am going to show you a second row of letters. They will be arranged the same way. When I uncover the letters, begin naming them. Do the best you can". The experimenter uncovered letters included in Set B and repeated the procedure of recording responses and letter naming speed as before. The experimenter ended the task by saying, "You did a good job".

PROCEDURES:

The letter naming measure was administered individually to all participants.

1. Participant was provided instruction about the task.

2. Participant was shown five rows of 10 lower-case letters; first Set A, then Set B.
3. Participant was asked to name the letters out loud as quickly and clearly as possible.
4. Participant named the letters aloud as rapidly and as correctly as possible.
5. Participant's oral responses were recorded on a data sheet. A check was placed for correct responses, incorrect responses were recorded with the letter names given, and skipped or missed letters were circled.
6. Participant's letter naming speed was timed with a stopwatch.
7. Participant's effort was acknowledged at the completion of the task through positive verbal reinforcement.

Appendix C – Material A

Naming Letters (Set A)

d v j p n i w z h r

u x g f m y b q k c

s d k z o u t g w f

i c x h r z q b n y

e t m v j i d p r w

Appendix C – Material A

Naming Letters (Set B)

y b x f u h k z q c

w q y s b a v h p c

e r g m k i x t n f

o y r d p v j z t u

k b h s w a g x c q

Appendix C – Material B

Naming Letters (Set A) – Data Sheet

NAME: _____ DATE: _____

TIME (START): _____

TIME (END): _____

d v j p n i w z h r**u x g f m y b q k c****s d k z o u t g w f****i c x h r z q b n y****e t m v j i d p r w**

Appendix C – Material B

Naming Letters (Set B) – Data Sheet

NAME: _____ DATE: _____

TIME (START): _____

TIME (END): _____

y b x f u h k z q c**w q y s b a v h p c****e r g m k i x t n f****o y r d p v j z t u****k b h s w a g x c q**

Appendix D

Decoding Subtle Misspellings of Real Words

MATERIALS:

1. Word cards – Two sets (see Appendix D – Material A)
2. A data sheet – Two sets (see Appendix D – Material B)

DIRECTIONS:

The participants were told, "I am going to show you some cards. I would like you to read each card as it is written. Say what is written out loud clearly so I can hear you. Do you understand what to do? Good. Here is the first one to read". The experimenter began recording responses when the first made-up word was decoded and stopped recording responses when the last word was decoded or if the participant did not want to continue decoding the made-up words any more. The experimenter ended the task by saying, "You read the made-up words quite well. Thank you for trying hard."

PROCEDURES:

The subtle misspelling of real words task was administered individually to all participants.

1. Participant was given instruction for completing the task.
2. Participant was presented with 15 cards, one at a time, containing made-up words that resembled real words except for a single misspelling buried in each.
3. Participant was asked to read each word out loud the way it was written.
4. Participant's responses were recorded on a data sheet. A check was placed if a word was decoded correctly as a made-up word, incorrect responses were be written down verbatim, and words not decoded were recorded as DK (i.e., Don't know).

Appendix D – Material A

Decoding Subtle Misspellings of Real Words- Nonword CardsPretest

people

beakfast

recongize

somethrig

friedly

remenber

mecidine

strekch

pirture

immebiate

teacker

burgny

tonorrow

anpry

mounfain

Posttest

surprise

arithetic

whipser

neighor

trackor

elertric

musuem

ditterent

nunber

winbow

hopsital

pactage

trouple

airphane

wondenful

Appendix D – Material B

Decoding Subtle Misspellings of Real Words – Pretest Data Sheet

NAME: _____

DATE: _____

TIME (Start): _____

TIME (End): _____

| | DECODED PRINT | SIMILAR REAL WORD | NOT READ/ OTHER WORDS |
|---------------|------------------|----------------------|--------------------------|
| 1. people | _____ | _____ | _____ |
| 2. beakfast | _____ | _____ | _____ |
| 3. recongize | _____ | _____ | _____ |
| 4. somethirg | _____ | _____ | _____ |
| 5. friedly | _____ | _____ | _____ |
| 6. remenber | _____ | _____ | _____ |
| 7. mecidine | _____ | _____ | _____ |
| 8. strekch | _____ | _____ | _____ |
| 9. pirture | _____ | _____ | _____ |
| 10. immebiate | _____ | _____ | _____ |
| 11. teacker | _____ | _____ | _____ |
| 12. hurgny | _____ | _____ | _____ |
| 13. tonorrow | _____ | _____ | _____ |
| 14. anpry | _____ | _____ | _____ |
| 15. mounfain | _____ | _____ | _____ |

Appendix D – Material B

Decoding Subtle Misspellings of Real Words – Posttest Data Sheet

NAME: _____

DATE: _____

TIME (Start): _____

TIME (End): _____

| | Decoded print | Similar real word | Not Read/ Other |
|---------------|------------------|----------------------|--------------------|
| 1. surprise | _____ | _____ | _____ |
| 2. arithetic | _____ | _____ | _____ |
| 3. whipser | _____ | _____ | _____ |
| 4. neighor | _____ | _____ | _____ |
| 5. trackor | _____ | _____ | _____ |
| 6. elertric | _____ | _____ | _____ |
| 7. musuem | _____ | _____ | _____ |
| 8. ditterent | _____ | _____ | _____ |
| 9. nunber | _____ | _____ | _____ |
| 10. winbow | _____ | _____ | _____ |
| 11. hopsital | _____ | _____ | _____ |
| 12. pactage | _____ | _____ | _____ |
| 13. trouple | _____ | _____ | _____ |
| 14. airphane | _____ | _____ | _____ |
| 15. wondenful | _____ | _____ | _____ |

Appendix E

Letter-Sounds in Nonwords**MATERIALS:**

1. A list of made-up words (see Appendix E – Material A)
2. A place card
3. A data sheet (see Appendix E – Material B)

DIRECTIONS:

The participants were told, "I am going to show you a list of made-up words. These are not real words, and therefore they do not mean anything. In each word, one or two of the letters will be underlined. I want you to look at each made-up word and pronounce the sound that the underlined letters say in the word. Here is the list. The experimenter presented the list and said, "Begin at the top. Here is a card to help you keep your place as you move down the list. As soon as you can pronounce the underlined letter or letters, say the sound out loud for me. Do the best you can. If you can't pronounce a letter or letters, you can guess or say that you don't know it". The experimenter began recording responses on a data sheet as the first letter was pronounced and stopped recording when the sound for last cluster of letters was provided, or if the participant did not want to continue with the task. The experimenter ended task by saying, "You did very well. Thank you for trying hard."

PROCEDURES:

The letter-sound task was administered individually to all participants.

1. Participant was given directions for completing the task.

2. Participant was shown a list of made-up words with one or two initial, middle, or final letter or letters of each word underlined.
3. Participant was asked to look at each word on the list and pronounce the sound that the underlined letter or letters said in the word.
4. Participant was not provided feedback for incorrect responses or items not attempted.
5. Participant's responses were recorded on a data sheet. A check was placed for correct responses, incorrect responses were recorded with the sound given by participant, and letter-sounds not attempted were recorded as DK (i.e., Don't Know).
6. Participant's effort was acknowledged at the end of the task with positive verbal reinforcement.

Appendix E – Material B

Letter-Sounds in Nonwords

- | | |
|-------------------|----------------------|
| 1. <u>y</u> at | 16. sa <u>i</u> p |
| 2. g <u>a</u> ck | 17. ti <u>z</u> z |
| 3. <u>s</u> hen | 18. ru <u>p</u> e |
| 4. <u>c</u> im | 19. do <u>a</u> k |
| 5. p <u>h</u> up | 20. le <u>a</u> m |
| 6. <u>w</u> ug | 21. ple <u>w</u> |
| 7. <u>t</u> hit | 22. ra <u>ch</u> |
| 8. qu <u>o</u> ck | 23. sib <u>b</u> y |
| 9. <u>h</u> od | 24. pro <u>ck</u> ed |
| 10. <u>g</u> end | 25. sid <u>d</u> le |
| 11. ta <u>ff</u> | 26. pi <u>gh</u> |
| 12. pu <u>x</u> | 27. fre <u>ng</u> |
| 13. bi <u>n</u> e | 28. slo <u>g</u> e |
| 14. te <u>z</u> z | 29. slo <u>y</u> |
| 15. po <u>bb</u> | 30. we <u>a</u> ce |

Appendix E – Material B

Letter-Sounds in Nonwords – Data Sheet

NAME: _____ DATE: _____

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NO RESPONSE | | CORRECT RESPONSE | ERROR RESPONSE | NO RESPONSE |
|-----|---------------------|-------------------|----------------|-----|---------------------|-------------------|----------------|
| 1. | <u>y</u> at | _____ | _____ | 16. | s <u>a</u> ip | _____ | _____ |
| 2. | <u>g</u> ack | _____ | _____ | 17. | t <u>i</u> zz | _____ | _____ |
| 3. | <u>s</u> hen | _____ | _____ | 18. | r <u>u</u> pe | _____ | _____ |
| 4. | <u>c</u> im | _____ | _____ | 19. | d <u>o</u> ak | _____ | _____ |
| 5. | <u>p</u> hup | _____ | _____ | 20. | l <u>e</u> am | _____ | _____ |
| 6. | <u>w</u> ug | _____ | _____ | 21. | pl <u>e</u> w | _____ | _____ |
| 7. | <u>t</u> hit | _____ | _____ | 22. | r <u>a</u> ch | _____ | _____ |
| 8. | <u>q</u> uock | _____ | _____ | 23. | s <u>i</u> bby | _____ | _____ |
| 9. | <u>h</u> od | _____ | _____ | 24. | pr <u>o</u> cked | _____ | _____ |
| 10. | <u>g</u> end | _____ | _____ | 25. | s <u>i</u> ddle | _____ | _____ |
| 11. | <u>t</u> aff | _____ | _____ | 26. | p <u>i</u> gh | _____ | _____ |
| 12. | <u>p</u> ux | _____ | _____ | 27. | f <u>r</u> eng | _____ | _____ |
| 13. | <u>b</u> ine | _____ | _____ | 28. | s <u>l</u> oge | _____ | _____ |
| 14. | <u>t</u> ezz | _____ | _____ | 29. | s <u>l</u> oy | _____ | _____ |
| 15. | <u>p</u> obb | _____ | _____ | 30. | w <u>e</u> ace | _____ | _____ |

Appendix F

Word Identification (Woodcock, 1987)**MATERIALS:**

1. Two graded list of words - Form G and H
2. A place card
3. Data sheets - Form G and H

DIRECTIONS:

The participants were told, "I am going to show you a list of words to read. I would like you to read the words out loud so I can hear you. Do the best you can. If you can't read a word, you can guess or say that you don't know it". The experimenter presented the list of words (Form G) and said, "This is the list of words I would like you to read. Here is a card to help you keep your place as you move down the list and read each word out loud. Are you ready? Good. Let's begin." The experimenter began recording responses on a data sheet as the first word was decoded and stopped recording as the last word was read, or when participants failed to read six items in a row from the list, or if the participant did not want to continue reading the words. A check was placed for words read correctly, words read incorrectly were written down as pronounced by the participants, and words not attempted were recorded as DK (i.e., "Don't know."). When the participants finished reading the words included in Form G, the experimenter presented the second list of words (Form H) and said, "You did a good job reading the words. Now I would like you to read some more words. This is a second list. The words on this list are like the words you just read. I would like you to read these words out loud like you did just now. Do the

best you can". The experimenter then began recording responses as done earlier. At the end of the task, the experimenter said, "You did a good job again. Thank you."

PROCEDURES:

The word identification subtest was administered individually to all participants.

1. Participant was provided direction for completing the task.
2. Participant was presented with a graded list of 106 words, first Form G, then form H.
3. Participant was given a card to help keep his or her place as he or she moved down the list and read each word.
4. Participant was asked to read the words out loud as clearly as possible.
5. Participant read each word out loud or said that he or she did not know the word.
6. Participant was not provided feedback for incorrect responses or for words not attempted.
7. Participant's responses were recorded on a data sheet. A check was placed if a word was read correctly, incorrect responses were written verbatim, and words not read were recorded as DK.
8. Participant's effort was acknowledged at the end of the task through positive verbal reinforcement.

Appendix G

Word Attack (Woodcock, 1987)**MATERIALS:**

1. A list of made-up words - Form G
2. A place card
3. A data sheet

DIRECTIONS:

The participants were told, "I am going to show you some imaginary words. These are not real words and therefore they do not mean anything. I would like you to look at each word and to read them out loud for me. Remember these are not real words but you should read them just as if they were real words. Say the words loud enough so I can hear you. Do the best you can. If you can't read a word, you can guess or say that you don't know it. Here is the list. Here is a card to help you keep your place as you move down the list and read each word. Are you ready? Good. Let's begin". The experimenter began recording responses as the first made-up word was decoded and stopped recording as the last made-up word was read, or when participants fail to read six consecutive items in a row, or if the participant did not want to continue decoding the made-up words. A check was placed for words read correctly, words read incorrectly were written down as pronounced by participants, and words not attempted were recorded as DK (i.e., "Don't know."). The experimenter ended the task by saying, "You did very well. Thank you for trying hard."

PROCEDURES:

The word attack subtest was administered individually to all participants.

- 1. Participant was given instruction for completing the task.**
- 2. Participant was presented with a list of 45 made-up words.**
- 3. Participant was given a card to help keep his or her place as he or she moved down the list and read each word.**
- 4. Participant was advised to read the words out loud as clearly as possible.**
- 5. Participant's responses were recorded on a data sheet. A check was placed if a word was read correctly, incorrect responses were written verbatim, and words that were not decoded were recorded as DK.**
- 6. Participant's effort was acknowledged at the end of the task through positive verbal reinforcement.**

Appendix H

Word Learning Task - Reading Words**MATERIALS:**

1. A set of 16 word cards in three orders - Set A or B (see Appendix H – Material A)
2. Data sheets in three orders - Set A or B (see Appendix H – Material B)

DIRECTIONS:

The participants were told, "Now I am going to show you some words to read. You will practice reading the words several times so you can learn them. I will help you read the words if you cannot read them". The experimenter presented one card at a time and said, "Read the word". Participants decoded each word out loud, one at a time. When the participants read a word correctly, the experimenter acknowledged accurate decoding of the word by saying, "Very good" and presented the next word. If the participants read a word incorrectly or gave no response, the experimenter provided corrective feedback or read the word, saying, "This word says simplify." Now you read it. After the participants responded, the experimenter presented the next word. The experimenter recorded participants' responses, one at a time. Correct responses were recorded with a check mark, incorrect responses were recorded verbatim, and words not attempted were recorded as DK (i.e., "Don't know"). The experimenter ended the task by remarking, "You tried really hard reading those words. Good work".

PROCEDURES:

The words reading measure was individually administered to all participants.

1. Participant was provided instruction for the task.
2. Participant was presented with 16 word cards, one at a time.
3. Participant was asked to read each word out loud, one at a time.
4. Participant's correct responses were acknowledged with positive feedback.
5. Participant's incorrect responses or non-responses were backed with corrective feedback and he or she was instructed to read the word aloud based on feedback.
6. Participant's responses were recorded on a data sheet. A check was placed for words read correctly, incorrect responses were written verbatim, and words not read were noted as DK.
7. Participant's effort was acknowledged at the end of the task with positive verbal reinforcement.

Note: The two set of words were counterbalanced across participants, so half got Set A as pretest and Set B as posttest, and half got Set B as pretest and A as posttest.

Appendix H – Material A

Word Learning Task - Reading Words – Word Cards (Set A)

| <u>First Order</u> | <u>Second Order</u> | <u>Third Order</u> |
|--------------------|---------------------|--------------------|
| generation | competition | professor |
| ceremony | dependent | comparison |
| invention | projector | transit |
| department | transit | simplify |
| similar | graduation | cemetery |
| projector | comparison | dependent |
| transfer | invitation | invention |
| competition | ceremony | transfer |
| graduation | simplify | invitation |
| cemetery | professor | ceremony |
| comparison | generation | projector |
| simplify | similar | graduation |
| invitation | transfer | department |
| transit | invention | generation |
| professor | department | similar |
| dependent | cemetery | competition |

Appendix H – Material A

Word Learning Task - Reading Words – Word Cards (Set B)

| <u>First Order</u> | <u>Second Order</u> | <u>Third Order</u> |
|--------------------|---------------------|--------------------|
| magnificent | discovery | discussion |
| cancellation | exercise | complaint |
| substitute | companion | regular |
| individual | regular | substance |
| register | magnetism | candidate |
| executive | complaint | exercise |
| companion | industry | substitute |
| discovery | cancellation | companion |
| magnetism | substance | industry |
| candidate | discussion | cancellation |
| complaint | magnificent | executive |
| substance | register | magnetism |
| industry | executive | individual |
| regular | substitute | magnetism |
| discussion | individual | register |
| exercise | candidate | discovery |

Appendix H – Material B

Word Learning Task - Reading Words – Data Sheet (Set A - First Order)

NAME: _____

DATE: _____

TRIAL #1

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|----------------|-----------------------------|---------------------------|---------------------|
| 1. generation | _____ | _____ | _____ |
| 2. ceremony | _____ | _____ | _____ |
| 3. invention | _____ | _____ | _____ |
| 4. department | _____ | _____ | _____ |
| 5. similar | _____ | _____ | _____ |
| 6. projector | _____ | _____ | _____ |
| 7. transfer | _____ | _____ | _____ |
| 8. competition | _____ | _____ | _____ |
| 9. graduation | _____ | _____ | _____ |
| 10. cemetery | _____ | _____ | _____ |
| 11. comparison | _____ | _____ | _____ |
| 12. simplify | _____ | _____ | _____ |
| 13. invitation | _____ | _____ | _____ |
| 14. transit | _____ | _____ | _____ |
| 15. professor | _____ | _____ | _____ |
| 16. dependent | _____ | _____ | _____ |

Appendix H – Material B

Word Learning Task - Reading Words – Data Sheet (Set A - Second Order)

NAME: _____

DATE: _____

TRIAL #2

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|-----------------|------------------|----------------|----------|
| 1. professor | _____ | _____ | _____ |
| 2. comparison | _____ | _____ | _____ |
| 3. transit | _____ | _____ | _____ |
| 4. simplify | _____ | _____ | _____ |
| 5. cemetery | _____ | _____ | _____ |
| 6. dependent | _____ | _____ | _____ |
| 7. invention | _____ | _____ | _____ |
| 8. transfer | _____ | _____ | _____ |
| 9. invitation | _____ | _____ | _____ |
| 10. ceremony | _____ | _____ | _____ |
| 11. projector | _____ | _____ | _____ |
| 12. graduation | _____ | _____ | _____ |
| 13. department | _____ | _____ | _____ |
| 14. generation | _____ | _____ | _____ |
| 15. similar | _____ | _____ | _____ |
| 16. competition | _____ | _____ | _____ |

Appendix H – Material B

Word Learning Task - Reading Words – Data Sheet (Set A – Third Order)

NAME: _____

DATE: _____

TRIAL #3

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|----------------|---------------------|-------------------|-------------|
| 1. competition | _____ | _____ | _____ |
| 2. dependent | _____ | _____ | _____ |
| 3. projector | _____ | _____ | _____ |
| 4. transit | _____ | _____ | _____ |
| 5. graduation | _____ | _____ | _____ |
| 6. comparison | _____ | _____ | _____ |
| 7. invitation | _____ | _____ | _____ |
| 8. ceremony | _____ | _____ | _____ |
| 9. simplify | _____ | _____ | _____ |
| 10. professor | _____ | _____ | _____ |
| 11. generation | _____ | _____ | _____ |
| 12. similar | _____ | _____ | _____ |
| 13. transfer | _____ | _____ | _____ |
| 14. invention | _____ | _____ | _____ |
| 15. department | _____ | _____ | _____ |
| 16. cemetery | _____ | _____ | _____ |

Appendix H – Material B

Word Learning Task - Reading Words – Data Sheet (Set B - First Order)

NAME: _____

DATE: _____

TRIAL #1

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|-----------------|---------------------|-------------------|-------------|
| 1. magnificent | _____ | _____ | _____ |
| 2. cancellation | _____ | _____ | _____ |
| 3. substitute | _____ | _____ | _____ |
| 4. individual | _____ | _____ | _____ |
| 5. register | _____ | _____ | _____ |
| 6. executive | _____ | _____ | _____ |
| 7. companion | _____ | _____ | _____ |
| 8. discovery | _____ | _____ | _____ |
| 9. magnetism | _____ | _____ | _____ |
| 10. candidate | _____ | _____ | _____ |
| 11. complaint | _____ | _____ | _____ |
| 12. substance | _____ | _____ | _____ |
| 13. industry | _____ | _____ | _____ |
| 14. regular | _____ | _____ | _____ |
| 15. discussion | _____ | _____ | _____ |
| 16. exercise | _____ | _____ | _____ |

Appendix H – Material B

Word Learning Task - Reading Words – Data Sheet (Set B - Second Order)

NAME: _____

DATE: _____

TRIAL #2

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|-----------------|------------------|----------------|----------|
| 1. discovery | _____ | _____ | _____ |
| 2. exercise | _____ | _____ | _____ |
| 3. companion | _____ | _____ | _____ |
| 4. regular | _____ | _____ | _____ |
| 5. magnetism | _____ | _____ | _____ |
| 6. complaint | _____ | _____ | _____ |
| 7. industry | _____ | _____ | _____ |
| 8. cancellation | _____ | _____ | _____ |
| 9. substance | _____ | _____ | _____ |
| 10. discussion | _____ | _____ | _____ |
| 11. magnificent | _____ | _____ | _____ |
| 12. register | _____ | _____ | _____ |
| 13. executive | _____ | _____ | _____ |
| 14. substitute | _____ | _____ | _____ |
| 15. individual | _____ | _____ | _____ |
| 16. candidate | _____ | _____ | _____ |

Appendix H - Material B

Word Learning Task - Reading Words - Data Sheet (Set B - Third Order)

NAME: _____

DATE: _____

TRIAL #3

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|------------------|---------------------|-------------------|-------------|
| 1. discussion | _____ | _____ | _____ |
| 2. complaint | _____ | _____ | _____ |
| 3. regular | _____ | _____ | _____ |
| 4. substance | _____ | _____ | _____ |
| 5. candidate | _____ | _____ | _____ |
| 6. exercise | _____ | _____ | _____ |
| 7. substitute | _____ | _____ | _____ |
| 8. companion | _____ | _____ | _____ |
| 9. industry | _____ | _____ | _____ |
| 10. cancellation | _____ | _____ | _____ |
| 11. executive | _____ | _____ | _____ |
| 12. magnetism | _____ | _____ | _____ |
| 13. individual | _____ | _____ | _____ |
| 14. magnificent | _____ | _____ | _____ |
| 15. register | _____ | _____ | _____ |
| 16. discovery | _____ | _____ | _____ |

Appendix I

Word Learning Task – Spelling Words**MATERIALS:**

1. A set of eight spelling words - Set A or B (see Appendix I – Material A)
2. Ruled white sheet to write spellings
3. Pencil

DIRECTIONS:

The participants were told, “You did a very good job learning to read the words. Now I would like you to write the words that you learned. I will say each word, you repeat the word after I say it and then write it. Try to remember how the word was spelled and write the spelling on this paper. Here is a pencil. Write your letters clearly so I can read them. If you can’t remember how to spell a word, make a good guess. Do the best you can”. The experimenter read each word out loud, the participants repeated the words, and wrote the spellings. The experimenter reminded the participants to repeat the word if they did not do so by saying, “Please say the word out loud before writing the spelling.” The experimenter acknowledged participants’ efforts by saying, “Thank you for writing the words”.

PROCEDURES:

The spelling measure was individually administered to all participants.

1. Participant was provided directions for the task.
2. Each of the eight words was read out loud by the experimenter.
3. Participant was asked to repeat each word and write its spelling on the piece of paper.
4. Participant’s effort was recognized at the end of the task with positive verbal reinforcement.

Appendix I - Material A

Word Learning Task – Spelling WordsSet A

1. generation
2. ceremony
3. invention
4. department
5. similar
6. projector
7. transfer
8. competition

Set B

1. magnificent
2. cancellation
3. substitute
4. individual
5. register
6. executive
7. companion
8. discovery

Note: The two set of words were counterbalance across participants, so half got Set A as pretest and Set B as posttest, and half got Set B as pretest and A as posttest.

Appendix J

Word Learning Task – Reading Nonwords by Analogy**MATERIALS:**

1. A set of eight made-up words - Set A or B (see Appendix J – Material A)
2. A place card
3. A data sheet - Set A or B (see Appendix J – Material B)

DIRECTIONS:

The participants were told, “You did a fine job remembering the spellings of those words. Now I am going to show you some made-up words that don’t mean anything. I would like you to look at the spellings and try to pronounce the words for me. Say the words loud enough so I can hear you. Do the best you can. If you can’t read a word, you can guess or say you don’t know. This is the list of made-up words. Here is a card to help you keep your place as you move down the list and read each word. Are you ready? Good. Let us begin”. The experimenter began recording responses as the first word was decoded and stopped recording as the last word was read, or if the participant did not want to continue reading the words. A check was placed for words read correctly, words read incorrectly were written down as pronounced by the participants, and words not attempted were recorded as DK (i.e., “Don’t know.”). The experimenter ended the task by remarking, “Good job”.

PROCEDURES:

The analogy nonwords reading measure was individually administered to all participants.

1. Participant was provided directions for the task.
2. Participant was presented with a list of eight made-up words.
3. Participant was given a card to help keep his or her place as he or she moved down the list and read each word.
4. Participant was asked to read the words out loud as clearly as possible.
5. Participant's responses were recorded on a data sheet. A check was placed for made-up words decoded correctly, incorrect responses were written verbatim, and words not attempted were recorded as DK.
6. Participant's effort was recognized at the end of the task with positive verbal reinforcement.

Note: The two set of made-up words were counterbalanced across participants, so half got Set A as pretest and Set B as posttest, and half got Set B as pretest and A as posttest.

Appendix J – Material A

Word Learning Task – Reading Nonwords by Analogy – Nonwords List

| <u>Set A</u> | <u>Set B</u> |
|----------------|---------------|
| 1. traduation | 1. dagnetism |
| 2. pemetry | 2. panditate |
| 3. domparison | 3. vomplaint |
| 4. nimplify | 4. nubstance |
| 5. minvitation | 5. rinduatri |
| 6. bransit | 6. kegar |
| 7. krofessor | 7. miscussion |
| 8. repondent | 8. bexercice |

Appendix J – Material B

Word Learning Task – Reading Nonwords by Analogy – Data Sheet (Set A)

NAME: _____

DATE: _____

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|----------------|-----------------------------|---------------------------|---------------------|
| 1. traduation | _____ | _____ | _____ |
| 2. pemetry | _____ | _____ | _____ |
| 3. domparison | _____ | _____ | _____ |
| 4. nimplify | _____ | _____ | _____ |
| 5. minvitation | _____ | _____ | _____ |
| 6. bransit | _____ | _____ | _____ |
| 7. krofessor | _____ | _____ | _____ |
| 8. repondent | _____ | _____ | _____ |

Appendix J – Material B

Word Learning Task – Reading Nonwords by Analogy – Data Sheet (Set B)

NAME: _____

DATE: _____

TIME (Start): _____

TIME (End): _____

| | CORRECT RESPONSE | ERROR RESPONSE | NOT READ |
|---------------|-----------------------------|---------------------------|---------------------|
| 1. dagnetism | _____ | _____ | _____ |
| 2. pandidate | _____ | _____ | _____ |
| 3. vomplaint | _____ | _____ | _____ |
| 4. nubstance | _____ | _____ | _____ |
| 5. rindustry | _____ | _____ | _____ |
| 6. kegular | _____ | _____ | _____ |
| 7. miscussion | _____ | _____ | _____ |
| 8. bexercice | _____ | _____ | _____ |

Appendix K

Spelling Treatment Words**MATERIALS:**

1. A list of 10 spelling words (see Appendix F – Material A)
2. A ruled white sheet to write spellings
3. A pencil

DIRECTIONS:

The participants were told, "I would like you to write spellings of some words for me. I will say each word, you repeat the word after I say it and then write it. Write the spellings on this piece of paper. Here is a pencil. Write your letters clearly so I can read them. Try to remember how each word is spelt, if you can't remember how to spell a word, make a good guess. Do the best you can". The experimenter read each word out loud, the participants repeated the words, and wrote the spellings. The experimenter reminded the participants to repeat the words if they did not do so by saying, "Please say the word out loud before writing the spelling." The experimenter acknowledged participants' efforts by saying, "Thank you for writing the words".

PROCEDURES:

The spelling training words measure was administered individually to all participants.

1. Participant was provided directions for the task.
2. Each of the 10 words was read out loud by the experimenter.
3. Participant was asked to repeat each word and write its spelling on the ruled paper.
4. Participant's effort was recognized at the end of the task with positive verbal reinforcement.

Appendix K – Material A

Spelling Treatment Words

1. **dictionary**
2. **objection**
3. **attractive**
4. **gossip**
5. **dictator**
6. **cosmetic**
7. **civilization**
8. **maximum**
9. **gorilla**
10. **punctuation**

Appendix L

Syllable Segmentation Training**MATERIALS:**

1. Two sample word cards (see Appendix L - Material A)
2. One hundred word cards (see Appendix L - Material B)
3. A list of meanings (see Appendix L – Material C)
4. A list of syllables (see Appendix L – Material D)
5. Data sheets (see Appendix L - Material E)

TRAINING SESSION 1.**DIRECTIONS:**

The participants were told, “I am going to show you some words that are real and have meanings. I will teach you to read the words using a special method. First, you will look at a whole word printed on an index card and read it out loud. Next, you will explain the meaning of the word you read out loud. Then you will read the word again and say aloud each syllables or beats in the word while counting them on your fingers. You will then tell the number of syllables you counted. After that, you will read the word again and show the syllables in the printed word by pointing with your finger. In the end, you will put together the syllables and read the whole word”.

The experimenter demonstrated the syllable segmentation strategy by saying, “Let me show you how you will read a word and break it into syllables”. The experimenter presented a sample word, finish, printed on an index card and said, “Here is a word. First, I will read the whole word out loud, finish. Then I will explain the meaning of the word.

Finish means ‘to complete a job.’ Next, I will say aloud the syllables and count them on my fingers, **fin – ish**”. The experimenter said aloud each syllable and raised one finger at a time to count the syllables. The experimenter held up two fingers and said, “There are two syllables in the word **finish**. Let me read the word again, **finish**. Now let me look at the word, say each syllable, and find the letters that match up to the syllables in the word”. The experimenter looked at the word, said aloud each syllable, and used the thumbs to show the letters that spelled each syllable in the word printed on the index card, **fin - ish**. “Finally, I will put the syllables together and read the whole word **finish**.”

The experimenter explained the correct way of segmenting words by saying, “First, every syllable has a vowel in it. You will hear one and only one vowel sound in every syllable. Do you know what a vowel is? Vowels are usually spelled with the letters A, E, I, O, U, Y or certain combinations of these letters, like EA together or EE together, or AI together. Notice that in the word **finish** there is one vowel in each syllable, /i/ in **fin** and /i/ in **ish**. Second, each letter can go in only one syllable. You can’t put the same letter in two different syllables. I can’t break the word **finish** as **fin – nish**. I have to put the letter N in one syllable only, **fin - ish**. The letter N went into the first syllable, **fin**, so it cannot be in the second syllable, **ish**. Finally, the sounds in the syllables should be as close as possible to sounds in the whole word. Notice that I said **fin – ish** because I heard **fin** and **ish** in the word **fin – ish**. I didn’t say **fine – ish** because I did not hear **fine** and **ish** in **finish**. I didn’t say **fin – ush** because I did not hear **fin** and **ush** in **finish**. I pronounced the sounds in the syllables to be as close as possible to sounds I heard in the word.”

The experimenter analyzed another word to demonstrate the syllable segmentation strategy. The experimenter presented an index card and said, “Watch me analyze another

word using the special method I just taught you. This word is violinist. Violinist is 'a person who plays music on the violin'. I will break violinist into its syllables and count them on my fingers, vi - o - lin - ist". The experimenter said aloud each syllable and raised one finger at a time to count them. The experimenter raised four fingers and said, "Violinist has four syllables. Now I will look at the word, violinist, printed on this card, say each syllable, and match the sound of each syllable to the letters in the spelling of the word, vi - o - lin - ist". Experimenter used the thumbs to expose spellings of each syllable and matched them to the pronounced sounds. "Notice how each beat has a vowel, how each letter goes into one syllable only, and how the sounds in the syllables match the letters in the printed whole word. This is how I would like you to practice reading several words. Your job is to say the word, explain its meaning, break the word into syllables, count the syllables, match the sounds of the syllables to their spellings in the word, and read the whole word by putting together the syllables. Do you understand what to do? All right."

TRAINING SESSION I - TRIAL 1

The experimenter began the first trial by saying, "I am going to show you some words. You will practice reading the words several times using the method you just learned. If you can't read a word, explain its meaning, break the word into syllables, match the letters and sounds of the syllables, or put the syllables together to read the whole word, I will help you. Let's begin".

First, the experimenter presented an index card with the word digit printed on it and said, "Read the word". When the participant read the word correctly, the experimenter

checked off the correct response on the data sheet and acknowledged the participant's effort by saying, "Very good." If, on the other hand, the participant read the word incorrectly or failed to read the word, the experimenter recorded the incorrect response verbatim or the non-response as DK ("Don't know.") and provided corrective feedback by saying, "This word is digit. Now you read it". The participant practiced reading the word as corrected by the experimenter and continued to do so until he or she provided the correct response. The experimenter provided feedback as long as the participant required practice reading the word.

Next, the experimenter asked the participant to explain the meaning of the word digit by saying, "Do you know what the word digit means?" If the participant said, "Yes", the experimenter said, "Tell me its meaning." An answer similar to, Digit means 'any number from zero to nine' was accepted and recorded as a correct response. If the participant said, "No", the experimenter recorded the response as DK and gave the meaning of the word.

The participant was then told to read the word digit again, break it into syllables, and count the syllables. If the participant divided the word as, di - git or dig - it, and said that there were two syllables, it was recorded as a correct response. If the participant divided the word as, d - ig - it, and said that there were three syllables, the experimenter recorded the incorrect response and modeled the correct way of segmenting and counting the syllable. The experimenter said, "Listen to me say the whole word carefully. The word is digit". The experimenter then said aloud the syllable sounds, counted them on the fingers, held up two fingers, and said, "There are two syllables in the word digit, di - git. Now you copy me and do it just like that". The participant then practiced segmenting and

counting syllables as modeled by the experimenter and continued to do so until he or she was able to provide accurate response. The experimenter provided feedback as long as the participant practiced mastering the accurate way of segmenting and counting the syllables.

The participant was then asked to match the sounds of the orally pronounced syllables with the spellings in the printed word. The participant had to use his or her thumbs to expose di or dig and git or it in the printed word digit and match it with the pronounced sounds of the syllables. Either of the two ways of matching sounds and letters of the syllables was accepted and recorded as a correct response. If, on the other hand, the participant matched the sounds and letters as, di-gi-t or di-gi-t, or did not know how to match the sounds and spellings of syllables, the experimenter recorded the incorrect response or the non-response as DK and modeled the correct way of matching the sounds and spellings of syllables. The experimenter said, "Watch me say the syllables and find their spellings". The experimenter used the thumbs to expose di and git in the printed word digit and match it with the pronounced sounds of the syllables. The participant was then told, "You copy me and do just like that". The participant continued practicing the appropriate way of matching the sounds and spellings of syllables, and the experimenter provided feedback until an accurate response was elicited.

Finally, the participant was told, "Now read the spelling beats together to say the whole word". If the participant put together the syllables, di-git or dig-it, and read them as a digit, the experimenter recorded the response with a check mark to indicate a correct response and said, "You did a very good job analyzing the syllables in the word. Let's try the next word". If, on the other hand, the participant misread the word or did not

read the word, the experimenter recorded the incorrect response verbatim or recorded DK for no response, and provided corrective feedback by saying, "The word is Digit. Now you read it". The participant practiced combining the syllables and reading the whole word until he or she pronounced the word accurately. The experimenter provided corrective feedback until an accurate response was elicited. The participant was then told, "You tried hard reading the word. Let's read another word." The above described procedure of monitoring performance, providing corrective feedback, demonstrating syllable segmentation strategy, and recording responses was adhered to during Trial 1 of Session 1 for each of the 25 words practiced by the participants.

TRAINING SESSION 1 - TRIALS 2 - 4

During Trials 2, 3, and 4 of Session 1, participants were told, "You did a good job reading the word you just finished. Now, I am going to show you the words again, and I would like you to read them aloud twice, one after the other, but without explaining the meanings of the words. If you cannot read any word, divide the word into syllables, count the syllables, or put together the syllables to read the whole word I will help you. After I show you the correct way of reading the word, or breaking the word into syllables, or counting the syllables, or putting together the syllable to read the whole word, you will practice reading the word like I did. Do you understand? Very good. Here is the first word". The procedure of monitoring performance, providing corrective feedback, and recording responses described during Trial 1 was also implemented for Trials 2, 3, and 4 of the Session 1. At the end of Session 1, participants were told, "You did very well

learning to read those words and dividing them into their syllables. Thank you for trying hard”.

TRAINING SESSION 2 AND TRAINING SESSION 3.

DIRECTIONS:

Participants were told, “Remember how you learned to read words and break them into their syllables the other day? Well, we are going to do the same thing today so that you will get some more practice using the special method you learned the other day. I will show you some new words. I want you to read the new words and divide them into syllables. If you cannot read a word, do not know its meaning, have difficulty dividing and count the syllables, or cannot match the letters and sounds of the syllables, I will help you. Are you ready? Good. Let’s begin”. The procedure used for monitoring performance, providing corrective feedback, demonstrating syllable segmentation strategy, and recording responses during Session 1 was also included in Sessions 2 and 3 of training. At the end of Session 2 and Session 3, participants were told, “You did very well learning to read those words and dividing them into their syllables. Thank you for trying hard”.

TRAINING SESSION 4

DIRECTIONS:

Before beginning Session 4 of syllable training, participants were told, “You did a very good job reading and dividing the syllables of different words during the last three sessions. Today, I would like you to read some more new words and learn to divide them into their syllables using the special method you have practiced before. Do the best you

can. If you cannot read a word, do not know its meaning, cannot divide it into syllables, or cannot match the letters and sounds of the syllables, I will help you. Do you understand? Good". The procedure for monitoring performance, providing corrective feedback, demonstrating syllable segmentation strategy, and recording responses included in Sessions 2 and 3 was also repeated during Session 4. At the end of Session 4, participants were told, "You did very well learning to read those words and dividing them into their syllables. Thank you for trying hard".

PROCEDURE:

The syllable segmentation training was provided individually to all participants during Trials 1 – 4 of Sessions 1 – 4.

1. Participant was provided explanation and shown the process of reading and analyzing words using the syllable segmentation method at the start of Session 1.
2. Participant was provided instruction for reading and analyzing words at the start of each training session.
3. Participant was presented with 25 new words printed on index cards, one at a time, during each training session.
4. Participant read aloud 25 new words, presented in two different order, during Trials 1 – 4 of each training session.
5. Participant was provided corrective feedback for words read incorrectly or not attempted during Trials 1 – 4 of each training session.
6. Participant explained the meanings of each of the 25 words, one at a time, during Trial 1 of each training session.

7. Participant was provided corrective feedback for incorrect explanations or for words not explained during Trial 1 of each training session.
8. Participant segmented and counted syllables for each of the 25 words, one at a time, during Trials 1 – 4 of each training session.
9. Participant was provided explanation and shown the correct way of segmenting and counting syllables when words were segmented inaccurately or not attempted during Trials 1 – 4 of each training session.
10. Participant matched the sounds and spellings of syllables for each of the 25 words, one at a time, during Trials 1 – 4 of each training session.
11. Participant was provided explanation and shown the correct way of matching the sounds and spellings of syllables when an incorrect response was provided or no-response was elicited during Trials 1 – 4 of each training session.
12. Participant read each of the 25 words, one at a time, by combining the syllables during Trials 1 – 4 of each training session.
13. Participant was provided corrective feedback for words read incorrectly or not attempted during Trials 1 – 4 of each training session.
14. Participant's responses were recorded on the data sheets. Correctly decoded words were recorded with a check mark, incorrectly decoded words, as well as correct and incorrect segmentation of syllables in words, were recorded verbatim, and non-responses were recorded as DK during Trials 1 – 4 of each training session.
15. Participant was provided positive verbal reinforcement for his or her effort at reading and analyzing each of the 25 words at the end of each training session.

Appendix L – Material A

Sample Word Cards

finish

violinist

Appendix L – Material B

Training Words - Training Session 1

The following 25 words were read during Session 1 of the syllable segmentation and whole word training.

| | | |
|-------------------|-------------------|---------------------|
| digit | welfare | senator |
| poverty | victim | mental |
| congress | mustard | congratulate |
| utensil | democratic | conference |
| microphone | testimony | binoculars |
| walnut | cavity | power |
| notify | vanilla | pistol |
| token | cathedral | visual |
| sacrifice | | |

Appendix L – Material B

Training Words - Training Session 2

The following 25 words were read during Session 2 of the syllable segmentation and whole word training.

| | | |
|---------------------|-----------------------|-------------------|
| reduce | communication | burglar |
| document | constitutional | target |
| multiply | commercial | percentage |
| tobacco | portable | vertical |
| molecule | surrender | capacity |
| modify | violet | memorial |
| violence | maintenance | population |
| metropolitan | damage | personal |
| federal | | |

Appendix L – Material B

Training Words - Training Session 3

The following 25 words were read during Session 3 of the syllable segmentation and whole word training.

| | | |
|---------------------|--------------------|-----------------|
| summary | verdict | positive |
| veteran | calculation | fantasy |
| surplus | conclude | paradise |
| walrus | robbery | major |
| construction | category | poetry |
| secretary | corporation | politics |
| location | domestic | combine |
| magical | comment | piggy |
| conductor | | |

Appendix L – Material B

Training Words - Training Session 4

The following 25 words were read during Session 4 of the syllable segmentation and whole word training.

| | | |
|---------------------|-----------------------|---------------------|
| invisible | destructive | supervision |
| contribution | dictionary | subject |
| formula | gossip | transformer |
| punctuation | compliment | objection |
| civilization | gorilla | committee |
| attractive | prediction | contradict |
| dictator | transportation | confidential |
| maximum | subtraction | cosmetic |
| instructor | | |

Appendix L – Material C

Meanings of Training Words - Sessions 1 - 4

Session 1: The following definitions were considered accurate and acceptable explanation of each of the 25 words read during Session 1 of the syllable segmentation training and whole word training.

1. **digit** - any number from 0 through 9; a numeral.
2. **welfare** — well being; aid by government agencies for poor.
3. **senator** - a member of a senate.
4. **poverty** – not having enough; condition of being poor.
5. **victim** - some one or something killed, hurt, or destroyed.
6. **mental** – having an illness of the mind, in the mind.
7. **congress** – a meeting; a group of elected officials in the US government that makes the law.
8. **mustard** – a dark yellow paste used as seasoning; a plant with yellow flowers and round seeds.
9. **congratulate** – to tell a person that one is happy for his or her success.
10. **utensil** – a container, tool (i.e., pots and pans), etc. used for a special purpose.
11. **democratic** – supporting democracy, treating people of all classes in the same way.
12. **conference** – a meeting of people to discuss something.
13. **microphone** – an electronic device for picking up sounds that is to make stronger or sent over long distance.
14. **testimony** – a statement made by a person who testifies under oath in a court, or a declaration.

15. **binoculars** – a pair of small telescope.
16. **walnut** – a round nut with a hard shell; wrinkled hard shell and a seed that is eaten.
17. **cavity** – a hole or hollow place; a hole in a tooth caused by decay.
18. **power** – fine particles like dust, made by crushing or grinding.
19. **notify** – to inform, to give notice, to let know.
20. **vanilla** - a flavoring made from the pods of certain tropical orchids.
21. **pistol** – a small gun that can be held with one hand.
22. **token** – a sign or symbol, souvenir, metal used in place of money.
23. **cathedral** – any large, important church.
24. **visual** – having to do with sight, used in seeing, able to be seen.
25. **sacrifice** – the act of giving up one thing for some thing else; offering some thing.

Session 2: The following definitions were considered accurate and acceptable explanation of each of the 25 words read during Session 2 of the syllable segmentation training and whole word training.

1. **reduce** –To make smaller; to decrease; to lower.
2. **communication** – message; a way of communicating (e.g., letter).
3. **burglar** – a person who breaks into a building to steal.
4. **document** – any thing printed or written used to prove something (e.g., birth certificate).
5. **constitutional** – having to do with laws or rules of a government.
6. **target** – a thing aimed at (e.g., arrow); a goal or an objective.
7. **multiply** – to become more; to grow; to increase.

8. **commercial** – a paid advertisement on radio or television; having to do with a trade.
9. **percentage** – a certain part or amount in every hundred; part or portion.
10. **tobacco** – dried leaves of a plant prepared for smoking or chewing.
11. **portable** – able to be carried; easily carried.
12. **vertical** – straight up and down; perpendicular line.
13. **molecule** – a very small piece or particle.
14. **surrender** – to give oneself up (e.g., criminal); let go off; to give into.
15. **capacity** – room for holding, the ability to learn, the amount of space.
16. **modify** - to make a small change.
17. **violet** – a small plant with white, blue, red, and yellow flowers; bluish-purple color.
18. **memorial** – held or done in memory of some person or event.
19. **violence** – force used to cause injury; damage; harm done.
20. **maintenance** – up keep or support of a building; a means of support.
21. **population** – total number of in a country, city, etc.
22. **metropolitan** – any large or important city and its suburbs.
23. **damage** – injury or harm to a person or thing.
24. **personal** – of one's own , private , individual , done by oneself.
25. **federal** – a union of states having a central government.

Session 3: The following definitions were considered accurate and acceptable explanation of each of the 25 words read during Session 3 of the syllable segmentation training and whole word training.

1. **summary** – a brief report or statement of main points in a few words.

2. **verdict** – decision or opinion reached by a jury in a law case.
3. **positive** – sure of oneself, confident, definite, answering “YES”.
4. **veteran** – having had long experience in some work; a person who has served in the armed forces.
5. **calculation** – answer found by using mathematics, computing.
6. **fantasy** – imagination, story that is unreal.
7. **surplus** – amount left over , excess , more than what needed.
8. **conclude** – to come or bring to an end.
9. **paradise** – any place that is beautiful or of great happiness.
10. **walrus** – a large sea animal like the seal.
11. **robbery** – theft, the act of robbing.
12. **major** – greater in size, important.
13. **construction** – put together, building a thing, structure.
14. **category** – class, group, a division of main subject.
15. **poetry** – poems as a group , rhythms , feelings , imagination in poem.
16. **secretary** – a person who works for a company or for a person; does filing, typing, or makes phone calls.
17. **corporation** – business, or a city unit with power.
18. **politics** – science of government, use scheme, or plan to get power.
19. **location** – site, place where something is, or will be.
20. **domestic** – having to do with home or family, not wild, tame.
21. **combine** – to join, bring together, unite.
22. **magical** – like magic, mysterious.

23. **comment** – a remark, note that explains, or gives an opinion, talk, or a gossip.

24. **piggy** – a small pig.

25. **conductor** – director, person in charge of (e.g., train , bus etc.).

Session 4: The following definitions were considered accurate and acceptable explanation for each of the 25 words read during Session 4 of the syllable training and whole word training.

1. **invisible** – not to be seen.
2. **destructive** – likely to break up, tear down, or spoil.
3. **supervision** – direction or management.
4. **contribution** – to give money, to bring about something.
5. **dictionary** – book in which words of all language are explained.
6. **subject** - a course of study in school.
7. **formula** – a mixture of milk for baby.
8. **gossip** – rumors, small talk about someone, idle talk, not true.
9. **transformer** – a person or thing who changes the form, or look of something.
10. **punctuation** – the use of commas, periods, etc. in writing.
11. **compliment** - something said when one wants to praise or admire.
12. **objection** – a protest, expression of dislike or disapproval.
13. **civilization** – stage in progress of people, the way of life of people, nation, or period.
14. **gorilla** – largest and strongest of apes.
15. **committee** – a group of people chosen to do a certain thing.
16. **attractive** – good looking, charming.
17. **prediction** – something told about the future.

18. **contradict** – go against, to be different, say the opposite.
19. **dictator** – any person with power over a country; a person who dictates.
20. **transportation** – a system of moving things from one place to another.
21. **confidential** – secret, private matter.
22. **maximum** – the greatest amount, or number that is possible.
23. **subtraction** – to take away one part, number etc. from another.
24. **cosmetic** – any substance used to make the skin or hair beautiful.
25. **instructor** – a teacher.

tes – tim – o – ny; tes – tim – on – y; test – i – mon – y;

15. binoculars (4 Syllables) – bin - o - cu - lars; bi - no - cu - lars; bin - o - cul - ars;

bin – oc – u – lars; bin – oc – ul – ars; bi – noc – u – lars;

bi – noc – ul - ars

16. walnut (2 Syllables) – wal – nut

17. cavity (3 Syllables) – ca - vi - ty; cav - i - ty; cav - it - y; ca - vit - y

18. power (2 Syllables) – pow - der; powd - er

19. notify (3 Syllables) – not - i - fy; no - ti - fy; no - tif - y; not - if - y

20. vanilla (3 Syllables) – van - i - lla; va - ni - lla; va - nil - la; van - ill - a; va - nill - a;

van - il – la

21. pistol (2 Syllables) – pi - stol; pis - tol; pist - ol

22. token (2 Syllables) – to - ken; tok - en

23. cathedral (3 Syllables) – ca - the - dral; cath - e - dral; cath - ed - ral; ca - thed - ral

24. visual (3 Syllables) – vi - su - al; vis - u - al

25. sacrifice (3 Syllables) – sa - cri - fice; sac - ri - fice

Session 2: The following were considered accurate and acceptable segmentation and counting of syllables for each of the 25 words practiced during Session 2 of the Syllable Segmentation Training.

1. reduce (2 Syllables) – red - uce; re - duce

2. communication (5 Syllables) – com - mu - ni - ca - tion; com - mun - i - ca - tion;

com - mu - nic - a - tion; com - mun - ic - a - tion;

comm - u - ni - ca - tion; comm - un - i - ca - tion;

comm - uni - c - a - tion; comm - u - nic - a - tion

3. burglar (2 Syllables) – bur - glar; burg - lar
4. document (3 Syllables) – do - cu - ment; doc - u - ment; doc - um - ent
5. constitutional (5 Syllables) – co - sti - tu - tion - al; con - stit - u - tion - al;
cons - ti - tu - tion - al; cons - tit - u - tion - al
6. target (2 Syllables) – tar - get; targ - et
7. multiply (3 Syllables) – mul - ti - ply; mult - i - ply; mul - tip - ly; mult - ip - ly
8. commercial (3 Syllables) – com - mer - cial; comm - er - cial
9. percentage (3 Syllables) – per - cent - age; per - cen - tage
10. tobacco (3 Syllables) – to - bac - co; tob - ac - co; to - ba - cco; tob - a - cco;
to - bacc - o
11. portable (3 Syllables) – port - a - ble; por - ta - ble; por - tab - le
12. vertical (3 Syllables) – ver - ti - cal; vert - i - cal; ver - tic - al; vert - ic - al
13. molecule (3 Syllables) – mol - e - cule; mo - le - cule; mo - lec - ule
14. surrender (3 Syllables) – sur - ren - der; surr - en - der; surr - end - er
15. capacity (4 Syllables) – ca - pa - ci - ty; cap - a - ci - ty; ca - pac - i - ty;
cap - ac - i - ty; cap - ac - it - ty; ca - pac - it - y;
ca - pa - cit - y; cap - a - cit - y
16. modify (3 Syllables) – mo - di - fy; mod - i - fy; mod - if - y; mo - dif - y
17. violet (3 Syllables) – vi - o - let; vi - ol - et
18. memorial (4 Syllables) – me - mo - ri - al; mem - o - ri - al; me - mor - i - al;
mem - or - i - al
19. violence (3 Syllables) – vi - o - lence; vi - ol - ence

20. maintenance (3 Syllables) – main - ten - ence; maint - en - ence; main - ten - nence
21. population (4 Syllables) – po - pu - la - tion; pop - u - la - tion; pop - ul - a - tion;
po - pul - a - tion
22. metropolitan (5 Syllables) – met - ro - pol - i - tan; met - ro - po - li - tan;
met - ro - po - lit - an; met - ro - pol - it - an;
me - tro - po - li - tan; me - tro - pol - i - tan;
me - tro - pol - it - an; me - tro - po - lit - an
23. damage (2 Syllables) – da - mage; dam - age
24. personal (3 Syllables) – per - son - al; per - so - nal; pers - on - al; pers - o - nal
25. federal (3 Syllables) – fed - er - al; fed - e - al; fe - de - ral; fe - der - al

Session 3: The following were considered accurate and acceptable segmentation and counting of syllables for each of the 25 words practiced during Session 3 of the Syllable Segmentation Training.

1. summary (3 Syllables) – sum - ma - ry; summ - a - ry; summ - ar - y; sum - mar - y
2. verdict (2 Syllables) – ver - dict; verd - ict
3. positive (3 Syllables) – po - si - tive; pos - i - tive; po - sit - ive; pos - it - ive
4. veteran (3 Syllables) – ve - te - ran; ve - ter - an; vet - e - ran; vet - er - an
5. calculation (4 Syllables) – cal - cul - a - tion; cal - cu - la - tion
6. fantasy (3 Syllables) – fan - ta - sy; fant - a - sy; fan - tas - y; fant - as - y
7. surplus (2 Syllables) – sur - plus; surp - lus
8. conclude (2 Syllables) – con - clude
9. paradise (3 Syllables) – pa - ra - dise; par - a - dise; par - ad - ise; pa - rad - ise

10. walrus (2 Syllables) – wal - rus
11. robbery (3 Syllables) – rob - ber - y; rob - be - ry; robb - er - y; robb - e - ry
12. major (2 Syllables) – ma - jor; maj - or
13. construction (3 Syllables) – con - struc - tion; cons - truc - tion
14. category (4 Syllables) – cat - e - go - ry; ca - te - go - ry; cat - eg - or - y;
ca - teg - o - ry; ca - teg - or - y; cat - e - gor - y;
ca - te - gor - y
15. poetry (3 Syllables) – po - e - try; po - et - ry
16. secretary (4 Syllables) – se - cre - ta - ry; sec - re - ta - ry; sec - re - tar - y;
sec - ret - ar - y; se - cret - ar - y; se - cre - tar - y
17. corporation (4 Syllables) – cor - por - a - tion; cor - po - ra - tion
18. politics (3 Syllables) – po - li - tics; pol - i - tics; pol - it - ics; po - lit - ics
19. location (3 Syllables) – lo - ca - tion; loc - a - tion
20. domestic (3 Syllables) – do - mes - tic; dom - es - tic; do - me - stic; dom - e - stic
21. combine (2 Syllables) – com - bine; comb - ine
22. magical (3 Syllables) – ma - gi - cal; mag - i - cal; ma - gic - al
23. comment (2 Syllables) – com - ment; comm - ent; co - mment
24. piggy (2 Syllables) – pig - gy; pigg - y; pi - ggy
25. conductor (3 Syllables) – con - duc - tor; con - duct - or; cond - uc - tor;
cond - uct - or

Session 4: The following were considered accurate and acceptable segmentation and counting of syllables for each of the 25 words practiced during Session 4 of the Syllable Segmentation Training.

1. invisible (4 Syllables) – in - vi - si - ble; in - vis - i - ble
2. destructive (3 Syllables) – des - truc - tive; de - struc - tive; de - struct - ive;
des - truct - ive
3. supervision (4 Syllables) – su - per - vi - sion; sup - er - vi - sion
4. contribution (4 Syllables) – con - tri - bu - tion; con - trib - u - tion; cont - rib - u - tion
5. dictionary (4 Syllables) – dic - tion - ar - y; dic - tion - a - ry
6. subject (2 Syllables) - sub - ject
7. formula (3 Syllables) – for - mu - la; form - u - la; for - mul - a
8. gossip (2 Syllables) – goss - ip; go - ssip; gos - sip
9. transformer (3 Syllables) – trans - for - mer; trans - form - er
10. punctuation (4 Syllables) – punc - tu - a - tion; punct - u - a - tion
11. compliment (3 Syllables) – comp - li - ment; com - pli - ment;
comp - lim - ent; com - plim - ent
12. objection (3 Syllables) – ob - jec - tion
13. civilization (5 Syllables) – ci - vi - li - za - tion; civ - i - li - za - tion;
civ - il - i - za - tion; ci - vil - i - za - tion;
civ - i - liz - a - tion; ci - vil - iz - a - tion
14. gorilla (3 Syllables) – go - rill - a; gor - ill - a; go - ril - la; go - ri - lla; gor - i - lla
15. committee (3 Syllables) – co - mit - tee; comm - it - tee; comm - itt - ee;
co - mmit - tee; co - mmit - ee

16. attractive (3 Syllables) – at - trac - tive; att - rac - tive; at - tract - ive; att - ract - ive
17. prediction (3 Syllables) – pre - dic - tion; pred - ic - tion
18. contradict (3 Syllables) – con - tra - dict; con - trad - ict; cont - ra - dict;
cont - rad - ict
19. dictator (3 Syllables) – dict - a - tor; dic - ta - tor; dict - at - or; dic - tat - or
20. transportation (4 Syllables) – tran - sport - a - tion; tran - spor - ta - tion;
trans - port - a - tion; trans - por - ta - tion
21. confidential (4 Syllables) – con - fi - den - tial; con - fid - en - tial; con - fi - dent - ial;
con - fid - ent - ial
22. maximum (3 Syllables) – max - i - mum; max - im - um; ma - xi - mum
23. subtraction (3 Syllables) – sub - trac - tion; sub - tract - ion
24. cosmetic (3 Syllables) – cos - me - tic; cos - met - ic
25. instructor (3 Syllables) – in - struct - or; in - struc - tor

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 1 - Trial 1)

SESSION 1 TRIAL 1

NAME: _____ **DATE:** _____

| | WORD | MEANING | SEGMENTATION | BEATS | WORD |
|-----|--------------|----------------|---------------------|--------------|-------------|
| 1. | digit | _____ | _____ | _____ | _____ |
| 2. | welfare | _____ | _____ | _____ | _____ |
| 3. | senator | _____ | _____ | _____ | _____ |
| 4. | poverty | _____ | _____ | _____ | _____ |
| 5. | victim | _____ | _____ | _____ | _____ |
| 6. | mental | _____ | _____ | _____ | _____ |
| 7. | congress | _____ | _____ | _____ | _____ |
| 8. | mustard | _____ | _____ | _____ | _____ |
| 9. | congratulate | _____ | _____ | _____ | _____ |
| 10. | utensil | _____ | _____ | _____ | _____ |
| 11. | democratic | _____ | _____ | _____ | _____ |
| 12. | conference | _____ | _____ | _____ | _____ |
| 13. | microphone | _____ | _____ | _____ | _____ |
| 14. | testimony | _____ | _____ | _____ | _____ |
| 15. | binoculars | _____ | _____ | _____ | _____ |
| 16. | walnut | _____ | _____ | _____ | _____ |
| 17. | cavity | _____ | _____ | _____ | _____ |
| 18. | powder | _____ | _____ | _____ | _____ |
| 19. | notify | _____ | _____ | _____ | _____ |
| 20. | vanilla | _____ | _____ | _____ | _____ |
| 21. | pistol | _____ | _____ | _____ | _____ |
| 22. | token | _____ | _____ | _____ | _____ |
| 23. | cathedral | _____ | _____ | _____ | _____ |
| 24. | visual | _____ | _____ | _____ | _____ |
| 25. | sacrifice | _____ | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 1 - Trial 2)

SESSION 1 TRIAL 2

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|--------------|--------------|-------|-------|
| 1. | binoculars | _____ | _____ | _____ |
| 2. | poverty | _____ | _____ | _____ |
| 3. | cathedral | _____ | _____ | _____ |
| 4. | visual | _____ | _____ | _____ |
| 5. | digit | _____ | _____ | _____ |
| 6. | sacrifice | _____ | _____ | _____ |
| 7. | mustard | _____ | _____ | _____ |
| 8. | congratulate | _____ | _____ | _____ |
| 9. | token | _____ | _____ | _____ |
| 10. | democratic | _____ | _____ | _____ |
| 11. | victim | _____ | _____ | _____ |
| 12. | cavity | _____ | _____ | _____ |
| 13. | notify | _____ | _____ | _____ |
| 14. | congress | _____ | _____ | _____ |
| 15. | mental | _____ | _____ | _____ |
| 16. | vanilla | _____ | _____ | _____ |
| 17. | senator | _____ | _____ | _____ |
| 18. | pistol | _____ | _____ | _____ |
| 19. | testimony | _____ | _____ | _____ |
| 20. | conference | _____ | _____ | _____ |
| 21. | walnut | _____ | _____ | _____ |
| 22. | microphone | _____ | _____ | _____ |
| 23. | welfare | _____ | _____ | _____ |
| 24. | utensil | _____ | _____ | _____ |
| 25. | powder | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 1 - Trial 3)

SESSION 1 TRIAL 3

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|--------------|--------------|-------|-------|
| 1. | digit | _____ | _____ | _____ |
| 2. | welfare | _____ | _____ | _____ |
| 3. | senator | _____ | _____ | _____ |
| 4. | poverty | _____ | _____ | _____ |
| 5. | victim | _____ | _____ | _____ |
| 6. | mental | _____ | _____ | _____ |
| 7. | congress | _____ | _____ | _____ |
| 8. | mustard | _____ | _____ | _____ |
| 9. | congratulate | _____ | _____ | _____ |
| 10. | utensil | _____ | _____ | _____ |
| 11. | democratic | _____ | _____ | _____ |
| 12. | conference | _____ | _____ | _____ |
| 13. | microphone | _____ | _____ | _____ |
| 14. | testimony | _____ | _____ | _____ |
| 15. | binoculars | _____ | _____ | _____ |
| 16. | walnut | _____ | _____ | _____ |
| 17. | cavity | _____ | _____ | _____ |
| 18. | powder | _____ | _____ | _____ |
| 19. | notify | _____ | _____ | _____ |
| 20. | vanilla | _____ | _____ | _____ |
| 21. | pistol | _____ | _____ | _____ |
| 22. | token | _____ | _____ | _____ |
| 23. | cathedral | _____ | _____ | _____ |
| 24. | visual | _____ | _____ | _____ |
| 25. | sacrifice | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 1 - Trial 4)

SESSION 1 TRIAL 4

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|--------------|---------------------|--------------|-------------|
| 1. | binoculars | _____ | _____ | _____ |
| 2. | poverty | _____ | _____ | _____ |
| 3. | cathedral | _____ | _____ | _____ |
| 4. | visual | _____ | _____ | _____ |
| 5. | digit | _____ | _____ | _____ |
| 6. | sacrifice | _____ | _____ | _____ |
| 7. | mustard | _____ | _____ | _____ |
| 8. | congratulate | _____ | _____ | _____ |
| 9. | token | _____ | _____ | _____ |
| 10. | democratic | _____ | _____ | _____ |
| 11. | victim | _____ | _____ | _____ |
| 12. | cavity | _____ | _____ | _____ |
| 13. | notify | _____ | _____ | _____ |
| 14. | congress | _____ | _____ | _____ |
| 15. | mental | _____ | _____ | _____ |
| 16. | vanilla | _____ | _____ | _____ |
| 17. | senator | _____ | _____ | _____ |
| 18. | pistol | _____ | _____ | _____ |
| 19. | testimony | _____ | _____ | _____ |
| 20. | conference | _____ | _____ | _____ |
| 21. | walnut | _____ | _____ | _____ |
| 22. | microphone | _____ | _____ | _____ |
| 23. | welfare | _____ | _____ | _____ |
| 24. | utensil | _____ | _____ | _____ |
| 25. | powder | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 2 - Trial 1)

SESSION 2 TRIAL 1

NAME: _____ **DATE:** _____

| | WORD | MEANING | SEGMENTATION | BEATS | WORD |
|-----|----------------|---------|--------------|-------|------|
| 1. | reduce | | | | |
| 2. | communication | | | | |
| 3. | burglar | | | | |
| 4. | document | | | | |
| 5. | constitutional | | | | |
| 6. | target | | | | |
| 7. | multiply | | | | |
| 8. | commercial | | | | |
| 9. | percentage | | | | |
| 10. | tobacco | | | | |
| 11. | portable | | | | |
| 12. | vertical | | | | |
| 13. | molecule | | | | |
| 14. | surrender | | | | |
| 15. | capacity | | | | |
| 16. | modify | | | | |
| 17. | violet | | | | |
| 18. | memorial | | | | |
| 19. | violence | | | | |
| 20. | maintenance | | | | |
| 21. | population | | | | |
| 22. | metropolitan | | | | |
| 23. | damage | | | | |
| 24. | personal | | | | |
| 25. | federal | | | | |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 2 - Trial 2)

SESSION 2 TRIAL 2

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|----------------|---------------------|--------------|-------------|
| 1. | document | _____ | _____ | _____ |
| 2. | target | _____ | _____ | _____ |
| 3. | multiply | _____ | _____ | _____ |
| 4. | personal | _____ | _____ | _____ |
| 5. | commercial | _____ | _____ | _____ |
| 6. | burglar | _____ | _____ | _____ |
| 7. | percentage | _____ | _____ | _____ |
| 8. | federal | _____ | _____ | _____ |
| 9. | maintenance | _____ | _____ | _____ |
| 10. | communication | _____ | _____ | _____ |
| 11. | metropolitan | _____ | _____ | _____ |
| 12. | violet | _____ | _____ | _____ |
| 13. | capacity | _____ | _____ | _____ |
| 14. | population | _____ | _____ | _____ |
| 15. | damage | _____ | _____ | _____ |
| 16. | portable | _____ | _____ | _____ |
| 17. | molecule | _____ | _____ | _____ |
| 18. | vertical | _____ | _____ | _____ |
| 19. | reduce | _____ | _____ | _____ |
| 20. | modify | _____ | _____ | _____ |
| 21. | surrender | _____ | _____ | _____ |
| 22. | memorial | _____ | _____ | _____ |
| 23. | tobacco | _____ | _____ | _____ |
| 24. | violence | _____ | _____ | _____ |
| 25. | constitutional | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 2 - Trial 3)

SESSION 2 TRIAL 3

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|----------------|---------------------|--------------|-------------|
| 1. | reduce | _____ | _____ | _____ |
| 2. | communication | _____ | _____ | _____ |
| 3. | burglar | _____ | _____ | _____ |
| 4. | document | _____ | _____ | _____ |
| 5. | constitutional | _____ | _____ | _____ |
| 6. | target | _____ | _____ | _____ |
| 7. | multiply | _____ | _____ | _____ |
| 8. | commercial | _____ | _____ | _____ |
| 9. | percentage | _____ | _____ | _____ |
| 10. | tobacco | _____ | _____ | _____ |
| 11. | portable | _____ | _____ | _____ |
| 12. | vertical | _____ | _____ | _____ |
| 13. | molecule | _____ | _____ | _____ |
| 14. | surrender | _____ | _____ | _____ |
| 15. | capacity | _____ | _____ | _____ |
| 16. | modify | _____ | _____ | _____ |
| 17. | violet | _____ | _____ | _____ |
| 18. | memorial | _____ | _____ | _____ |
| 19. | violence | _____ | _____ | _____ |
| 20. | maintenance | _____ | _____ | _____ |
| 21. | population | _____ | _____ | _____ |
| 22. | metropolitan | _____ | _____ | _____ |
| 23. | damage | _____ | _____ | _____ |
| 24. | personal | _____ | _____ | _____ |
| 25. | federal | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 2 - Trial 4)

SESSION 2 TRIAL 4

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|----------------|---------------------|--------------|-------------|
| 1. | document | _____ | _____ | _____ |
| 2. | target | _____ | _____ | _____ |
| 3. | multiply | _____ | _____ | _____ |
| 4. | personal | _____ | _____ | _____ |
| 5. | commercial | _____ | _____ | _____ |
| 6. | burglar | _____ | _____ | _____ |
| 7. | percentage | _____ | _____ | _____ |
| 8. | federal | _____ | _____ | _____ |
| 9. | maintenance | _____ | _____ | _____ |
| 10. | communication | _____ | _____ | _____ |
| 11. | metropolitan | _____ | _____ | _____ |
| 12. | violet | _____ | _____ | _____ |
| 13. | capacity | _____ | _____ | _____ |
| 14. | population | _____ | _____ | _____ |
| 15. | damage | _____ | _____ | _____ |
| 16. | portable | _____ | _____ | _____ |
| 17. | molecule | _____ | _____ | _____ |
| 18. | vertical | _____ | _____ | _____ |
| 19. | reduce | _____ | _____ | _____ |
| 20. | modify | _____ | _____ | _____ |
| 21. | surrender | _____ | _____ | _____ |
| 22. | memorial | _____ | _____ | _____ |
| 23. | tobacco | _____ | _____ | _____ |
| 24. | violence | _____ | _____ | _____ |
| 25. | constitutional | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 3 - Trial 1)

SESSION 3 TRIAL 1

NAME: _____ **DATE:** _____

| | WORD | MEANING | SEGMENTATION | BEATS | WORD |
|-----|--------------|----------------|---------------------|--------------|-------------|
| 1. | summary | | | | |
| 2. | verdict | | | | |
| 3. | positive | | | | |
| 4. | veteran | | | | |
| 5. | calculation | | | | |
| 6. | fantasy | | | | |
| 7. | surplus | | | | |
| 8. | conclude | | | | |
| 9. | paradise | | | | |
| 10. | walrus | | | | |
| 11. | robbery | | | | |
| 12. | major | | | | |
| 13. | construction | | | | |
| 14. | category | | | | |
| 15. | poetry | | | | |
| 16. | secretary | | | | |
| 17. | corporation | | | | |
| 18. | politics | | | | |
| 19. | location | | | | |
| 20. | domestic | | | | |
| 21. | combine | | | | |
| 22. | magical | | | | |
| 23. | comment | | | | |
| 24. | piggy | | | | |
| 25. | conductor | | | | |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 3 - Trial 2)

SESSION 3 TRIAL 2

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|--------------|---------------------|--------------|-------------|
| 1. | location | _____ | | |
| 2. | category | _____ | | |
| 3. | poetry | _____ | | |
| 4. | combine | _____ | | |
| 5. | secretary | _____ | | |
| 6. | magical | _____ | | |
| 7. | comment | _____ | | |
| 8. | walrus | _____ | | |
| 9. | conductor | _____ | | |
| 10. | summary | _____ | | |
| 11. | paradise | _____ | | |
| 12. | fantasy | _____ | | |
| 13. | major | _____ | | |
| 14. | corporation | _____ | | |
| 15. | piggy | _____ | | |
| 16. | veteran | _____ | | |
| 17. | construction | _____ | | |
| 18. | positive | _____ | | |
| 19. | verdict | _____ | | |
| 20. | calculation | _____ | | |
| 21. | politics | _____ | | |
| 22. | conclude | _____ | | |
| 23. | surplus | _____ | | |
| 24. | robbery | _____ | | |
| 25. | domestic | _____ | | |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 3 - Trial 3)

SESSION 3 TRIAL 3

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|--------------|---------------------|--------------|-------------|
| 1. | summary | _____ | _____ | _____ |
| 2. | verdict | _____ | _____ | _____ |
| 3. | positive | _____ | _____ | _____ |
| 4. | veteran | _____ | _____ | _____ |
| 5. | calculation | _____ | _____ | _____ |
| 6. | fantasy | _____ | _____ | _____ |
| 7. | surplus | _____ | _____ | _____ |
| 8. | conclude | _____ | _____ | _____ |
| 9. | paradise | _____ | _____ | _____ |
| 10. | walrus | _____ | _____ | _____ |
| 11. | robbery | _____ | _____ | _____ |
| 12. | major | _____ | _____ | _____ |
| 13. | construction | _____ | _____ | _____ |
| 14. | category | _____ | _____ | _____ |
| 15. | poetry | _____ | _____ | _____ |
| 16. | secretary | _____ | _____ | _____ |
| 17. | corporation | _____ | _____ | _____ |
| 18. | politics | _____ | _____ | _____ |
| 19. | location | _____ | _____ | _____ |
| 20. | domestic | _____ | _____ | _____ |
| 21. | combine | _____ | _____ | _____ |
| 22. | magical | _____ | _____ | _____ |
| 23. | comment | _____ | _____ | _____ |
| 24. | piggy | _____ | _____ | _____ |
| 25. | conductor | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 3 - Trial 4)

SESSION 3 TRIAL 4

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|--------------|--------------|-------|-------|
| 1. | location | _____ | _____ | _____ |
| 2. | category | _____ | _____ | _____ |
| 3. | poetry | _____ | _____ | _____ |
| 4. | combine | _____ | _____ | _____ |
| 5. | secretary | _____ | _____ | _____ |
| 6. | magical | _____ | _____ | _____ |
| 7. | comment | _____ | _____ | _____ |
| 8. | walrus | _____ | _____ | _____ |
| 9. | conductor | _____ | _____ | _____ |
| 10. | summary | _____ | _____ | _____ |
| 11. | paradise | _____ | _____ | _____ |
| 12. | fantasy | _____ | _____ | _____ |
| 13. | major | _____ | _____ | _____ |
| 14. | corporation | _____ | _____ | _____ |
| 15. | piggy | _____ | _____ | _____ |
| 16. | veteran | _____ | _____ | _____ |
| 17. | construction | _____ | _____ | _____ |
| 18. | positive | _____ | _____ | _____ |
| 19. | verdict | _____ | _____ | _____ |
| 20. | calculation | _____ | _____ | _____ |
| 21. | politics | _____ | _____ | _____ |
| 22. | conclude | _____ | _____ | _____ |
| 23. | surplus | _____ | _____ | _____ |
| 24. | robbery | _____ | _____ | _____ |
| 25. | domestic | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 4 - Trial 1)

SESSION 4 TRIAL 1

NAME: _____ **DATE:** _____

| | WORD | MEANING | SEGMENTATION | BEATS | WORD |
|-----|----------------|---------|--------------|-------|------|
| 1. | invisible | | | | |
| 2. | destructive | | | | |
| 3. | supervision | | | | |
| 4. | contribution | | | | |
| 5. | dictionary | | | | |
| 6. | subject | | | | |
| 7. | formula | | | | |
| 8. | gossip | | | | |
| 9. | transformer | | | | |
| 10. | punctuation | | | | |
| 11. | compliment | | | | |
| 12. | objection | | | | |
| 13. | civilization | | | | |
| 14. | gorilla | | | | |
| 15. | committee | | | | |
| 16. | attractive | | | | |
| 17. | prediction | | | | |
| 18. | contradict | | | | |
| 19. | dictator | | | | |
| 20. | transportation | | | | |
| 21. | confidential | | | | |
| 22. | maximum | | | | |
| 23. | subtraction | | | | |
| 24. | cosmetic | | | | |
| 25. | instructor | | | | |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 4 - Trial 2)

SESSION 4 TRIAL 2

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|----------------|--------------|-------|------|
| 1. | formula | _____ | | |
| 2. | committee | _____ | | |
| 3. | punctuation | _____ | | |
| 4. | invisible | _____ | | |
| 5. | gorilla | _____ | | |
| 6. | contradict | _____ | | |
| 7. | dictator | _____ | | |
| 8. | prediction | _____ | | |
| 9. | contribution | _____ | | |
| 10. | subject | _____ | | |
| 11. | instructor | _____ | | |
| 12. | maximum | _____ | | |
| 13. | compliment | _____ | | |
| 14. | objection | _____ | | |
| 15. | subtraction | _____ | | |
| 16. | dictionary | _____ | | |
| 17. | confidential | _____ | | |
| 18. | transformer | _____ | | |
| 19. | gossip | _____ | | |
| 20. | destructive | _____ | | |
| 21. | supervision | _____ | | |
| 22. | transportation | _____ | | |
| 23. | civilization | _____ | | |
| 24. | attractive | _____ | | |
| 25. | cosmetic | _____ | | |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 4 - Trial 3)

SESSION 4 TRIAL 3

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|----------------|--------------|-------|-------|
| 1. | invisible | _____ | _____ | _____ |
| 2. | destructive | _____ | _____ | _____ |
| 3. | supervision | _____ | _____ | _____ |
| 4. | contribution | _____ | _____ | _____ |
| 5. | dictionary | _____ | _____ | _____ |
| 6. | subject | _____ | _____ | _____ |
| 7. | formula | _____ | _____ | _____ |
| 8. | gossip | _____ | _____ | _____ |
| 9. | transformer | _____ | _____ | _____ |
| 10. | punctuation | _____ | _____ | _____ |
| 11. | compliment | _____ | _____ | _____ |
| 12. | objection | _____ | _____ | _____ |
| 13. | civilization | _____ | _____ | _____ |
| 14. | gorilla | _____ | _____ | _____ |
| 15. | committee | _____ | _____ | _____ |
| 16. | attractive | _____ | _____ | _____ |
| 17. | prediction | _____ | _____ | _____ |
| 18. | contradict | _____ | _____ | _____ |
| 19. | dictator | _____ | _____ | _____ |
| 20. | transportation | _____ | _____ | _____ |
| 21. | confidential | _____ | _____ | _____ |
| 22. | maximum | _____ | _____ | _____ |
| 23. | subtraction | _____ | _____ | _____ |
| 24. | cosmetic | _____ | _____ | _____ |
| 25. | instructor | _____ | _____ | _____ |

Appendix L - Material E

Syllable Segmentation Training - Data Sheet (Session 4 - Trial 4)

SESSION 4 TRIAL 4

NAME: _____ **DATE:** _____

| | WORD | SEGMENTATION | BEATS | WORD |
|-----|----------------|---------------------|--------------|-------------|
| 1. | formula | _____ | _____ | _____ |
| 2. | committee | _____ | _____ | _____ |
| 3. | punctuation | _____ | _____ | _____ |
| 4. | invisible | _____ | _____ | _____ |
| 5. | gorilla | _____ | _____ | _____ |
| 6. | contradict | _____ | _____ | _____ |
| 7. | dictator | _____ | _____ | _____ |
| 8. | prediction | _____ | _____ | _____ |
| 9. | contribution | _____ | _____ | _____ |
| 10. | subject | _____ | _____ | _____ |
| 11. | instructor | _____ | _____ | _____ |
| 12. | maximum | _____ | _____ | _____ |
| 13. | compliment | _____ | _____ | _____ |
| 14. | objection | _____ | _____ | _____ |
| 15. | subtraction | _____ | _____ | _____ |
| 16. | dictionary | _____ | _____ | _____ |
| 17. | confidential | _____ | _____ | _____ |
| 18. | transformer | _____ | _____ | _____ |
| 19. | gossip | _____ | _____ | _____ |
| 20. | destructive | _____ | _____ | _____ |
| 21. | supervision | _____ | _____ | _____ |
| 22. | transportation | _____ | _____ | _____ |
| 23. | civilization | _____ | _____ | _____ |
| 24. | attractive | _____ | _____ | _____ |
| 25. | cosmetic | _____ | _____ | _____ |

Appendix M

Whole Word Training

MATERIALS:

1. Sample word cards (same as syllable training [see Appendix L –Material A])
2. Training word cards (same as syllable training [see Appendix L – Material B])
3. A list of meanings (same as syllable training [see Appendix L – Material C])
4. Data sheets (see Appendix M - Material A)

TRAINING SESSION 1

DIRECTIONS:

The participants were told, “I am going to show you some words that are real and have meanings. I will teach you to read the words. First, you will look at a whole word printed on an index card and read it out loud. Next, you will explain the meaning of the word you read out loud. Then you will read the word again”. The experimenter demonstrated the whole word reading process by saying, “Let me show you how you will read a word”. The experimenter presented a sample word, finish, printed on an index card and said, “Here is a word. First, I will read the whole word out loud, finish. Then I will explain the meaning of the word. Finish means ‘to complete a job’. Now, I will read the whole word again, finish. You will practice reading words like finish six times. The first time you see a word, you will read the word, explain its meaning, and read the word again. After you have read a word the first time, you will read the word twice without explaining the word’s meaning for the next three trials. For the last two trials, you will read the word one time as quickly as you can without making any mistake”.

The experimenter demonstrated the whole word reading procedure again by reading a different word. The experimenter presented an index card and said, "Watch me read another word just like I taught you before. This word is violinist. Violinist is 'a person who plays music on the violin'. The word is violinist. Now, I will read the word, two times, for the next three trials, without explaining the meaning of the word." The experimenter read the word, violinist, then paused and read the word again, violinist. The experimenter then said, "Let's say I finished reading the word for three trials. I will now read the word out loud quickly, without making any mistake, one time, for the last two trials. I will read it as, violinist. You will learn to read many words this way so that you can get better at doing it. I will show you each word on an index card. Your job is to read each word loud enough so I can hear you, explain the word's meaning the first time only, and read the whole word again. Remember after the first time, you will read each word twice, and for the last two trials you will read aloud each word one time only, as quickly and correctly as you can. Do you understand what to do? All right."

TRAINING SESSION 1 - TRIAL 1

The experimenter began the first trial by saying, "I am going to show you some words. You will practice reading the words several times using the method you just learned. If you can't read a word or explain its meaning, I will help you. Let's begin".

First, the experimenter presented an index card with the word, digit, printed on it and said, "Read the word". When the participant read the word correctly, the experimenter checked off the correct response on the data sheet and acknowledged the participant's effort by saying, "Very good." If, on the other hand, the participant read the

word incorrectly or failed to read the word, the experimenter recorded the incorrect response verbatim or the non-response as DK (i.e., "Don't know.") and provided corrective feedback by saying, "This word is digit. Now you read it". The participant was asked to practice reading the word as corrected by the experimenter and continued to do so until he or she provided the correct response. The experimenter provided feedback as long as the participant required practice reading the word.

Next, the experimenter asked the participant to explain the meaning of the word digit by saying, "Do you know what the word digit means?" If the participant said, "Yes", the experimenter said, "Tell me its meaning." An answer similar to, Digit means 'any number from zero to nine' was accepted and recorded as a correct response. The experimenter acknowledged participant's correct response by saying, "Very good". If the participant said, "I don't know the meaning", the experimenter recorded the response as DK and explained the meaning of the word.

Finally, the participant was told to read the whole word again. If the participant read the word as digit, the experimenter recorded the response with a check mark to indicate a correct response and said, "You did a very good job reading the word". Let's try the next word". If, on the other hand, the participant misread the word or did not read the word, the experimenter recorded the incorrect response verbatim or recorded DK for no response, and provided corrective feedback by saying, "The word is Digit. Now you read it". The participant practiced reading the whole word until he or she pronounced the word accurately. The experimenter provided corrective feedback until an accurate response was elicited. The participant was then told, "You tried hard reading the word. Let's read another word." Participants were shown 25 words printed on index cards

during Trial 1, one at a time, and asked to read aloud the words, explain the meanings of the words, and read aloud the words again after explaining the meanings. The above described procedure of monitoring performance, providing corrective feedback, and recording responses was adhered to for each of the 25 words practiced by participants during Trial 1 of the whole word training Session 1.

TRAINING SESSION 1 - TRIALS 2 - 4

During Trials 2, 3, and 4 of Session 1, participants were told, "You did a good job reading the word you just finished. Now, I am going to show you the words again, and I would like you to read them aloud twice, one after the other, but without explaining the meanings of the words. If you cannot read any word, I will read the word aloud for you. After I read aloud the word, you will practice reading the word like I did. Do you understand? Very good. Here is the first word". The procedure of monitoring performance, providing corrective feedback, and recording responses described during Trial 1 was also implemented for Trials 2, 3, and 4 of the whole word training Session 1.

TRAINING SESSION 1 - TRIALS 5 - 6

At the start of Trials 5 and 6, participants were told, "You did a very good job reading those words. Let's read them again. This time I would like you to read each word one time only. Try to read each word aloud as quickly and correctly as possible. Remember, read each word once, as quickly as you can, but without making any mistake. Do you have any questions? Okay, let's begin". Participants' responses were recorded on the data sheet during Trials 5 and 6. A check was placed for correct responses, incorrect

responses were recorded verbatim, and words not attempted were recorded as DK. Participants' word reading speed was recorded with a stopwatch, and total time in seconds was noted down. At the end of Session 1, participants were told, "You did very well learning to read those words. Thank you for trying hard".

TRAINING SESSIONS 2 - 3

DIRECTIONS:

The experimenter began Session 2 and 3 by saying, "Remember how you learned to read words the other day? Well, we are going to do the same thing today so that you will get some more practice reading words. Here are some new words. You will practice reading the words several times using the method you learned the other day. First, you will read the word, explain its meaning, and read the word again during Trial 1. Next, you will read the word twice without explaining the word's meaning during Trials 2, 3, and 4. Finally, you will read the word one time as quickly as you can without making any mistake during Trials 5 and 6. If you can't read a word, or explain its meaning, I will help you. Are you ready? Good. Let's begin". The procedure of monitoring performance, providing corrective feedback, and recording responses described for Session 1 was adhered to during Sessions 2 - 3 of the word reading training. At the end of Sessions 2 and 3, participants were told, "You did very well learning to read those words. Thank you for trying".

TRAINING SESSION 4**DIRECTIONS:**

At the start of Session 4, participants were told, "You did a very good job reading different words during the last three sessions. Today, I would like you to read some more new words using the method you have practiced before. You will practice reading the words several times using the method you learned the other day. For Trial 1, you will read the word, explain its meaning, and read the word again. For Trials 2, 3, and 4, you will read the word twice without explaining the word's meaning. For the Trials 5 and 6, you will read the word one time as quickly as you can without making any mistake. If you can't read a word or explain its meaning I will help you. Do the best you can. Do you understand? Good. Let's begin". The procedure of monitoring performance, providing corrective feedback, demonstrating syllable segmentation strategy, and recording responses adhered to during Sessions 1 - 3 was adopted for Session 4 as well. At the end of Session 4, participants were told, "You did very well learning to read those words and dividing them into their syllables. Thank you for trying hard".

PROCEDURE:

The whole word training was provided individually to all participants during Trials 1 – 6 of Sessions 1 - 4.

1. Participant was provided explanation and shown the process of reading whole words using two sample word cards, finish and violinist, at the start of Session 1.
2. Participant practiced reading a set of 25 new words, presented in two separate orders, in six separate trials during Session 1 - 4.

3. **Participant was presented with 25 new words, one at a time, printed on index cards during the Trials 1 – 6 of each training session.**
4. **Participant read aloud each of the 25 words, one at a time. Participant read each word twice for Trails 1 - 4, and once, quickly and accurately in Trials 5 and 6 of each training session.**
5. **Participant was provided corrective feedback for words read incorrectly or not attempted during Trials 1 – 4 of each training session.**
6. **Participant explained the meanings of each of the 25 words during Trial 1 of Sessions 1 - 4.**
7. **Participant was provided corrective feedback for incorrect explanations or for words not explained during Trials 1 – 4 of each training session.**
8. **Participant's word reading speed during Trails 5 and 6 of each training session was recorded in seconds with a stopwatch.**
9. **Participant's responses were recorded on the data sheets. Correct responses were checked off, incorrect responses were recorded verbatim, and non-responses were recorded as DK.**
10. **Participant was provided positive verbal reinforcement for his or her effort at reading each of the 25 words at the end of each of training session.**

Appendix M - Material A

Whole Word Training - Data Sheet (Session 1 - Trial 1)

SESSION 1 TRIAL 1

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>MEANING</u> | <u>WORD</u> |
|-----------------|-------------|----------------|-------------|
| 1. digit | _____ | _____ | _____ |
| 2. welfare | _____ | _____ | _____ |
| 3. senator | _____ | _____ | _____ |
| 4. poverty | _____ | _____ | _____ |
| 5. victim | _____ | _____ | _____ |
| 6. mental | _____ | _____ | _____ |
| 7. congress | _____ | _____ | _____ |
| 8. mustard | _____ | _____ | _____ |
| 9. congratulate | _____ | _____ | _____ |
| 10. utensil | _____ | _____ | _____ |
| 11. democratic | _____ | _____ | _____ |
| 12. conference | _____ | _____ | _____ |
| 13. microphone | _____ | _____ | _____ |
| 14. testimony | _____ | _____ | _____ |
| 15. binoculars | _____ | _____ | _____ |
| 16. walnut | _____ | _____ | _____ |
| 17. cavity | _____ | _____ | _____ |
| 18. powder | _____ | _____ | _____ |
| 19. notify | _____ | _____ | _____ |
| 20. vanilla | _____ | _____ | _____ |
| 21. pistol | _____ | _____ | _____ |
| 22. token | _____ | _____ | _____ |
| 23. cathedral | _____ | _____ | _____ |
| 24. visual | _____ | _____ | _____ |
| 25. sacrifice | _____ | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 1 - Trial 2)

SESSION 1 TRIAL 2

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|-----------------|-------------|-------------|
| 1. binoculars | _____ | _____ |
| 2. poverty | _____ | _____ |
| 3. cathedral | _____ | _____ |
| 4. visual | _____ | _____ |
| 5. digit | _____ | _____ |
| 6. sacrifice | _____ | _____ |
| 7. mustard | _____ | _____ |
| 8. congratulate | _____ | _____ |
| 9. token | _____ | _____ |
| 10. democratic | _____ | _____ |
| 11. victim | _____ | _____ |
| 12. cavity | _____ | _____ |
| 13. notify | _____ | _____ |
| 14. congress | _____ | _____ |
| 15. mental | _____ | _____ |
| 16. vanilla | _____ | _____ |
| 17. senator | _____ | _____ |
| 18. pistol | _____ | _____ |
| 19. testimony | _____ | _____ |
| 20. conference | _____ | _____ |
| 21. walnut | _____ | _____ |
| 22. microphone | _____ | _____ |
| 23. welfare | _____ | _____ |
| 24. utensil | _____ | _____ |
| 25. powder | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 1 - Trial 3)

SESSION 1 TRIAL 3

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|-----------------|-------------|-------------|
| 1. digit | _____ | _____ |
| 2. welfare | _____ | _____ |
| 3. senator | _____ | _____ |
| 4. poverty | _____ | _____ |
| 5. victim | _____ | _____ |
| 6. mental | _____ | _____ |
| 7. congress | _____ | _____ |
| 8. mustard | _____ | _____ |
| 9. congratulate | _____ | _____ |
| 10. utensil | _____ | _____ |
| 11. democratic | _____ | _____ |
| 12. conference | _____ | _____ |
| 13. microphone | _____ | _____ |
| 14. testimony | _____ | _____ |
| 15. binoculars | _____ | _____ |
| 16. walnut | _____ | _____ |
| 17. cavity | _____ | _____ |
| 18. powder | _____ | _____ |
| 19. notify | _____ | _____ |
| 20. vanilla | _____ | _____ |
| 21. pistol | _____ | _____ |
| 22. token | _____ | _____ |
| 23. cathedral | _____ | _____ |
| 24. visual | _____ | _____ |
| 25. sacrifice | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 1 - Trial 4)**SESSION 1 TRIAL 4**

NAME: _____

DATE: _____

| | <u>WORD</u> | <u>WORD</u> |
|-----------------|-------------|-------------|
| 1. binoculars | _____ | _____ |
| 2. poverty | _____ | _____ |
| 3. cathedral | _____ | _____ |
| 4. visual | _____ | _____ |
| 5. digit | _____ | _____ |
| 6. sacrifice | _____ | _____ |
| 7. mustard | _____ | _____ |
| 8. congratulate | _____ | _____ |
| 9. token | _____ | _____ |
| 10. democratic | _____ | _____ |
| 11. victim | _____ | _____ |
| 12. cavity | _____ | _____ |
| 13. notify | _____ | _____ |
| 14. congress | _____ | _____ |
| 15. mental | _____ | _____ |
| 16. vanilla | _____ | _____ |
| 17. senator | _____ | _____ |
| 18. pistol | _____ | _____ |
| 19. testimony | _____ | _____ |
| 20. conference | _____ | _____ |
| 21. walnut | _____ | _____ |
| 22. microphone | _____ | _____ |
| 23. welfare | _____ | _____ |
| 24. utensil | _____ | _____ |
| 25. powder | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 1 - Trial 5)

SESSION 1 TRIAL 5

TIME: _____

NAME: _____

DATE: _____

WORD

1. digit _____
2. welfare _____
3. senator _____
4. poverty _____
5. victim _____
6. mental _____
7. congress _____
8. mustard _____
9. congratulate _____
10. utensil _____
11. democratic _____
12. conference _____
13. microphone _____
14. testimony _____
15. binoculars _____
16. walnut _____
17. cavity _____
18. powder _____
19. notify _____
20. vanilla _____
21. pistol _____
22. token _____
23. cathedral _____
24. visual _____
25. sacrifice _____

Appendix M - Material A

Whole Word Training - Data Sheet (Session 1 - Trial 6)

SESSION 1 TRIAL 6

TIME: _____

NAME: _____

DATE: _____

WORD

- 1. binoculars _____
- 2. poverty _____
- 3. cathedral _____
- 4. visual _____
- 5. digit _____
- 6. sacrifice _____
- 7. mustard _____
- 8. congratulate _____
- 9. token _____
- 10. democratic _____
- 11. victim _____
- 12. cavity _____
- 13. notify _____
- 14. congress _____
- 15. mental _____
- 16. vanilla _____
- 17. senator _____
- 18. pistol _____
- 19. testimony _____
- 20. conference _____
- 21. walnut _____
- 22. microphone _____
- 23. welfare _____
- 24. utensil _____
- 25. powder _____

Appendix M - Material A

Whole Word Training - Data Sheet (Session 2 - Trial 1)

SESSION 2 TRIAL 1

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>MEANING</u> | <u>WORD</u> |
|-------------------|-------------|----------------|-------------|
| 1. reduce | _____ | _____ | _____ |
| 2. communication | _____ | _____ | _____ |
| 3. burglar | _____ | _____ | _____ |
| 4. document | _____ | _____ | _____ |
| 5. constitutional | _____ | _____ | _____ |
| 6. target | _____ | _____ | _____ |
| 7. multiply | _____ | _____ | _____ |
| 8. commercial | _____ | _____ | _____ |
| 9. percentage | _____ | _____ | _____ |
| 10. tobacco | _____ | _____ | _____ |
| 11. portable | _____ | _____ | _____ |
| 12. vertical | _____ | _____ | _____ |
| 13. molecule | _____ | _____ | _____ |
| 14. surrender | _____ | _____ | _____ |
| 15. capacity | _____ | _____ | _____ |
| 16. modify | _____ | _____ | _____ |
| 17. violet | _____ | _____ | _____ |
| 18. memorial | _____ | _____ | _____ |
| 19. violence | _____ | _____ | _____ |
| 20. maintenance | _____ | _____ | _____ |
| 21. population | _____ | _____ | _____ |
| 22. metropolitan | _____ | _____ | _____ |
| 23. damage | _____ | _____ | _____ |
| 24. personal | _____ | _____ | _____ |
| 25. federal | _____ | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 2 - Trial 2)

SESSION 2 TRIAL 2

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|--------------------|-------------|-------------|
| 1. document | _____ | _____ |
| 2. target | _____ | _____ |
| 3. multiply | _____ | _____ |
| 4. personal | _____ | _____ |
| 5. commercial | _____ | _____ |
| 6. burglar | _____ | _____ |
| 7. percentage | _____ | _____ |
| 8. federal | _____ | _____ |
| 9. maintenance | _____ | _____ |
| 10. communication | _____ | _____ |
| 11. metropolitan | _____ | _____ |
| 12. violet | _____ | _____ |
| 13. capacity | _____ | _____ |
| 14. population | _____ | _____ |
| 15. damage | _____ | _____ |
| 16. portable | _____ | _____ |
| 17. molecule | _____ | _____ |
| 18. vertical | _____ | _____ |
| 19. reduce | _____ | _____ |
| 20. modify | _____ | _____ |
| 21. surrender | _____ | _____ |
| 22. memorial | _____ | _____ |
| 23. tobacco | _____ | _____ |
| 24. violence | _____ | _____ |
| 25. constitutional | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 2 - Trial 3)

SESSION 2 TRIAL 3

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|-------------------|-------------|-------------|
| 1. reduce | _____ | _____ |
| 2. communication | _____ | _____ |
| 3. burglar | _____ | _____ |
| 4. document | _____ | _____ |
| 5. constitutional | _____ | _____ |
| 6. target | _____ | _____ |
| 7. multiply | _____ | _____ |
| 8. commercial | _____ | _____ |
| 9. percentage | _____ | _____ |
| 10. tobacco | _____ | _____ |
| 11. portable | _____ | _____ |
| 12. vertical | _____ | _____ |
| 13. molecule | _____ | _____ |
| 14. surrender | _____ | _____ |
| 15. capacity | _____ | _____ |
| 16. modify | _____ | _____ |
| 17. violet | _____ | _____ |
| 18. memorial | _____ | _____ |
| 19. violence | _____ | _____ |
| 20. maintenance | _____ | _____ |
| 21. population | _____ | _____ |
| 22. metropolitan | _____ | _____ |
| 23. damage | _____ | _____ |
| 24. personal | _____ | _____ |
| 25. federal | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 2 - Trial 4)

SESSION 2 TRIAL 4

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|--------------------|-------------|-------------|
| 1. document | _____ | _____ |
| 2. target | _____ | _____ |
| 3. multiply | _____ | _____ |
| 4. personal | _____ | _____ |
| 5. commercial | _____ | _____ |
| 6. burglar | _____ | _____ |
| 7. percentage | _____ | _____ |
| 8. federal | _____ | _____ |
| 9. maintenance | _____ | _____ |
| 10. communication | _____ | _____ |
| 11. metropolitan | _____ | _____ |
| 12. violet | _____ | _____ |
| 13. capacity | _____ | _____ |
| 14. population | _____ | _____ |
| 15. damage | _____ | _____ |
| 16. portable | _____ | _____ |
| 17. molecule | _____ | _____ |
| 18. vertical | _____ | _____ |
| 19. reduce | _____ | _____ |
| 20. modify | _____ | _____ |
| 21. surrender | _____ | _____ |
| 22. memorial | _____ | _____ |
| 23. tobacco | _____ | _____ |
| 24. violence | _____ | _____ |
| 25. constitutional | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 2 - Trial 5)

SESSION 2 TRIAL 5

TIME: _____

NAME: _____

DATE: _____

WORD

- 1. reduce _____
- 2. communication _____
- 3. burglar _____
- 4. document _____
- 5. constitutional _____
- 6. target _____
- 7. multiply _____
- 8. commercial _____
- 9. percentage _____
- 10. tobacco _____
- 11. portable _____
- 12. vertical _____
- 13. molecule _____
- 14. surrender _____
- 15. capacity _____
- 16. modify _____
- 17. violet _____
- 18. memorial _____
- 19. violence _____
- 20. maintenance _____
- 21. population _____
- 22. metropolitan _____
- 23. damage _____
- 24. personal _____
- 25. federal _____

Appendix M - Material A

Whole Word Training - Data Sheet (Session 2 - Trial 6)

SESSION 2 TRIAL 6

TIME: _____

NAME: _____

DATE: _____

WORD

- 1. document _____
- 2. target _____
- 3. multiply _____
- 4. personal _____
- 5. commercial _____
- 6. burglar _____
- 7. percentage _____
- 8. federal _____
- 9. maintenance _____
- 10. communication _____
- 11. metropolitan _____
- 12. violet _____
- 13. capacity _____
- 14. population _____
- 15. damage _____
- 16. portable _____
- 17. molecule _____
- 18. vertical _____
- 19. reduce _____
- 20. modify _____
- 21. surrender _____
- 22. memorial _____
- 23. tobacco _____
- 24. violence _____
- 25. constitutional _____

Appendix M - Material A

Whole Word Training - Data Sheet (Session 3 - Trial 1)

SESSION 3 TRIAL 1

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>MEANING</u> | <u>WORD</u> |
|------------------|-------------|----------------|-------------|
| 1. summary | _____ | _____ | _____ |
| 2. verdict | _____ | _____ | _____ |
| 3. positive | _____ | _____ | _____ |
| 4. veteran | _____ | _____ | _____ |
| 5. calculation | _____ | _____ | _____ |
| 6. fantasy | _____ | _____ | _____ |
| 7. surplus | _____ | _____ | _____ |
| 8. conclude | _____ | _____ | _____ |
| 9. paradise | _____ | _____ | _____ |
| 10. walrus | _____ | _____ | _____ |
| 11. robbery | _____ | _____ | _____ |
| 12. major | _____ | _____ | _____ |
| 13. construction | _____ | _____ | _____ |
| 14. category | _____ | _____ | _____ |
| 15. poetry | _____ | _____ | _____ |
| 16. secretary | _____ | _____ | _____ |
| 17. corporation | _____ | _____ | _____ |
| 18. politics | _____ | _____ | _____ |
| 19. location | _____ | _____ | _____ |
| 20. domestic | _____ | _____ | _____ |
| 21. combine | _____ | _____ | _____ |
| 22. magical | _____ | _____ | _____ |
| 23. comment | _____ | _____ | _____ |
| 24. piggy | _____ | _____ | _____ |
| 25. conductor | _____ | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 3 - Trial 2)

SESSION 3 TRIAL 2

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|------------------|-------------|-------------|
| 1. location | _____ | _____ |
| 2. category | _____ | _____ |
| 3. poetry | _____ | _____ |
| 4. combine | _____ | _____ |
| 5. secretary | _____ | _____ |
| 6. magical | _____ | _____ |
| 7. comment | _____ | _____ |
| 8. walrus | _____ | _____ |
| 9. conductor | _____ | _____ |
| 10. summary | _____ | _____ |
| 11. paradise | _____ | _____ |
| 12. fantasy | _____ | _____ |
| 13. major | _____ | _____ |
| 14. corporation | _____ | _____ |
| 15. piggy | _____ | _____ |
| 16. veteran | _____ | _____ |
| 17. construction | _____ | _____ |
| 18. positive | _____ | _____ |
| 19. rdict | _____ | _____ |
| 20. calculation | _____ | _____ |
| 21. politics | _____ | _____ |
| 22. conclude | _____ | _____ |
| 23. surplus | _____ | _____ |
| 24. robbery | _____ | _____ |
| 25. cosmetic | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 3 - Trial 3)

SESSION 3 TRIAL 3

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|------------------|-------------|-------------|
| 1. summary | _____ | _____ |
| 2. verdict | _____ | _____ |
| 3. positive | _____ | _____ |
| 4. veteran | _____ | _____ |
| 5. calculation | _____ | _____ |
| 6. fantasy | _____ | _____ |
| 7. surplus | _____ | _____ |
| 8. conclude | _____ | _____ |
| 9. paradise | _____ | _____ |
| 10. walrus | _____ | _____ |
| 11. robbery | _____ | _____ |
| 12. major | _____ | _____ |
| 13. construction | _____ | _____ |
| 14. category | _____ | _____ |
| 15. poetry | _____ | _____ |
| 16. secretary | _____ | _____ |
| 17. corporation | _____ | _____ |
| 18. politics | _____ | _____ |
| 19. location | _____ | _____ |
| 20. domestic | _____ | _____ |
| 21. combine | _____ | _____ |
| 22. magical | _____ | _____ |
| 23. comment | _____ | _____ |
| 24. piggy | _____ | _____ |
| 25. conductor | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 3 - Trial 4)

SESSION 3 TRIAL 4

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|------------------|-------------|-------------|
| 1. location | _____ | _____ |
| 2. category | _____ | _____ |
| 3. poetry | _____ | _____ |
| 4. combine | _____ | _____ |
| 5. secretary | _____ | _____ |
| 6. magical | _____ | _____ |
| 7. comment | _____ | _____ |
| 8. walrus | _____ | _____ |
| 9. conductor | _____ | _____ |
| 10. summary | _____ | _____ |
| 11. paradise | _____ | _____ |
| 12. fantasy | _____ | _____ |
| 13. major | _____ | _____ |
| 14. corporation | _____ | _____ |
| 15. piggy | _____ | _____ |
| 16. veteran | _____ | _____ |
| 17. construction | _____ | _____ |
| 18. positive | _____ | _____ |
| 19. verdict | _____ | _____ |
| 20. calculation | _____ | _____ |
| 21. politics | _____ | _____ |
| 22. conclude | _____ | _____ |
| 23. surplus | _____ | _____ |
| 24. robbery | _____ | _____ |
| 25. domestic | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 3 - Trial 5)

SESSION 3 TRIAL 5

TIME: _____

NAME: _____

DATE: _____

WORD

- 1. summary _____
- 2. verdict _____
- 3. positive _____
- 4. veteran _____
- 5. calculation _____
- 6. fantasy _____
- 7. surplus _____
- 8. conclude _____
- 9. paradise _____
- 10. walrus _____
- 11. robbery _____
- 12. major _____
- 13. construction _____
- 14. category _____
- 15. poetry _____
- 16. secretary _____
- 17. corporation _____
- 18. politics _____
- 19. location _____
- 20. domestic _____
- 21. combine _____
- 22. magical _____
- 23. comment _____
- 24. piggy _____
- 25. conductor _____

Appendix M - Material A

Whole Word Training - Data Sheet (Session 3 - Trial 6)

SESSION 3 TRIAL 6

TIME: _____

NAME: _____

DATE: _____

WORD

- 1. location _____
- 2. category _____
- 3. poetry _____
- 4. combine _____
- 5. secretary _____
- 6. magical _____
- 7. comment _____
- 8. walrus _____
- 9. conductor _____
- 10. summary _____
- 11. paradise _____
- 12. fantasy _____
- 13. major _____
- 14. corporation _____
- 15. piggy _____
- 16. veteran _____
- 17. construction _____
- 18. positive _____
- 19. verdict _____
- 20. calculation _____
- 21. politics _____
- 22. conclude _____
- 23. surplus _____
- 24. robbery _____
- 25. domestic _____

Appendix M - Material A

Whole Word Training - Data Sheet (Session 4 - Trial 1)

SESSION 4 TRIAL 1

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>MEANING</u> | <u>WORD</u> |
|--------------------|-------------|----------------|-------------|
| 1. invisible | _____ | _____ | _____ |
| 2. destructive | _____ | _____ | _____ |
| 3. supervision | _____ | _____ | _____ |
| 4. contribution | _____ | _____ | _____ |
| 5. dictionary | _____ | _____ | _____ |
| 6. subject | _____ | _____ | _____ |
| 7. formula | _____ | _____ | _____ |
| 8. gossip | _____ | _____ | _____ |
| 9. transformer | _____ | _____ | _____ |
| 10. punctuation | _____ | _____ | _____ |
| 11. compliment | _____ | _____ | _____ |
| 12. objection | _____ | _____ | _____ |
| 13. civilization | _____ | _____ | _____ |
| 14. gorilla | _____ | _____ | _____ |
| 15. committee | _____ | _____ | _____ |
| 16. attractive | _____ | _____ | _____ |
| 17. prediction | _____ | _____ | _____ |
| 18. contradict | _____ | _____ | _____ |
| 19. dictator | _____ | _____ | _____ |
| 20. transportation | _____ | _____ | _____ |
| 21. confidential | _____ | _____ | _____ |
| 22. maximum | _____ | _____ | _____ |
| 23. subtraction | _____ | _____ | _____ |
| 24. cosmetic | _____ | _____ | _____ |
| 25. instructor | _____ | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 4 - Trial 2)

SESSION 4 TRIAL 2

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|--------------------|-------------|-------------|
| 1. formula | _____ | _____ |
| 2. committee | _____ | _____ |
| 3. punctuation | _____ | _____ |
| 4. invisible | _____ | _____ |
| 5. gorilla | _____ | _____ |
| 6. contradict | _____ | _____ |
| 7. dictator | _____ | _____ |
| 8. prediction | _____ | _____ |
| 9. contribution | _____ | _____ |
| 10. subject | _____ | _____ |
| 11. instructor | _____ | _____ |
| 12. maximum | _____ | _____ |
| 13. compliment | _____ | _____ |
| 14. objection | _____ | _____ |
| 15. subtraction | _____ | _____ |
| 16. dictionary | _____ | _____ |
| 17. confidential | _____ | _____ |
| 18. transformer | _____ | _____ |
| 19. gossip | _____ | _____ |
| 20. destructive | _____ | _____ |
| 21. supervision | _____ | _____ |
| 22. transportation | _____ | _____ |
| 23. civilization | _____ | _____ |
| 24. attractive | _____ | _____ |
| 25. cosmetic | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 4 - Trial 3)

SESSION 4 TRIAL 3

NAME: _____ **DATE:** _____

| | <u>WORD</u> | <u>WORD</u> |
|--------------------|-------------|-------------|
| 1. invisible | _____ | _____ |
| 2. destructive | _____ | _____ |
| 3. supervision | _____ | _____ |
| 4. contribution | _____ | _____ |
| 5. dictionary | _____ | _____ |
| 6. subject | _____ | _____ |
| 7. formula | _____ | _____ |
| 8. gossip | _____ | _____ |
| 9. transformer | _____ | _____ |
| 10. punctuation | _____ | _____ |
| 11. compliment | _____ | _____ |
| 12. objection | _____ | _____ |
| 13. civilization | _____ | _____ |
| 14. gorilla | _____ | _____ |
| 15. committee | _____ | _____ |
| 16. attractive | _____ | _____ |
| 17. prediction | _____ | _____ |
| 18. contradict | _____ | _____ |
| 19. dictator | _____ | _____ |
| 20. transportation | _____ | _____ |
| 21. confidential | _____ | _____ |
| 22. maximum | _____ | _____ |
| 23. subtraction | _____ | _____ |
| 24. cosmetic | _____ | _____ |
| 25. instructor | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 4 - Trial 4)

NAME: _____ DATE: _____

SESSION 4 TRIAL 4

| | <u>WORD</u> | <u>WORD</u> |
|--------------------|-------------|-------------|
| 1. formula | _____ | _____ |
| 2. committee | _____ | _____ |
| 3. punctuation | _____ | _____ |
| 4. invisible | _____ | _____ |
| 5. gorilla | _____ | _____ |
| 6. contradict | _____ | _____ |
| 7. dictator | _____ | _____ |
| 8. prediction | _____ | _____ |
| 9. contribution | _____ | _____ |
| 10. subject | _____ | _____ |
| 11. instructor | _____ | _____ |
| 12. maximum | _____ | _____ |
| 13. compliment | _____ | _____ |
| 14. objection | _____ | _____ |
| 15. subtraction | _____ | _____ |
| 16. dictionary | _____ | _____ |
| 17. confidential | _____ | _____ |
| 18. transformer | _____ | _____ |
| 19. gossip | _____ | _____ |
| 20. destructive | _____ | _____ |
| 21. supervision | _____ | _____ |
| 22. transportation | _____ | _____ |
| 23. civilization | _____ | _____ |
| 24. attractive | _____ | _____ |
| 25. cosmetic | _____ | _____ |

Appendix M - Material A

Whole Word Training - Data Sheet (Session 4 - Trial 5)

SESSION 4 TRIAL 5

TIME: _____

NAME: _____

DATE: _____

WORD

- 1. invisible _____
- 2. destructive _____
- 3. supervision _____
- 4. contribution _____
- 5. dictionary _____
- 6. subject _____
- 7. formula _____
- 8. gossip _____
- 9. transformer _____
- 10. punctuation _____
- 11. compliment _____
- 12. objection _____
- 13. civilization _____
- 14. gorilla _____
- 15. committee _____
- 16. attractive _____
- 17. prediction _____
- 18. contradict _____
- 19. dictator _____
- 20. transportation _____
- 21. confidential _____
- 22. maximum _____
- 23. subtraction _____
- 24. cosmetic _____
- 25. instructor _____

Appendix M - Material A

Whole Word Training - Data Sheet (Session 4 - Trial 6)

SESSION 4 TRIAL 6 **TIME:** _____

NAME: _____ **DATE:** _____

WORD

1. formula _____
2. committee _____
3. punctuation _____
4. invisible _____
5. gorilla _____
6. contradict _____
7. dictator _____
8. prediction _____
9. contribution _____
10. subject _____
11. instructor _____
12. maximum _____
13. compliment _____
14. objection _____
15. subtraction _____
16. dictionary _____
17. confidential _____
18. transformer _____
19. gossip _____
20. destructive _____
21. supervision _____
22. transportation _____
23. civilization _____
24. attractive _____
25. cosmetic _____

Appendix N

Syllable Segmentation Posttest**MATERIALS:**

1. Sample word cards (see Appendix N – Material A)
2. Syllable segmentation worksheet (see Appendix N – Material B)
3. Pencil

DIRECTIONS:

Participants were told, “I am going to give you a list of words. I would like you to look at each word on the list and read them out loud. If you can’t read a word, I will tell you the word. After you read a word, I would like you to say the syllables in the word, count the number of syllables by raising your fingers, and state the number of syllables counted. You will then draw circles around the syllables in each printed word, and write the number of syllables counted in the blank space provided next to each word on the worksheet”.

“Let me show you how I would like you to read the words on the list”.

Participants were shown the word, excellent, printed on an index card. The experimenter said, “This word says excellent. The syllables in the word are ex-cell-ent. (The experimenter said aloud the syllables and raised one finger at a time to match the sounds of the syllables and count them). There are three syllables in the word. Let me show you the syllables by drawing a circle around each syllable. (The experimenter drew circles around the three beats in the word excellent). Now let me write the number of syllables in the blank space next to the word. (The experimenter wrote the number of beats [i.e., 3] in the space next to the word excellent). Do you understand what to do? Good.”

“Now I want you to try reading some words using the special method I just taught you”. (Participants were shown two words, television and telephone, one at a time). You did a fine job reading those words. Here is a list of some more words that I would like you to read using the method you just practiced. (Participants were given a list of words). Are you ready? Good. Begin at the top. Do the best you can.”

PROCEDURES:

The syllable segmentation posttest was individually administered.

1. Participant was shown a sample multisyllabic word (e.g., excellent) and the researcher demonstrated the process of reading and segmenting the word into syllables (e. g., ex-cell-ent).
2. Participant was provided practice reading and segmenting two sample multisyllabic words (e.g., television and telephone) using the procedure demonstrated by the researcher.
3. Participant was presented with a list of multisyllabic words and he or she was asked to read and segment words using the syllable segmentation procedure practiced earlier.
4. Researcher acknowledged participant’s effort by saying, “You did very well. Thank you for trying hard”.

Appendix N – Material A

Syllable Segmentation Posttest - Sample Word Card

excellent

television

telephone

Appendix N – Material B

Syllable Segmentation Posttest – Worksheet

NAME: _____ DATE: _____

Read aloud each word below, say and count the syllables, circle the syllables in the printed words, and record the number of syllables in the blank space.

| <u>READ WORDS</u> | <u>CIRCLE SYLLABLES</u> | <u># OF SYLLABLES</u> |
|-------------------|-------------------------|-----------------------|
| historian | h i s t o r i a n | _____ |
| cultivation | c u l t i v a t i o n | _____ |
| computer | c o m p u t e r | _____ |
| manuscript | m a n u s c r i p t | _____ |
| nourishment | n o u r i s h m e n t | _____ |
| investigator | i n v e s t i g a t o r | _____ |
| fertilizer | f e r t i l i z e r | _____ |
| satisfactory | s a t i s f a c t o r y | _____ |
| tuberculosis | t u b e r c u l o s i s | _____ |
| interesting | i n t e r e s t i n g | _____ |
| enthusiastic | e n t h u s i a s t i c | _____ |
| distribute | d i s t r i b u t e | _____ |

Appendix O**Motivation Questionnaire****MATERIALS:**

1. Questionnaire (see Appendix O – Material A)
2. Pencil or pen

DIRECTIONS:

Participants were told, "I am going to give you a questionnaire. The questionnaire has five questions asking you to show the usefulness of the word reading practice for you. Let me read the directions and questions aloud for you." The experimenter read aloud the directions and questions. "Now, I would like you to read each question on your own and to circle the number that best shows the usefulness of the word reading practice for you. Circle number 1 if you think the word reading practice was "not useful at all", circle number 2 if it was of "very little" use, circle 3 if it was "somewhat" useful, circle 4 if it was "a lot" useful, and circle 5 if it was "a great deal" useful. Try to answer the questions as honestly as you can. Here is the questionnaire. Please write your name and today's date in the blank space provided at the top of the questionnaire. Remember, read each question and circle a number you think best shows your choice. Thank you for answering the questionnaire."

PROCEDURE:

The motivation questionnaire was individually administered to each participant.

1. Participant was given a questionnaire.
2. Directions and questions were read aloud for the participant.
3. The purpose and process of completing the questionnaire was explained.

Appendix O - Material A

Motivation Questionnaire

NAME: _____ DATE: _____

For each question given below, please circle the number that best shows the usefulness of the word reading practice for you.

1 = Not at all

4 = A lot

2 = Very little

5 = A great deal

3 = Some

1. How much did you enjoy participating in the word reading project?

(Low) 1 2 3 4 5 (High)

2. How much has practicing all these words helped you to read words in class or at home?

(Low) 1 2 3 4 5 (High)

3. How much has practicing all these words helped you to spell words in class or at home?

(Low) 1 2 3 4 5 (High)

4. How much have you used the word reading method to read words in class or at home?

(Low) 1 2 3 4 5 (High)

5. How much have you used the word reading method to spell words in class or at home?

(Low) 1 2 3 4 5 (High)

Appendix P

Mean Performance and Standard Deviations Reading Words During Training

| Sessions | Treatment Group | | | |
|--|-----------------|-------------|----------|-------------|
| | Syllable | | Word | |
| | <u>M</u> | <u>(SD)</u> | <u>M</u> | <u>(SD)</u> |
| Session 1-Trial 1 | | | | |
| Low (3 rd Level) Readers | 16.10 | (3.92) | 14.30 | (5.37) |
| High (4 th – 5 th Level) Readers | 20.80 | (3.22) | 21.70 | (2.05) |
| Session 2 -Trial 1 | | | | |
| Low (3 rd Level) Readers | 19.30 | (4.73) | 16.20 | (5.61) |
| High (4 th – Level) Readers | 20.30 | (3.19) | 22.30 | (2.16) |
| Session 3 -Trial 1 | | | | |
| Low (3 rd Level) Readers | 19.70 | (4.13) | 15.80 | (7.03) |
| High (4 th – Level) Readers | 22.50 | (2.36) | 23.50 | (1.50) |
| Session 4 -Trial 1 | | | | |
| Low (3 rd Level) Readers | 19.60 | (3.50) | 17.00 | (4.96) |
| High (4 th – Level) Readers | 21.70 | (2.40) | 22.80 | (1.22) |

Note. There were 20 students in each treatment condition, 10 reading at the low (3rd grade-equivalent) level and 10 reading at the high (4th – 5th grade-equivalent) level. A total of 25 words were read on the first trial of each training session.

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