THE EFFECT OF WRITTEN WORD WORK USING WORD BOXES ON THE DECODING FLUENCY OF YOUNG AT-RISK READERS

By

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A dissertation submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

WASHINGTON STATE UNIVERSITY
College of Education

MAY 2007
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ACKNOWLEDGEMENTS

I am appreciative of the assistance I received from many wise and charitable individuals I met during my doctoral degree experience. My committee under the leadership of Darcy Miller gently guided and encouraged me through the research process. I am indebted to Dr. Miller for her kindness, flexibility, and confidence in my abilities. I would also like to thank Michael Dunn, Roxanne Hudson, and Paulette Mills for their mentorship and valuable feedback before and during the course of this project. I am grateful to Jennifer Beller, Anne Campbell, Roxanne Hudson, Paulette Mills and Kelly Ward whose friendship and instruction inspired me to reach my goal. My gratitude is extended to John Bellow who provided technical assistance at a critical time in the writing process.

I would like to acknowledge the many people who willingly volunteered to be a part of this research study. The production team of Linda Byerley, Becky Cruz, Pam Deccio, Lori Kissinger, and Emma Northrop brought life and energy to the project. The students were the heart of this study and their efforts and commitment are admired and appreciated. The principal and staff where this study took place supported the project with their cooperation, time and interest. I am honored to know you.

Finally, I am grateful for my family and friends who surround me daily with their love. They believed I could accomplish my goal, continued to tell me that age is not a deterrent, and celebrated my success.

Claudia Lynne Angus
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Abstract

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May 2007

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The effect of written word work using word boxes on the decoding fluency of nine first grade students at-risk for reading failure was investigated. A multiple baseline across-participants single subject research design was implemented to measure the effect on students’ rate and accuracy of phoneme segmentation fluency, non-word reading fluency, and oral reading fluency, and the accuracy of spelling. Students were screened and assessed using Dynamic Indicators for Basic Early Literacy Skills (DIBELS) subtests for phonological segmentation fluency (PSF), nonsense word fluency (NWF), and oral reading fluency (ORF) and a six word spelling test. Additional data were collected on students’ reading comprehension, receptive vocabulary, and classroom behaviors at the beginning and end of the study. Research was conducted under three conditions: general education curriculum, small group instruction, and a reading intervention that targeted grapheme-phoneme correspondence using guided sentence writing and word boxes. Students participated in a twenty-five minute small group reading intervention four days a week for 6 to 18 weeks depending on when each group entered the study. The results of this study suggest that written word work using word boxes positively impacted students’ decoding skills. The most significant effects were noted in the
rate and accuracy of non-word fluency and accuracy of spelling. Lower effect sizes were reported in phoneme segmentation and oral reading fluency measures. Two students reached DIBELS grade level goals in PSF and NWF measures by the end of the study. Instruction in written word work that uses guided sentence writing in combination with word boxes appears to be an effective intervention for students who encounter difficulty mastering the alphabetic principle and struggle with decoding fluency.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>viii</td>
</tr>
<tr>
<td><strong>CHAPTERS</strong></td>
<td></td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2. REVIEW OF THE LITERATURE</td>
<td>6</td>
</tr>
<tr>
<td>3. METHODS</td>
<td>35</td>
</tr>
<tr>
<td>4. RESULTS</td>
<td>53</td>
</tr>
<tr>
<td>5. DISCUSSION</td>
<td>78</td>
</tr>
<tr>
<td>6. REFERENCES</td>
<td>96</td>
</tr>
<tr>
<td><strong>APPENDIX</strong></td>
<td></td>
</tr>
<tr>
<td>A. WORD LIST FOR SPELLING ASSESSMENT</td>
<td>115</td>
</tr>
<tr>
<td>B. SPELLING TEST FORM</td>
<td>116</td>
</tr>
<tr>
<td>C. MATERIALS</td>
<td>117</td>
</tr>
<tr>
<td>D. PRESCRIBED WORD LIST FOR WORD BOX WARM-UPS</td>
<td>119</td>
</tr>
<tr>
<td>E. TEACHER SESSION NOTES: VOCABULARY AND COMPREHENSION</td>
<td>122</td>
</tr>
<tr>
<td>F. TEACHER SESSION NOTES: WORD BOX/GUIDED SENTENCE WRITING</td>
<td>123</td>
</tr>
<tr>
<td>G. OBSERVER CHECKLIST: WORD BOX/GUIDED WRITING TREATMENT</td>
<td>124</td>
</tr>
<tr>
<td>H. OBSERVER CHECKLIST: SMALL GROUP TREATMENT</td>
<td>126</td>
</tr>
<tr>
<td>I. INTERVENTION SOCIAL ACCEPTABILITY MEASURE</td>
<td>127</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

1. Effect Size of Phonemic Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency and Spelling Measures .................................................................57

2. Effect Size of Errors on Phonemic Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency and Spelling Measures ..................................................58

3. Response Rates Indicated by Slope Levels ..............................................................................60

4. Phonemic Blending of Nonsense Words on NWF Measures ....................................................63

5. Effect Size of Small Group Treatment on Phonemic Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency and Spelling Measures ..................................................68

6. Standard Scores of Reading Comprehension and Receptive Vocabulary Assessments ........72

7. Raw Scores of Reading Comprehension and Receptive Vocabulary Assessments ................73

8. Results of Burk’s Behavior Rating Scale ...............................................................................75
LIST OF FIGURES

1. Model of parallel-distributed processing of reading……………………………………10
2. Results of phoneme segmentation fluency measures……………………………………55
3. Results of errors of phoneme segmentation fluency measures…………………………56
4. Results of nonsense word fluency measures………………………………………………61
5. Results of errors of nonsense word fluency measures……………………………………62
6. Results of oral reading fluency measures…………………………………………………65
7. Results of errors on oral reading fluency measures………………………………………66
8. Results of spelling measures………………………………………………………………69
9. Results of errors on spelling measures…………………………………………………70
Dedication

This dissertation is dedicated to my dear sister, Wendie, who while battling cancer, continued to provide inspiration and confidence to her younger sister.
CHAPTER ONE
INTRODUCTION

This investigation examined the effect of a reading intervention on the decoding skills of young at-risk readers. The intervention utilized word boxes and guided sentence writing to explicitly teach small groups of first grade students how to spell and read words and sentences. Effective interventions that target early reading delays are needed to remedy the current illiteracy rate documented in school systems across America.

In the mid-1960s, The National Institute of Child Health and Human Development began studying reading instruction in the United States. During the next thirty-five years, the extent of illiteracy and the problems associated with a non-reading populace became noticeably apparent. Dr. G. Reid Lyon (1997), then Chief of the Child Development and Behavior Branch of NICHD, in his statement before the House Committee on Education and the Workforce reported that for 60% of children in America learning to read presented problems; the extent of which crossed economic, ethnic and social boundaries. Citing the implications that arise from an illiterate population, Reid argued that the current situation created a significant educational and public health concern. He included in his report what he defined as obvious causes that led to the lack of reading achievement.

Given this general background, recent research has been able to identify and replicate findings which point to at least four factors that hinder reading development among children…These four factors include deficits in phoneme awareness and the development of the alphabetic principle, deficits in acquiring reading comprehension strategies and applying them to the reading of text, the development and maintenance of motivation to learn to read, and the inadequate preparation of teachers. (p. 6)
In an effort to change the course of reading instruction in the United States, the federal government took a leadership role. At the request of the Congress, a panel of literacy experts, researchers, reading teachers and parents was assembled to assess the implications of scientifically based research literature addressing the acquisition of reading. The results of the Panel’s work were described in the widely circulated and highly acclaimed National Reading Panel Report (2000). The report emphasized among other findings the importance of explicit reading instruction and the need for highly trained teachers.

The National Reading Panel’s (NRP) recommendations were aimed at reading instruction for the general population. The members of the panel concluded that research demonstrated positive changes in reading acquisition were possible for most readers. Still, there was inconclusive evidence that all children would benefit from the research-based techniques particularly children who were low achievers or had learning disabilities, cognitive delays or physical disabilities. The panel recommended that further high quality research was needed in all components of the reading process but especially for children who didn’t respond to classroom instruction (National Reading Panel, 2000).

More recent literacy research has focused on areas identified by the Panel as lacking in evidence, particularly in the area of phonics instruction for at-risk readers. Several researchers have examined explicit instruction in phonics as it relates to struggling readers (Berninger, Vermeulen, Abbott, & McCutchen, 2003; Denton, Vaughn, & Fletcher, 2003; Foorman & Torgesen, 2001; Joseph & McCachran, 2003; Speece, Mills, Ritchey, & Hillman, 2003; White, 2005). From a review of the literature, Denton et al. conclude that “Although many children learn to read with seemingly little guidance from the teacher, those who struggle require instruction that is directive and explicit…Explicit instruction addressing the instructional needs
of struggling readers is essential” (p. 202). Less clear in the research literature is how teachers should package explicit reading instruction for their struggling readers.

Despite what appears to be sweeping changes in literacy instruction as a result of research-based applications, a large number of students continue to be at risk for reading failure. According to the National Center of Education Statistics (NCES), no significant changes were found since 1992 in reading scores of fourth grade students who are reading at or above the basic reading level (NCES, 2007). Fourth grade reading assessments showed only 31 percent of students are performing at or above proficient standards while a startling 36 percent of students read below basic instructional levels (NCES, 2007). Clearly, the growing body of reading research has yet to make a significant impact on at-risk young readers.

Applying theory to practice is a necessary step if improvements in student reading scores are to be achieved. Teachers face a major challenge in knowing how to present explicit instruction to gain students’ interest and sustain their motivation. The need for practical applications of research recommendations is apparent. Most importantly, proven reading interventions focused on prevention and remediation that can be implemented within the limits of the school setting need to be identified.

One promising technique, using word boxes to teach phoneme-grapheme relationships, has been studied in different formats and with different age groups (Clay, 1993; Compton, 2000; Elkonin, 1963; Joseph, 1998, 2002a., 2002b.; Joseph & McCachran, 2003). Elkonin introduced word boxes as a method to teach preschool children that words can be divided into individual units. Clay incorporated the use of word boxes in the Reading Recovery® program that is aimed at young low achieving readers. Joseph and McCachran have reported positive results using word boxes with at-risk readers and students with learning disabilities.
Yet to be studied is the use of word boxes as a tool for the explicit teaching of phonics in combination with guided sentence writing, a technique that emphasizes the relationship between the reading and writing. The positive correlation between learning to read and learning to write is well documented (Berninger, Vermeulen, Abbott, & McCutchen, 1995; Ehri, 2000; O’Connor & Jenkins, 1995; Rayner, Foorman, Perfetti, & Seidenberg, 2001). Guided sentence writing provides the teacher and student a meaningful experience to examine words and build sentences using the student’s own language and ideas.

The purpose of the present investigation was to gain additional understanding of how best to design reading interventions that support the reading development of emergent readers who have difficulty developing the alphabetic principle. Specifically, the study examined an instructional practice designed to increase the decoding fluency skills of young readers who are at-risk for reading problems.

The primary research question guiding this study was as follows: Will a reading intervention that combines written word work and word boxes increase the decoding fluency skills of young at-risk readers? The research goal was accomplished by implementing a single-subject research design that compared guided sentence writing using word boxes to conditions of whole group general education reading instruction and small group instruction. Administration of the Dynamic Indicator of Basic Early Literacy Skill™ (DIBELS) subtests measuring phoneme segmentation fluency (PSF), nonsense word fluency (NWF), and oral reading fluency (ORF) and spelling assessments of six phonetically regular words were conducted in two week intervals. Data collected on the number of correct responses and errors per minute on the DIBELS measures and the number of correctly and incorrectly placed letters on the spelling measures were compared over time for effect levels.
Developing proven reading interventions that address the large student population at-risk for achieving reading proficiency is timely and important. Educators are concerned and are seeking student and teacher-friendly reading supports that can be administered in educational settings. This study examined one possible option of support for emergent readers who have difficulty with learning the alphabetic principles and decoding fluency.
CHAPTER TWO

REVIEW OF THE LITERATURE

Learning to read is an essential milestone in a literate society. Reading remains the primary avenue for accessing information from sources such as books, computer screens, periodicals, and environmental signs. Clearly, economic opportunities for adults with low levels of literacy are minimized in an economy that depends on high levels of literacy (Lyon, 1997; Torgeson, 2002). Recognizing the importance of reading, American citizens allocate one half trillion dollars annually to educate students in kindergarten through twelfth grade (Sweet, 2004). Legislative branches continue to support rigorous reading research agendas and accountability-based reading programs. Despite this longstanding focus on reading research and instruction, a startling one-third of students enrolled in public schools in the United States are unable to demonstrate age level reading skills by the time they graduate from high school (NCES, 2007).

To address this issue, recent federal legislation commonly known as No Child Left Behind (NCLB), requires students to reach grade proficient standards in reading by third grade (U.S. Dept. of Education, 2002). NCLB legislation mandates that research-based instruction regarding reading be implemented particularly for students identified in special population groups such as students who are economically disadvantaged, students in racial and ethnic minority groups, and students enrolled in special education programs. Raising the student population reading level is an ambitious goal requiring thoughtful consideration of the present knowledge base and crafted implementation of instructional techniques.

The purpose of this review of the literature is to provide information about: (a) the longstanding body of reading literature as it pertains to beginning readers and (b) the current reading
research addressing the identification and instruction of young readers who are at-risk for reading failure.

The Reading Process

Researchers have diligently pursued the pieces to the reading acquisition puzzle for over forty years. The result is an abundant body of reading research that forms a well-established and detailed picture of how a child learns to read. Not without controversy, reading research has undergone four major comprehensive reviews of the literature (Adams, 1990; Chall, 1967; National Reading Panel, 2000; Snow, Burns, & Griffin, 1998). Forming similar conclusions, the reports emphasize that the ultimate goal of reading is to comprehend meaning from the text. However, to attain this goal the reader must be able to decipher the alphabetic code and establish a connection to and understanding of each word on the page. Contrary to whole-word and whole-language approaches, the major body of reading research contends that learning to read is based on an awareness of the phonological idiosyncrasies of the English language and a working understanding of the alphabetic principles that includes learning letter and sound relationships as well as knowing the logic and conventions surrounding their use (Adam, 2002). The following paragraphs will discuss the reading process in terms of a theoretical framework, reading model, and skill areas.

Connectionist Theory

Current reading models are diverse and embrace a continuum of theoretical bases from developmental to constructionist to information processing (Ruddell & Unrau, 2004). Several reading researchers adhere to the connectionist theory as the theoretical framework that can more precisely explain the reading process based on the understandings emerging from reading research (Adams, 1990; Berninger & Richards, 2002; Foorman, 1994; Rayner et al., 2001;
Schwartz, 1980; Stanovich, 2000). Introduced over twenty-five years ago, connectionism, an interactive information processing perspective, is evolving from work in the fields of neurobiology, computer science, electrical engineering, statistics, and cognitive psychology (McMurray, 2000). McClelland and Rumelhart (1981) and McClelland, Rumelhart and Hinton (1986) were instrumental in the early development and application of the connectionist theory to the acquisition of reading.

Connectionists conceptualize that experience precipitates learning and stimulates the formation of connections between processing units. Information, gained during a learning experience, is held in the patterns of neural connections and strengthened by repetition (Adams, 1990; Rayner et al, 2001). Bereiter (1991) explains connectionism as learned behavior being “distributed across the whole network” and not localized in one particular spot. The matrix of connections holds the knowledge and repeated experience strengthens the pattern of response. This is consistent with current brain research that shows repeated practice and novel experiences stimulate cell growth and solidifies neural connections (Berninger & Richards, 2002). Applied to early literacy, this type of associative learning supports the use of skill-based explicit instruction to establish basic reading skills that leads to automaticity when reading connected text (Crawford, 1995).

A key understanding of connectionism is the concept of parallel distributed processing (PDP) that allows information to be processed in more than one way at the same time. The connectionist theory deviates from former accepted logic building theories by discrediting the idea of rule-based learning and single item processing. Logic building theories surmise that the brain follows a sequential pattern when processing information thus limiting the brain’s ability to activate more than one area of the brain at a time (Bereiter, 1991). In contrast, connectionists
speculate that learning happens as information is processed by several modalities in the brain simultaneously.

Bowers (2002) challenges the strict adherence to the parallel distributing approach and argues for the existence of localized representation as evidenced in regard to reading tasks involving monosyllable and non word naming. He contends that localized representation is occurring at some level during the reading process and that the connectionist models do, at times, demonstrate learning as localized representations. Bowers suggests connectionist theorists consider that localized representation may play a role in the storage and retrieval of information in conjunction with parallel distributing processes. Arguing that the connectionist theory is yet to be fully developed, Bowers’ discussion is helpful in continuing the quest for additional knowledge and understanding concerning the theoretical formulation of cognitive processing.

Functional computerized reading models are created that incorporate elements of the connectionist theory as applied to reading. Thus, the connectionist theory provides additional understanding about reading in three ways: (a) models can actually be tested using computer technology, (b) models portray reading in basic principles of learning that are common to aspects of language and cognition, and (c) models provide a new way of thinking about how knowledge is represented, for example, connectionist theorists identify learning in terms of encoding rather than entries (Bowers, 2002; Rayner et al., 2001). One such reading model that emerged from a connectionist theoretical framework was introduced by Marilyn Adams.

Adams Model

Marilyn Adams (1990), in her foundational book *Beginning to Read: Thinking and Learning about Print*, diagrams a reading model (see Figure 1) based on an earlier model by connectionist theorists, Seidenberg and McClelland (1989). Adams (2002) contends that the
argument of whether reading occurs from meaning to print or print to meaning no longer has relevance. She explains, “All levels of processing are assumed to be active and interactive at once, working in mutual coordination with each other” (p. 69). As a child perceives a written word, Adams (1990) theorizes that four types of processors are active and interactive at the same time: the orthographic processor, phonological processor, semantic processor, and the context processor.

*Figure 1.* Model of parallel-distributed processing of reading (From Adams, 1990).

The orthographic processor

The orthographic processor is stimulated by the sight of written letters or words. Print recognition is the major function of the orthographic processor which allows the reader to perceive letter shapes, word chunks, and letter patterns. The reader, particularly a young reader, attempts to gain meaning from letters and words by connecting the symbol to a sound or
associated visual memory. The orthographic processor thus has a direct and interrelated connection to the phonological processor and semantic processor.

**Phonological processor**

The phonological processor stores and identifies speech sounds. This processor could be described as *our quiet reading voice*. Developed through experiences with oral speech, the phonological processor associates word and letter sounds to orthographic forms. Readers who have not developed phonological processing have difficulty rhyming, segmenting, and decoding words. The phonological processor exchanges information with the orthographic and semantic processors as sound-letter associations are made and word meaning is pursued.

**Semantic processor**

The semantic processor is the center of the reading process and represents the primary goal of the reader. The semantic processor, triggered by either the orthographic or phonological processors, searches for appropriate meanings to be tagged on the oral or visual stimuli. The processor stores meaning associations for words and is considered the holding bin for a reader’s lexicon. When the meaning of a word requires the interpretation by context, the semantic processor refers to the context processor to consider all meaning options for the word and analyzes the use of the word within the sentence structure.

**Context processor**

The context processor is used to analyze word meaning within the context of a sentence. Experience with a variety of reading text and assorted background knowledge is helpful when the reader is asked to discern the correct meaning of a word. For skillful readers to access the context processor, the other three processors must provide reliable information. A second condition, that of automatic processing of letter, sound, and meaning, must function for the brain
to focus attention on the contextual meaning of the text. Young readers may not fully engage the context processor because they are still laboring over word and letter identification. The context processor only exchanges information and forms connections with the semantic processor.

The Adam’s model depicts the individual reader in action. Suggesting a strong relationship between letter and sound recognition, the model lends itself to explicit teaching of reading skills with an emphasis on phonics. The model incorporates the importance of comprehending meaning from text but suggests that without the development of basic reading skills, the reader will have difficulty accessing the meaning from the text. The strength of the model is the ability to pinpoint readers’ deficiencies and suggest interventions to strengthen connections between processors. The Adams model is particularly helpful in providing an explanation to the processing units and automaticity observed in successful readers.

Decoding Fluency

Adams (2002) emphasizes that the parallel-distributed process occurs in mega seconds as a reader embraces written text. A skilled reader learns to automatically move information through the processors thereby accessing information from all the processors to comprehend the written message. The skilled reader’s networking of these interactions happens so effortlessly that the idea of words and letters being processed on the orthographic and phonological level may be missed. In addition, for normally developing readers, the frequent retrieval of the same word form creates stronger neural connections that integrate to structure patterns that are more efficient to recall (Pugh et al., 2001). Thus, practice in letter sounds, words, and repeated readings are sound strategies for building decoding fluency (Adams, 1990).

As the brain learns to automatically recognize certain word patterns, more focused attention can be directed to comprehending the text. For students struggling to decode words,
focused attention must remain at the letter-sound level which creates difficulties in comprehending the meaning of the text (Snow et al., 1998). Torgesen, et al. (2001) agrees that the difficulty encountered by poor readers to accurately decipher written text appears to happen at the word recognition level. Without automaticity of single words, reading fluency levels are severally impacted (Stanovich, 2000). Familiarity with letter-sound relationships and blending to produce words must become automatic for students to achieve fluency while reading. The development and interchange of skill areas associated with the reading process and fluency development are discussed in more details.

*Phonological Awareness*

Phonological awareness is defined as a person’s sensitivity to the sound structure of spoken words (Rayner, et al., 2001; Lane, Pullen, Eisele, & Jordan, 2002). Considered an inclusive term associated with the detection of speech sounds, phonological awareness incorporates such abilities as matching, blending, segmenting, deleting, rhyming and manipulating sounds (Stanovich, 2000). Phonemic awareness, a more sophisticated level of phonological awareness, specifically addresses the ability to attend to the individual units of sounds and the sequencing of sounds to form words. Therefore, the development of phonological awareness leads directly to understanding and associating letters to sounds (Snow et al., 1998).

Performance on phonological awareness tasks is highly correlated with learning to read (Adams, 1990; National Reading Panel, 2000; Snow et al., 1998). Phonological processing abilities are strong predictors of later reading outcomes even more so than general intelligence (Stanovich, 2000). Interestingly, Snow, et al. (1998) point out that at the early kindergarten level the predictive values of phonological testing appear to identify those children who will later
become excellent readers rather than spotting children with reading problems. This may be due to the amount of exposure to language before entering kindergarten.

Early childhood language experiences influence the level of phonological awareness a child demonstrates when entering kindergarten (Snow et al., 1998). For some children, phonological awareness is a natural extension from playing with sounds, being read stories and learning songs and rhymes (Goswami, 2002). However, for children who lack positive language experiences, several studies confirm that phonological awareness and particularly phonemic awareness must be explicitly taught to students to enable them to link into the interactive cycle of the reading process (Adams, 1990; Bradley & Bryant, 1983; Lovett, Steinbach, & Frijters, 2000; Nicholas, Rupley, Ricelman & Algozzine, 2004; Snow et al., 1998).

The effect of phonemic awareness instruction on learning to read and spell is analyzed in a quantitative meta-analysis conducted by the National Reading Panel (National Reading Panel, 2000). The Panel reports that for students low in phonemic awareness, instruction has a significant impact on helping increase phonemic awareness skills and leads to increases in reading achievement. Referring to the meta-analysis, Stahl (2002) suggests that phonological training is more closely associated with gains in decoding skills rather than more distal skills such as oral reading and comprehension. Roth, Speece, and Cooper (2002) found concurring evidence that phonological awareness is a good predictor of single-word reading at 1st and 2nd grade but not of comprehension. Although an important precursor to reading, phonological awareness is only one of the building blocks to becoming a successful reader.

Interestingly, Snow, et al.’s (1998) extensive and researched review of the phonological process observes that a bidirectional flow exists between phonological skills and reading letters. Although phonological understandings initiates the reading process, once a student begins to read
letters and words, phonological growth continues and becomes more sophisticated. Phonological improvement is noted in research studies that paired letter sound training with phonological awareness activities such as using letter forms and reading alphabet books (Hohn & Ehri, 1983; Murray, Stahl, & Ivey, 1996). Such research demonstrates that phonological development continues as students gain more exposure to sounds in association with print.

Alphabetic Principle

When phonological awareness takes root, understanding of the alphabet and mapping sounds to written letters is the next task young readers must master. Learning to read an alphabetic writing system like English requires that the student understand both the simplicity of one to one letter correspondence and the complexity of letter blends and letter combinations representing several different sounds (Rayner, et al., 2001). Skilled readers decode all the letters in each word and use the information to connect to the word meaning (Adams, 1990). Once mastered, decoding becomes a mechanism for deciphering unfamiliar words and leads to productive reading that builds new lexical knowledge (Adams, 2002; Rayner, et al., 2001).

Grasping the abstract concepts involved in the alphabetic principle can be difficult. The implementation of explicit instructional methods to teach the alphabetic principle results in greater success for young readers (Adam, 1990; National Reading Panel, 2000; Snow et al. 1998; Rayner et al., 2001). Ehri, Nunes, Stahl, and Willows (2001) comment on the effects of phonics instruction in a quantitative meta-analysis conducted for the National Reading Panel. The evaluation included 66 treatment-control comparisons derived from 38 experiments published since 1970. The researchers conclude from the statistical analysis that (a) kindergarten and first grade students benefit from systematic phonic instruction, (b) phonics instruction is linked to improved word reading and comprehension, (c) students who are classified as reading disabled
responded positively to phonics instruction as a form of remediation, and (d) first grade spelling skills increases when linked with systematic phonics instruction.

Common patterns of alphabetic knowledge development are described in the literature. Reading researchers propose that children who are learning to read an alphabetic language such as English pass through a series of developmental stages (Chall, 1983; Ehri, 1995; Gough & Juel, 1991). Chall theorizes six stages of reading development beginning at birth. The first three stages, prereading, initial decoding stage, and confirmation fluency and ungluing from print, describe how young children acquire mastery of the alphabetic principle through oral and visual exposure to language and text. Likewise, Gough and Juel (1991) describe the beginning stages of reading as involving word forms and deciphering of orthography. During the first phase, termed selective association, the child recognizes partial visual cues from letters in a word and associates the cues with a familiar known word. After refining the process by gathering more orthographic cues, the child enters the cipher stage where accuracy increases and reading real words begins.

Ehri (1995) argues for a four-phase model of reading acquisition leading to full understanding and use of the alphabetic principle. In the first stage, referred to as the pre-alphabetic phase, the child is able to retrieve meaning from visual cues and picture representations such as advertising logos. In the next phase, partial alphabetic, the reader begins associating sounds to letters and uses this information to attempt the pronunciation of new words using partial letter cues. As the student moves through this phase, more connections are made between letter and sound combinations. However, at this level unfamiliar words and more complex letter combinations are still a challenge. Subsequently, the full alphabetic phase is entered when the student has a solid understanding of consonant and vowel sounds and is able to
use alphabetic principles to decode new words. At this stage, the student is able to recall frequently read words. In the final stage, consolidated alphabetic level, the student attends to syllables, affixes, and reoccurring blends making multisyllabic words easier to decipher. It is at this level that reading is more fluent and word recognition more automatic for the mature reader.

In summary, phonological awareness and a working understanding of the alphabetic principle are foundational to the reading process. Children who lack these skills are at-risk for reading difficulties. Explicit systematic instruction is an effective intervening strategy that strengthens phonological and decoding skills as young children’s reading behaviors progress through a series of stages.

The Link between Reading and Spelling

A strong relationship exists between learning to read and learning to write. Substantial evidence demonstrates a significant correlation, $r = .70$, between a child’s ability to read and the ability to spell (Ehri, 2000). Ehri depicts the relationship this way:

Based on the theory and evidence, reading words and spelling words are like two sides of a coin in that both rely on the same knowledge sources in memory: knowledge about the alphabetic system and knowledge about the spellings of specific words. (p. 32)

It appears that learning how to write letters and spell words reinforces other reading skills emphasized during classroom reading instruction such as letter naming, phonemic segmentation, and word reading (Berninger et al., 1995; Ehri & Wilce, 1987; O’Connor & Jenkins, 1995; Perfetti, 1992; Rayner et al., 2001). Even in sight word recognition, knowledge of the alphabetic system is required to establish connections between spellings of words and their pronunciations in memory (Berninger, et al., 2001; Ehri, 1992, 1998; Foorman, Francis, Novy, & Liberman, 1991). Reading and writing are directly connected to the grapheme-phoneme link. The student
relies on the grapheme-phoneme relationship to read and the phoneme-grapheme relationship to spell (Ehri, 1997). Ehri points out that learning the alphabetic principle is central to both skills. However, because the English language is not phonetically predictable, readers and spellers depend on context, memory and analogy as well as decoding strategies to process words (Ehri, 2000; Tunmer & Chapman, 2002). Ehri contends that beginning readers benefit from explicit instruction that integrates reading and spelling skills rather than teaching the two skills as separate approaches that may result in a disconnect between the similar alphabetic skills needed for both reading and writing. Conversely, integration of reading and writing demonstrates effective teaching and fosters mutual growth (Berninger, et al. 2001; Ehri, 2000).

Summary

The process of learning to read is based on a student’s ability to connect letters to sounds. Long before formal instruction begins, children are exposed to language and are taught to play with words and depict the individual letter sounds in words. Phonological awareness built during this stage of reading development provides the springboard for letter-sound knowledge. Furthermore, learning to decode and encode words trains the brain to respond almost automatically allowing focused attention to concentrate on the meaning of the text. Explicit instruction and integrated skill development appears to build and strengthen a young reader’s literacy abilities. Adams (1990) succinctly writes, “…reading depends on the connection between spellings, speech sounds, and meaning” (p. 234). For some children, the connections are weak and learning to read is a struggle.

Young At-Risk Readers

Students who struggle to read are at a definite disadvantage in achieving academic success. Early identification of struggling readers coupled with immediate and targeted interventions are
promising strategies for changing this outcome. The next section will discuss research related to
the identification, instruction, and intervention programs that address young at-risk readers.

Identification of At-Risk Readers

The level of reading difficulties that primary students encounter varies greatly from mild to severe dyslexia (Snow et al. 1998). Categorizing students’ reading disabilities is problematic since differences are subtle and the measurement of deficient skills is not always well-defined. For instance, the discrepancy measure used in special education programs to identify students with learning disabilities, the majority who exhibit reading delays, is highly criticized (Speece, & Shekitka, 2002). Documenting a student’s gap between intelligence and achievement only provides a partial explanation of the reading problems faced by the student. Additionally, the procedure is often initiated too late to reverse the cycle of poor reading (Torgesen, 1998).

Newly introduced changes to special education legislation allow for evaluations to include a student’s response to intervention (RTI). Vaughn and Fuchs (2003) define the requirements of the RTI model as: (a) identified effective and targeted instructional and behavioral interventions, (b) coordination between highly effective general education instruction and supplemental instruction for at-risk readers and (c) assessment procedures for the purpose of screening and progress monitoring. The length and severity of a non response level is yet to be determined. Similarly, this evaluation procedure remains poorly defined, time consuming, and likely to not fully depict a reader’s deficit profile (Fuchs, Mock, & Young, 2003).

For too many children who demonstrate low reading skills, early identification systems are not in place. Poor readers remain undiscovered and are not likely to enter remediation until third grade (Torgesen, 1998). Late identification is costly for school systems and students. Remediation programs are more expensive to deliver and require additional staff, classroom space,
and instructional resources. For students who are asked to read material above their instructional reading level, reading leads to frustration and reliance on sublevel approaches to comprehension (Torgesen et al. 2001). Students with poor decoding skills rely heavily on guessing and contextual clues that result in creating word errors and fluency problems (Torgesen, 2002). This type of self-teaching actually decreases the odds that the student will develop into a skilled reader (Foorman et al., 1997; Torgesen, 1998). Inversely, Stanovich (2000), coining the term, the Mathew Effect, describes good readers as progressing in the reading process by using learned reading skills to gain experience, practice fluency and expand their reading vocabulary. Good readers apply reading skills to improve while poor readers are stymied by inadequate abilities to embrace the text, and, consequently they usually avoid reading. The prognosis is dismal for children who display poor reading skills. The probability of a child in first grade continuing to read below grade level three years later is reported in the 75% to 90% range (Chard & Kame’enui, 2000; Juel, 1988; Scarborough, 1998).

The importance of identifying students who experience difficulties in kindergarten and first grade is well supported in the reading literature (Adams, 1990; Bishop, 2003; McCardle et al., 2001; Snow et al., 1998; Stanovich, 2000; Torgesen, 1998). Torgesen states, “Most children who become poor readers experience early and continuing difficulties in learning how to accurately identify printed words” (p 32). McCardle, et al. advocate for a prevention program that identifies children as early as preschool and continues through kindergarten and first grade. On-going research continues in the development of assessment measures and identification instruments (Berninger & Richards, 2002; Bishop, 2003; McCardle et al., 2001). Identification of deficits in reading skills and recognition of known risk factors are important to spot early in young readers so a change in outcome is possible.
**Risk factors**

Risk factors associated with poor readers are emerging in the literature although no one factor or combinations of factors should be interpreted as absolutely predictive of later reading achievement. Snow et al. (1998) describe three groups of risk factors associated with poor readers: child-based, family-based, and community and school-based. Child-based risk factors are largely organic in nature and include severe cognitive deficiencies, hearing impairment, chronic otitis media, early language impairment and attention deficit/hyperactivity disorder. Gender appears not to be a risk factor as an equal amount of boys and girls exhibit reading difficulties (Fletcher & Lyon, 1998). Family-based risk factors include a family history of reading difficulties, limited opportunities for reading in the home, decreased value placed on reading, low quantity of language experiences in English, use of nonstandard dialect, and low socioeconomic status. Community-based risk factors are less well defined and researched; however, families who live in low socioeconomic communities and children who attend ineffective schools have higher levels of reading failure. Young readers hold little responsibility for any of the recognized risk factors. Children at-risk for reading failure are dependent on the educational systems to identify their reading deficits and offer effective interventions imperative to change the probable outcome.

**Predictive measures**

Isolating predictive measures is a critical piece in identifying students who are at risk for reading difficulties. Considering that most students struggle at the word level, the performance of kindergarten and first graders in key areas of phonological awareness and the alphabetic principle is warranted (Adams, 1990; Bishop, 2003; Snow et al., 1998). Scarborough (1998) reported the findings of a meta-analysis that examines the outcomes of 61 samples related to kindergarten reading predictors and concluded that no one indicator alone can reliably predict reading
outcomes. A weak correlation is evidenced between reading and nonverbal measures such as motor skills, nonverbal IQ, and visual-motor integration. Moderately strong indicators in the $r = .45$ to $.57$ range are noted for measures associated with processing print, such as letter-sound naming and letter identification and measures of oral language proficiency, such as phonological awareness, sentence imitating, and expressive vocabulary. However, Scarborough emphasized that the highest correlation of $r = .75$ is documented when first or second grade reading scores are compared against the same students’ reading scores two to four years later.

Bishop (2003) investigated the validity of assessing reading skills of 103 kindergarten students at kindergarten entry and compared predictability rates with reading scores at the end of the kindergarten and first grade. Selecting instruments that related to the reading process (i.e. phonological awareness and letter identification), Bishop reported a moderately strong correlation between letter naming and phonological processing skills and later reading skills in first grade. This study suggests that testing students early in kindergarten proves to be just as accurate as waiting until the middle of the year. Of significance was Bishop’s use of multivariate, standardized measures that were directly related to the reading process. Thus, the assessment results provided usable information helpful for identification and planning reading interventions.

Interestingly, a student’s ability to accurately and fluently name visual stimuli such as letters, numbers, colors, or pictures is a good predictor of later reading abilities (Adam, 1990; Scanlon & Vellutine, 1996; Snow, et al., 1998). Speece, et al. (2003) report on rapid letter naming at the kindergarten level. Participants were presented with a list of lower case letters and asked to name as many as possible during a one-minute timing. The researchers found a moderate predictive value of $r = .69$ between rapid letter naming and later reading achievement. Although, a prereader’s ability to name the letters of the alphabet when presented in random order is a reliable
indicator of later reading achievement, the real predicting factor may be more than just letter knowledge (Adams, 1990; Bishop, 2003; Bond & Dykstra, 1967; Chall, 1967). Scanlon and Vellutino tested rapid number identification and reported a slightly higher correlation to reading achievement than that of letter naming. Because teaching children to read letters does not significantly change reading achievement, the research findings point to fluent recall of visual symbols as the defining predictor (Adams, 1990). Hence, good readers are able to fluently recall letters and other visual print stimuli whereas poor readers have difficulty processing this type of information.

Information processing deficits are likely to have a significant impact on learning to read (Pugh et al., 2000; Rayner et al., 2001). Schatschneider, Carlson, Francis, Foorman, and Fletcher (2002) examined multiple risk factors of children with impaired phonological skills and naming speed, and concluded that low naming speed is primarily a result of poor phonological processing. Neuroimaging studies of children and adults with reading disabilities (RD) speculate that RD readers fail to develop the temporo-parietal system of the brain that is instrumental in linking phonology, orthography, and meaning structures (Leonard, 2001; Pugh et al., 2001). Thus, readers who struggle with fluent recall may have neurological differences that create inefficient pathways and weak connections. Accordingly, research to fully understand brain function and how to specifically address identification and interventions issues continues (Berninger & Richards, 2002).

The Dynamic Indicators of Basic Early Literacy Skills (DIBELS)

One specific identification tool showing promise is the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (Kaminski & Good, 1996; Good & Kaminski, 2002). As suggested by McCrindle, et al. (2001), a well-designed battery of screening instruments yields a more accurate
prediction and provides practical and useful information for curriculum planning. DIBELS targets early reading development and growth in the areas of phonological awareness, alphabetic understanding, and fluency with connected text using one-minute assessment probes. DIBELS presents a comprehensive assessment package that helps to quantify predictive early reading measures and scales the results into at-risk, some risk and low risk categories. Twenty alternate forms are available for repeated measures that allow DIBELS flexible usage. Typically, DIBELS is administered to assess reading progress at three levels: a) tri-yearly interval for school wide identification, b) monthly intervals for monitoring students at risk, and c) weekly intervals for intensive instruction (Good, Gruba, & Kaminiski, 2002).

Due to its relatively recent development, research on DIBELS is continuing to establish a well-documented and broad research base (DIBELS, 2007). However, enough solid evidence does exist, including benchmark goals and validated results in different settings, to recommend DIBELS as a practical early reading assessment tool (Good et al., 2002; Good, Simmons, & Kame‘enui, 2001). Currently, the DIBELS database system is collecting results from 12,667 schools that involve over 1.7 million children (DIBELS, 2007). Analysis of the data and additional evidence documented by the developers of DIBELS continues to establish reliability and validity levels (Good, et al., 2002; Good, Simmons, & Smith, 1998; Kaminski & Good, 1996; Kaminski & Good, 1998). Independent researchers examining DIBELS subtests report that the subtests are valid measures of early literacy skills and reliable identifiers of poor readers (Hintze, Ryan & Stoner, 2003; Speece, et al. 2003). Additionally, several researchers have incorporated DIBELS as a measurement instrument in recent reading investigations (Berninger et al., 2003; Fuchs, Fuchs, & Compton, 2004; Kamps et al., 2003; Oudeans, 2003; Speece, et al., 2003).
Moreover, DIBELS subtests link directly to early reading skills and provide practical information for instructional decisions. Student progress is monitored quickly and the effectiveness of interventions is evaluated more accurately. The availability of reliable assessment information strengthens reading instruction and focuses interventions on deficient skills to address reading problems immediately.

To summarize, young students at-risk for reading difficulties are challenged with mastering phonological and alphabetic principle concepts. Research shows that young struggling readers can and should be identified as early as kindergarten so that interventions can be initiated. No one risk factor or measurement procedure will absolutely predict a student’s reading outcome; however, strong correlations can be drawn from a battery of assessments. DIBELS is emerging as a dependable early literacy assessment instrument that has practical application in the school setting.

*Instruction*

Reading instruction for most students begins in the general education classroom where literacy skills are taught primarily in large instructional groups, but not all children successfully learn to read in the classroom (Torgesen et al., 2001). Foorman & Torgesen (2001) suggest that the stages of reading development and acquisitions of skills are the same for all children, however, instruction for struggling readers must be “more explicit and comprehensive, more intensive, and more supportive than the instruction required by the majority of children” (p. 206). For students who remain unresponsive to the general education curriculum, three key instructional strategies are recommended: (a) instruction that is more supportive, (b) intensity of instruction is increased, and (c) systematic and explicit teaching is present (Al Otaiba and Fuchs, 2002; Foorman & Torgesen, 2001; Fletcher & Lyons, 1998; Snow et al., 1998; Toregsen, 2002).
Supportive instruction

Struggling readers proceed through learning tasks more slowly and are likely to find reading more difficult and frustrating (Fletcher & Lyons, 1998). For this reason, instructional approaches that address a student’s emotional and cognitive states are critical and may include such techniques as encouragement, feedback, and positive reinforcement. Torgesen, et al. (2001) describe two types of scaffolded instruction supportive to at-risk readers. The first type calls for skills that are carefully sequenced and for students to receive direct instruction and practice time for all the skills taught. The second type of scaffolding considers the interaction between the teacher and student. The teacher leads the student through a series of questions about the student’s thought and decision processes to help the student discover critical information about performance on a reading task. Reading interventions for at-risk readers should consider including supportive elements of organized sequential instruction, clear communication between the student and teacher, and appropriately paced delivery.

Increased intensity

For readers struggling to learn literacy skills, more opportunities provided more often is seen as necessary (Al Otaiba & Fuchs, 2002; Ehri, Nunes & Willow, 2001; Snow et al. 1998; Torgesen, 1997). A multi-tiered framework is suggested by several researchers beginning with classroom instruction and intensifying to a level of individualized programs (Al Otaiba & Fuchs, 2002; Fuchs, Fuchs, McMaster, Yen & Svenson, 2004; Vaughn & Fuchs, 2003). In general, the researchers’ recommendations describe a series of three phases. Phase one involves the implementation of effective instructional practices in the general education classroom. Students who demonstrate deficiencies in reading skills are moved into phase two. Phase two provides small group instruction for targeted skill mastery. Progress monitoring of students’ reading skills
occurs more frequently during this phase. If a student exhibits limited progress during phase two, more intensive instruction is recommended. In phase three, individualized instruction is offered for longer and more frequent periods of time allowing for multiple opportunities to practice and gain skills under close supervision. As students move through the phases, instruction is more explicit and the intensity and support increase.

Increasing the intensity of instruction by decreasing the number of students in an instructional group is a question considered and reported on in the reading literature. Intervention programs for at-risk readers are often delivered in individual teaching sessions (Clay, 1993; Torgesen et al., 1999). However, in a meta-analysis of intervention research, Elbaum, Vaughn, Hughes and Moody (2000) compared outcomes of students taught in three different group sizes: one to one, three to one, and ten to one. The researchers concluded that groups containing three students to one teacher were as effective as one to one tutoring sessions. Concurring with the results, Ehri, Nunes, and Willows’ (2001) meta-analysis of phonemic awareness found small groups produced statistically larger effect sizes than tutoring or whole classrooms. However, group size has yet to clearly demonstrate a significant impact on learning outcomes for phonics instruction (Ehri, Nunes, Stahl, et al., 2001). More research is needed to fully understand the ideal size for grouping of students for specific skill training. Even so, at this time, offering instruction in group sizes of three to one for at-risk students appears to be a sound teaching practice.

The number of hours of instruction to remediate students to grade level performance remains unclear. In the general education classroom, Ehri, Nunes, and Willows (2001) found 5 to 18 hours of phonemic awareness delivered in short segments through the school year was superior when compared to longer instructional times. For students with severe levels of
dyslexia, Torgesen, et al. (2001) reports that 67.5 hours of intensive instruction is required to produce large improvements in students. Less clear, is the amount of instruction required to remediate students who are at-risk for reading failure. Studies report positive responses under a variety of different time frames (Compton, 2000; O’Connor, Harty & Fuller, 2005; Hiebert & Taylor, 2000; Oudeans, 2003). In the studies, sessions ranged from fifteen to forty-five minute blocks, three to five times per week, for eight to thirty weeks. More research into the appropriate amount of time to deliver an intervention, especially for at-risk readers, is needed.

Explicit instruction

Explicit instruction, as defined by Denton, et al. (2003), is instruction modeled by the teacher who clearly explains concepts and thought processes. Unlike direct instruction, explicit instruction allows the student to respond in an open-ended manner and the teacher to provide instructional feedback (Berninger et al., 2003). The student is not asked to make inferences, a confusing and complicating effort for less skilled readers. For children who enter formal education without solid phonological development, explicit teaching allows quick exposure to skills and meaningful concept development (Stanovich, 2000). The goal of early explicit reading instruction is to focus the child’s attention on the important relationships between sounds and letters (Adams, 2002). The positive results of explicit instruction are well documented in the literature (National Reading Panel, 2000; Torgesen et al., 1999). Explicit instruction used effectively integrates skill development systematically with meaningful application to create a balanced approach to reading (Rayner et al., 2001; Snow et al., 1998).

Summary

Research indicates that effective intervention programs for young struggling readers contain elements that are: (a) supportive by providing scaffolded instruction and multiple
opportunities to practice skills, b) intensive by reducing group size and offering more time for instruction and practice, (c) systematic and (d) explicit. For students still struggling to read words, the instructional focus should be on development of phonological awareness and the alphabetic principle. The next section will identify and examine researched interventions that incorporate the described instructional practices considered effective for young at-risk readers.

**Interventions**

According to Torgesen (2004) reading intervention research examines teaching methods designed for at-risk or struggling readers that address deficiencies in basic skills, knowledge, and attitudes about reading. Intervention studies appear in two general categories: prevention and remediation. This on-going research is now focusing on several important questions including: (a) what methods are most effective, (b) what intensity level is appropriate and for how long, (c) how is instruction matched to student needs, and (d) how effective is remediation in bringing students back to grade level? (Torgesen, 2004).

Hiebert and Taylor’s (2000) review of research on beginning reading instruction identifies common features of four successful first grade reading interventions. Hiebert and Taylor’s findings indicate that (a) low achieving readers are grouped in small homogeneous skill groups or are individually tutored, (b) most sessions are 30 minutes, occurring daily, and ranging from twelve to thirty-six weeks in length (c) decoding skills are taught in a systematic and progressive manner starting with a solid understanding of letter and sound knowledge and (d) students are asked to spell words and write sentences in conjunction with reading instruction. The four first grade interventions share a common and primary goal, to help students gain fluency when reading text.
Three additional reading intervention studies are discussed that meet the following criteria: (a) explicit instructional techniques are used as part of a treatment condition; (b) the intervention focus is on phonological awareness and or alphabetic principle, (c) participants are identified as showing a reading delay and enrolled in kindergarten through third grade; (d) instruction is provided in groups; (e) the setting is in a school, and (f) research findings are published in a peer-reviewed journal (Compton, 2000; Oudeans, 2003; Pullen, Lane, Lloyd, Nowak, & Ryals, 2005). Each study is described in further detail and effective methods of instruction are highlighted.

Oudeans (2003) reports on the effect of sequencing the instruction of letter-sound correspondence for 56 identified at-risk kindergarten students. Students, placed in small groups, were taught in either a parallel integrated (PI) sequence or parallel non-integrated (PN-I). For example, in parallel integrated order the letter \( m \) is explicitly connected to the sound and practiced through blending activities. Non-integrated instruction tasks are taught separately and the student may implicitly make connections between the tasks, however the teacher does not tell or explain the connections to the student. Lessons were taught for 10 weeks, in 15-minute sessions, four days a week and topics included letter names, letter-sound correspondence, phoneme blending and segmentation. Oudeans reports that PI and PN-I produced similar results for letter naming, however PI was more effective in helping children apply their letter-sound knowledge to word reading.

Pullen, et al. (2005) examined a specific intervention targeted at decoding skills in beginning readers. Employing explicit instruction using manipulative letters and leveled books, nine identified struggling readers were taught in small groups of three students to one teacher. After ten lessons, all students increased in the number of pseudowords read correctly. This study
is limited by sample size, control of conflicting variables, and retention documentation; however, the study is a good model of using a direct intervention targeted to remediate a specific identified skill deficit. The positive outcomes of increased word reading are encouraging.

Compton (2000), in the second phase of a two phase investigation, measured the effect of a researcher-designed small group reading intervention for at-risk readers. First grade students were instructed three times a week for 45 minutes for ten weeks in the school setting. The treatment condition was a multifaceted program that incorporates Elkonin boxes, magnetic letters, sentence strips, and short stories designed to teach phonological awareness, letter-sound associations, decoding fluency, and spelling. Compton reports that growth rates of at-risk readers significantly increased during the intervention. The greatest gains in nonword reading were made by children who demonstrated higher levels of naming speeds at the beginning of the study. The results of the study are limited by the ceiling effects recorded on the assessment measures, lack of integrity of treatment, and poor control over students’ exposure to classroom instruction.

Of interest in this study is the use of Elkonin’s word boxes to teach letter-sound correspondence, a technique that is used widely in one to one reading instruction (Clay, 1993; Joseph, 1998/99; Hayes, Lane, & Pullen, 1998). Limited research is available on the use of word boxes, however, word boxes are a promising technique that visually illustrate phoneme-grapheme relationships and thereby teach students the alphabetic principle.

Word Boxes

Word boxes emerge from the work of D. B. Elkonin (1963) who developed an instructional technique of drawing rectangular shaped boxes to illustrate sound units heard in individual words. As a word is slowly spoken, the child listens for each sound and places a
marker in the box to represent identification of the phoneme. Designed to increase phonological awareness in preschool children, adapted versions of Elkonin boxes are used to teach reading skills to older children (Clay, 1993; Cunningham, 1999; Joseph, 1998/1999; Joseph, 2000; Joseph, 2002 a.).

Clay (1993) incorporates the use of word boxes in Reading Recovery lessons. By expanding on the approach, Clay suggests a three-step procedure for word box use: segmenting sounds, letter-to-sound matching, and spelling. Words are specifically chosen and boxes are predrawn. Students systematically work through a concrete learning sequence. The student identifies the phonemes heard in the word, and then represents each sound with a counter in a drawn box, and finally the substitution of graphemes for phonemes is made (Joseph, 2002 b.).

Investigation into the use of word boxes with larger group sizes and with other populations such as students with disabilities is reported in the reading literature (Devault & Joseph, 2004; Joseph, 1998-1999; Joseph, 2000; Joseph, 2002 a.). Collectively, the studies conclude that instruction that incorporates word boxes results in positive outcomes in the areas of word identification and spelling for the students in the experimental groups. In a study using large group instruction, Joseph (2000) documented transference of word identification and spelling skills to words not previously taught. Although limited by sample size and replication, this emerging evidence demonstrates that word boxes are a promising reading intervention.

The University of Florida Literacy Initiative (Hayes, Lane, & Pullen, 1998) incorporates the use of word boxes in the writing to read portion of the tutoring program. Word boxes are taught as a spelling strategy. The student creates a sentence and uses the boxes to derive the spelling of unknown words. The technique also differs from word box use in Reading Recovery in that counters are not used; students instead are encouraged to indicate a sound by putting up a
finger. The number of identified sounds matches with the number of upright fingers. The students draw the rectangular boxes to match the number of sounds heard. The word is written several times outside the box before the student places the word in the sentence. Although this portion of the reading program is well received by students and teachers, research is not available to verify the impact of word boxes on decoding skills of young at-risk readers. Also unknown is the effect of explicit instruction using word boxes in small groups and in connection with guided sentence writing.

Summary

Identification of reading interventions that target known reading deficits is a current research question (Kamil, Manning, & Walberg, 2002; Torgesen, 2004). At the same time, requirements to use only scientifically-based reading programs and materials in the classroom are on the increase. Sweet (2004) speculates that, “One day, it will be as unusual to find an educational strategy, instructional practice, or program that has not been validated by scientific evidence as it is to find a doctor who uses leeches to cure a fever” (p. 13). Quantifying the amount of intensity, support, and level of explicit instruction that is required for young at-risk readers to master beginning reading skills is still emerging from current literacy studies. Programs that describe significant effect sizes are at the same time reporting that not all students are responding to the intervention (Fuchs, et al., 2004). Clearly, more research is needed before a prescriptive intervention system can accurately be administered to meet the needs of at-risk students.

Conclusion

Much is known about a child’s journey to develop into a successful reader (Adams, 1990). Foundational to the process is a child’s ability to understand that words are made up of
sound units and sounds have a direct relationship to written symbols. In addition, the positive correlation between reading and spelling is well documented. Young children who succeed in reading are more likely to spell with proficiency. The link between reading, spelling, and writing should not be ignored nor should information about the brain’s ability to process information in a multifaceted manner. An integrated curriculum is deemed beneficial as is a balanced reading program that addresses phonological awareness, word recognition, vocabulary, fluency, and comprehension skills.

A current concern in the reading field is the quest for intervention approaches that are effective, economical, and easy to administer. With the advancements in better and faster ways to identify at-risk readers, the next step is to bolster students reading skills so development continues at an age appropriate rate. This can only be accomplished by continuing to build strong connections and common goals between research and practice.
CHAPTER THREE

METHODS

Effective instructional methods designed to increase the decoding fluency of young struggling readers are limited. Particularly lacking are researched-based interventions that are effective when used in school settings. The present study investigated the effect of written word work using word boxes on the decoding fluency of young at-risk readers in the school setting.

Research Design

A multiple baseline across-participants single subject research design was implemented to examine changes across baseline and treatment phases for nine participants. The AB design (baseline-treatment) was conducted with three groups of three students each. A multiple baseline design is appropriate because decoding fluency is an academic skill that cannot be reversed (Neuman & McCormick, 1995).

Single-subject experimental research features highly controlled variables and personalized evaluation (Neuman & McCormick, 1995). Results, reported visually, are quickly monitored and can indicate the impact of a prescribed treatment on an individual student. Unlike group investigations, where the performances of struggling students are averaged into the mean, single-subject methodology can discern the most effective technique for each student (Neuman & McCormick, 1995). The research process relates more closely to actual teaching practices where teachers must assess and adjust curriculum to meet the needs of individual students in the classroom.

Although limited by generalizability, Dermer and Hoch (1999) charge that single subject designs counter threats to internal and external validity through well-designed experiments and meta-analysis of the body of research. The multi-baseline design is used to effectively
demonstrate internal validity in literacy research (Neuman & McCormick, 1995; Swanson & Sachse-Lee, 2000). This design is particularly helpful in circumstances where behaviors or learning cannot be reversed. Properly designed, multi-baseline single subject research is an appropriate choice for literacy investigations.

Participants

Seventy-one first grade students were screened in September and December using the PSF and NWF subtests of the DIBELS. Nineteen students who performed at the “at risk” level on the NWF test by responding correctly to less than 13 prompts per minute at the beginning of the school year and less than 30 prompts per minute at mid year formed the initial pool of candidates for the study. Classroom teachers were asked to verify that the pool of 19 identified students were not responding to classroom instruction and were showing delays in the acquisition of reading skills, particularly skills associated with recalling phoneme-grapheme relationships. Students who demonstrated more than ten absences during the previous year as indicated by a review of their attendance record were excluded from the study because inconsistent participation during the concentrated instructional period could skew the results.

The principal investigator (PI) met with the parents or guardians of the potential participants to provide information about the study. Information about the teaching program, purpose, procedures, confidentiality measures, and results were discussed with the parents or legal guardians before requesting their written consent to allow their child to participate. If the study resulted in any negative outcomes for the participant, the PI offered to provide small group reading sessions equal to the time the participant was involved in the study. A telephone contact was made with parents who were unable to attend the meeting and information and consent forms were sent to their home. Fifteen students remained in the pool after consent forms and attendance records were considered.
Nine students were randomly selected and placed in three groups of three students each. The PI provided an introductory session for the students and each student was asked to give his or her verbal assent before the study began.

Setting

This investigation took place at a school-wide Title I elementary school that houses preschool through third grade students, in southeast Washington State. The school district’s PK-8 grade population is 925 students and 415 students attend the district’s one elementary school that is staffed by 28 certified personnel including four first grade teachers, one Title I reading coach and four Title I educational assistants.

Small group teaching sessions occurred outside the general education classroom at a table in the Title I reading classroom. Other students and staff were present in the room during the time of the intervention. Teaching sessions took place in twenty-five minute blocks at the same time during the school day. Sessions were conducted Monday through Thursday over a period of eighteen weeks. Students received 72, 48, or 24 sessions of the reading intervention depending upon the assigned group.

The administration of DIBELS assessments occurred outside the classroom in the Title I classroom. Spelling evaluations were administered at the beginning of the small group instruction. Participants remained in their classrooms during general curriculum reading, language arts and math instruction.

Instrumentation

To determine the effectiveness of the intervention, four measures were used to assess student learning: three subtests of the DIBELS and a researcher-developed six word spelling assessment.
Measures were administered in two week intervals. The following is a detailed description of each assessment tool.

*Dynamic Indicators of Basic Early Literacy Skills (DIBELS)*

DIBELS (Good & Kaminski, 2002; Kaminski & Good, 1996) is an assessment battery of one minute early literacy measures that can be used to provide information about (a) early identification of children who are experiencing difficulty with reading, (b) levels of student progress, and (c) the effectiveness of intervention programs (Good, et al., 1998). DIBELS is unique because it is easy to administer, capable of frequent and repeated measures, time efficient and cost effective. Subtests relate directly to early reading skills and are sensitive to changes in student learning (Good et al., 2002). DIBELS is a viable early literacy assessment tool useful in providing the repeated measures required in single-subject research designs. The subtest of Phonemic Segmentation Fluency (PFS), Nonsense Word Fluency (NWF), and Oral Reading Fluency (ORF) are directly related to areas of phonological awareness, alphabetic understanding, and fluency with connected text investigated by this research study. Reliability and validity measures for DIBELS are documented and on-going studies continue to take place (Good et al., 1998; Kaminski & Good, 1996, 1998). Validity and reliability measures are discussed as they relate to each subtest.

*Phoneme Segmentation Fluency.*

The PSF subtest assesses a student’s ability to segment words of three and four phonemes into individual phonemes. The examiner orally presents a word and asks the student to produce each phoneme heard in the word. PSF is an excellent indicator of a student’s level of phonological awareness. The test is intended for children from the middle of kindergarten to the end of first grade.
Kaminski and Good (1996) report a reliability level of .88 for kindergarten children using the two-week alternate-form. Hintz, et al. (2003) compared the Comprehensive Test of Phonological Processing (CTOPP) (Wagner, Torgesen & Rashotte, 1999) to DIBELS-PSF and conclude that a strong correlation exists between DIBELS-PSF and the composite scores of the CTOPP that are designed to measure phonological awareness. Concurrent validity estimates ranged from .43 to .65 on other measures of cognitive ability and school readiness (Kaminski & Good, 1996). Predictive validity of spring, kindergarten PSF with spring, first grade Woodcock-Johnson Psycho-Educational Battery is .68. Predictive validity of curriculum-based measurement of DIBELS Oral Reading Fluency (ORF) is .62 (DIBELS Technical Report, 2002).

**Nonsense Word Fluency**

The NWF subset assesses a student’s knowledge of the alphabetic principle including alphabetic understanding and phonological recoding. Tasks involve producing letter-sound correspondences and blending CVC letters to form unfamiliar pseudowords. The student is asked to read a series of pseudowords while timed for one minute. The number of responses in letter sounds and/or whole word naming is scored to indicate fluency measures.

The reliability of the NWF subtest ranges from .92 to .98 and the predictive accuracy one year later ranges from .66 to .82 (DIBELS Technical Report, 2002). The concurrent criterion-validity with the Woodcock-Johnson Psycho-Educational Battery-Revised Readiness Cluster score ranges from .36 to .59 (DIBELS Technical Report, 2002). Overall, the DIBELS NWF subtest reliability and validity measures are viewed with an acceptable degree of reliability and validity. More will be known as continued research findings are reported (Casey & Howe, 2002).
Oral Reading Fluency

The ORF subtest provides a standardized evaluation of the student’s word accuracy and fluency when reading connected text. The student is presented a grade level passage and asked to read aloud for one minute. The examiner scores words that are omitted or substituted and hesitations of more than three seconds as errors. Words that are self-corrected within three seconds are scored as accurate. The number of correct words read per minute from the passage is calculated to be the oral reading fluency rate. ORF is typically administered during the second half of first grade and can continue through sixth grade.

The ORF passages and procedures are based on the concepts developed in the Curriculum-Based Measurement (CBM) program (Shinn, 1989). CBM is a method of monitoring students’ academic progress by administering, under standardized conditions, short assessment probes that directly relate to information or skills the students are taught. CBM accuracy is confirmed and test-retest reliabilities ranged from .92 to .97 (Good, et al., 2002). The alternate-form reliability of the ORF ranges from .65 to .93 (Good, et al., 2002). Good et al. point out that ORF reliably of .65 may be low for standards of educational decision making; however, repeating the measure five times on five different days increases reliability to .90. Performance on DIBELS-ORF measures were compared to state assessment tests in Arizona, Colorado, and Florida (Buck & Torgesen, 2003; Shaw & Shaw, 2002; Wilson, 2005). Results indicated that the DIBELS-ORF was a reliable predictor of third grade students’ performances on state-wide assessments. The highest prediction rates were recorded for “low risk” and “at-risk” students. Correlation levels were least strong and the predictive value less reliable for students in the “some-risk” category. Overall, ORF is a dependable measure and valid predictor of students’ reading outcomes.

Spelling Test
A six word spelling test, developed by the PI, was administered by the teacher in two-week intervals. The decodable spelling words were selected from the first two hundred words on the *Fry Frequently Used Words* list (Fry, Kress, & Fountoukidis, 2000) and additional decodable 3-5 letter words selected by the researcher (see Appendix A & B). Each list of six words represented five different short vowel sounds and ten different consonant sounds.

The teacher said the word, stated a short sentence using the word, and then repeated the word. The teacher refrained from giving any other types of prompts. The student wrote the word on the spelling test form and the teacher attached it to the teacher’s session form. Each letter properly placed is scored as one point and the sum of points is recorded on the teacher’s session form. Improper placement of a letter was scored as an error. The spelling test provided an indication of the student’s level of retention and transfer of skills. This assessment is not standardized.

**Procedure**

**Baseline**

In baseline, students received the general education curriculum during classroom instruction. The PI observed in each of the three classrooms and interviewed the teachers. A basal reading series was used and supplemental reading materials were added at the teacher’s discretion. Students received instruction in letter-sound association, high frequency word recognition, rhyming, and comprehension. Students practiced repeated reading for fluency building and were given time to self-select books to read independently or to a reading partner.

**Treatment 1: Small group condition**

To determine the effect of small group instruction, one group was exposed to a small group condition before entering the intervention phase. The three students in group 2 participated in a reading group focused on comprehension and vocabulary skills. The teacher selected an age-
appropriate picture book for the session that was read to the students. The teacher introduced the book to the students and briefly showed the pictures as an overview of the story, setting, and characters. The teacher selected three to five vocabulary words from the story and discussed their meaning with the group. The book was then read aloud to the group. The students were instructed to listen for the new vocabulary words and to attend to the storyline. After reading the book to the students, the teacher lead a discussion about the story by asking at least four prepared open-ended, higher-order thinking questions related to the story. The teacher selected one of the following activities to be completed by the students: (a) draw a picture about the story (b) retell the story to a partner (c) act out a character in the story (d) play a guessing game using the vocabulary words (e) create a new ending to the story. The teacher refrained from explicitly teaching phonics and decoding skills during the session.

_Treatment 2: Intervention_

The intervention is adapted from The University of Florida Literacy Initiative (UFLI) Teaching for Beginning Readers Manual, Step 3: Writing for Reading (Hayes, Lane, & Pullen, 1998). The teacher and students met at a small table in the Title I classroom. Using the UFLI model, the teacher prepared materials for the session and guided the student through the four-part sequence of the UFLI model in a twenty-five minute time frame (see Appendix C for a complete list of the materials used in the research study).

*Step 1: Reading and assembling the student’s previous written sentence.* The session began when the teacher asked the students to read the sentence constructed during the previous session. The students were then given a glue stick to attach a sentence strip below the written sentence. Working around the table with each individual student, the teacher cut each word from a second sentence strip and asked the students to read each word individually and then assemble the sentence in the correct
order. As the students arranged the words, the teacher asked each student to read the sentence then glue a third sentence strip on the white envelope. The students were asked to read the sentence a final time and then place the word pieces in the envelope to take home.

**Step 2: Warm-up for word boxes.** The teacher introduced three to five new words to the students from a list of decodable words selected by the PI (see Appendix D). The word list was designed to provide the teacher an opportunity to explicitly teach phoneme-grapheme relationships by isolating sounds and increasing the order of difficulty (Adams, 1990; Honig, Diamond, & Gutlohn, 2000). Short vowel sounds were introduced before long sounds and in the following order: a,i,o,u,e. The teacher used two sessions to teach each short vowel sound in combination with new consonants.

Consonants were introduced by the level of difficulty category: continuous-voiced, l,m,n,r,v,w,y,z; continuous-unvoiced, f,s; stop-unvoiced, c,h,k,p,t; stop-voiced, b,d,g,j; non-category, q, x. Letters and sounds that are visually and auditorily similar were separated during the initial learning phase (Adams, 1990). The complexity of the word introduction moved from less complex to more complex for example CV/VC, CVC, VCC, CVCe, CCV, CVCC CCVC, CCVCC (Carnine, et al., 1997). Frequent review of previously taught letter-sound combinations were embedded in later word lists.

Students were given white boards and markers to use during this portion of the lesson. The teacher modeled the word box technique and the students repeat the following steps:

1. Say the word aloud.
2. Put up a finger for each sound in the word.
3. Count the number of fingers as a match for the number of phonemes in the word.
4. Draw a box for each phoneme.
5. Say the phoneme and write the grapheme in the box to match the sound.
6. Read the word.

7. Write the word under the boxes two more times.

As the teacher repeated the procedure for the rest of the word list, the teacher scaffolded the steps until less guidance was required and the students learned to complete the sequence independently.

**Step 3: Elicit a sentence.** The teacher asked the students to read the previous sentences in the student books. The teacher asked the students for a new sentence to write in their workbook. If the students were unable to create a sentence, the teacher engaged the students in an informal conversation or referred to the warm-up words as a sentence starter. When the teacher and students agreed to a sentence, the teacher recorded the sentence in the session notebook. The teacher analyzed the sentence by circling 1-3 high frequency words that were unfamiliar to the students, underlining words the students could attempt independently, and putting boxes around 2-4 predictable words that had phonemes that could easily be identified but not quickly spelled by the students. The teacher monitored the sentence length by requiring a minimum of four words during the first week of instruction and increasing sentence length each week by one word until a maximum of twelve words per sentence was reached.

**Step 4: Write the sentence.** The teacher guided the students as they wrote the sentence in the writing book. Two pages in the writing book were used during the session. Positioned sideways, the upper page, referred to as the word work page, was used by the teacher and student to construct word boxes and practice words before writing them in the sentence. The bottom page of the writing notebook was used to record the completed sentence.

The teacher guided the students as they wrote at least one complete sentence that began with a capital letter and ended with the appropriate punctuation mark. The following are additional
teaching techniques used with the students according to how the teacher categorized the word in the student’s sentence.

*Underlined words.* The students were encouraged to write known words directly into the sentence. If the teacher was unsure if a student was able to spell the word without assistance, the teacher directed the student to spell the word orally before writing it in the sentence. If a student was unable to spell the word orally, the teacher treated the word as an unfamiliar word and asked the student to draw word boxes.

*Circled high frequency words.* High frequency words with uncommon spelling (e.g., their, was, they) were written by the teacher on the word working page or the student was guided to spell the word through analogy to other known word pattern(s). The student was asked to write the word several times before entering it in the sentence.

*Boxed unfamiliar words.* As described in step 2, the teacher worked with the students to isolate, verbalize, and count each phoneme. Word boxes were drawn for each sound and the students wrote the letters in the box that represented the sounds. The teacher helped the students to correct or add letters. After the students correctly identified and wrote the word in the boxes, the teacher directed the students to write the word at least one time under the boxes before entering the word into the sentence.

*Unusual words.* When the sentence included uncommon or unusual words, the teacher assisted the student. The teacher encouraged the student to identify the beginning sound and letter of the word. In some cases, the teacher helped the student divide the word into understandable parts. When a word had unique spelling such as a name, the teacher wrote the word on the word page for the student to copy.
**Considerations.** The focus of the intervention was to help the student understand how letters and words are decoded. The teacher emphasized isolating and identifying phonemes, identifying letter patterns in word families, and built reading skills by helping the student become aware of every letter in a word.

Students were provided multiple opportunities to practice reading the words in the sentence. The teacher instructed the student to read all the words in the sentence as each word was added to the sentence. After the sentence was completed in the student’s writing book, the teacher asked the student to read the sentence. The student was asked to read the sentence a final time with speed and fluency and that ended the session.

**Dependent Variables and Measures**

To answer the research question concerning the effect of the intervention on decoding fluency skills, four dependent variables were determined to be probable indicators: (a) phoneme segmentation fluency measured by PSF (b) phonemic decoding fluency measured by NWF (c) oral reading fluency measured by ORF and (d) writing decodable words measured by a spelling test. The following section explains each dependent variable and the measurement tool used.

The DIBELS-PSF was administered to indicate change in the student’s ability to segment words into individual phonemes, an initial skill for decoding words. The PSF examiner asked that the student to listen to a word and divide the word into separate sound units. The number of correct responses per minute was recorded as a data point. The percentage of errors was calculated by dividing the total number of responses by the number or errors and reporting the percent as a data point.

Phonemic decoding fluency was defined as the students’ ability to orally identify letter-sound correspondences either by saying individual sounds or blending letter sounds to form words.
Decoding fluency was assessed using DIBELS-NWF. NWF was the central measurement used in the study because this assessment most directly answers the research question by measuring the students levels of decoding fluency. Thus, NWF was the data marker used to determine baseline and treatment changes (Fuchs, et al., 2004). Students were shown a different series of fifty consonant-vowel-consonant (CVC) nonsense words and asked to read as many letter sounds and/or words as possible in a one minute time period. The number of correct responses per minute was recorded as data points. The percentage of errors was calculated by dividing the total number of responses by the number or errors. The resulting percent was reported as a data point.

The students’ transference of knowledge of letter-sound relationships was measured in two areas: oral reading fluency and spelling. The DIBELS-ORF was used to measure the students’ word fluency and reading accuracy when presented with connected text. This individually administered assessment measures the student’s performance on grade-leveled readings. The number of words read correctly in one minute was scored as the oral reading fluency rate. Accuracy was calculated by dividing the total number of words read by the number or errors and reporting the percent as a data point. To assess the students’ progress in written phoneme-grapheme skills, a spelling test using six decodable words from the Fry Frequently Used Words list and additional 3-5 letter decodable words was administered. The number of correctly placed letters was recorded as a data point. The percentage of errors was calculated by dividing the number of possible correct letter placements by the number of letter placement errors. The resulting percent was reported as a data point.

The three dependent variables are indicators of a student’s skills in reading fluency. The rates used to determine when a student reaches fluency levels are standardized for each subtest of the DIBELS. Students who score 35 or more points on the PSF subtest are considered to have established the skill of phonemic segmentation. On the NWF subtest, students scoring 50 points at
the middle of first grade and beyond are considered to be established readers. On the ORF subtest, students scoring at or above 20 correct words at the middle of first grade and 40 correct words at the end of first grade are considered to be at a low risk for future reading difficulties. The DIBELS levels indicate when and if a student is performing at a level of proficiency in comparison to peers.

**Measurement Procedures**

The school-wide evaluation team recorded two baseline measures of student performances on the DIBELS-PSF, NWF and ORF during the months of September and December. Three month after the study was completed, the school-wide evaluation team continued grade level assessments and progress monitoring. The data were collected and reported in the maintenance phases of the NWF and ORF measures. PFS was no longer administered because the students had reached the benchmark goal during the previous school year. Student 7 left the school district at the end of first grade and was not included in the maintenance phase.

Upon entering the research study, students were assessed by the research evaluators. The results were reported as the third baseline data points. During the study, measurements were taken in two week intervals using DIBELS-PSF, NWF and ORF assessments. The PSF, NWF and ORF subtests took approximately ten minutes to administer per student. The evaluators recorded the number of errors and correct responses. A written report of each student’s performance including the scoring sheets was collected by the PI.

The teachers administered the spelling test in two week intervals at the beginning of the instructional session. Six decodable words were orally presented to the participants. The number of errors and correctly placed letters were recorded in the teacher’s log and the spelling tests were attached to the lesson sheet.
The number of correct responses and errors on the spelling test, the PFS, NWF, and ORF subtests of the DIBELS were graphed individually for each student within a day of administration by the PI. The PI used visual analysis methods to examine the data for stability, trends, and changes. Decisions concerning treatment placement were made based on the data.

The teachers maintained a session log for each treatment session. During treatment 1, the small group condition, the teacher documented the title of the book, the student activity, attendance, and additional session notes about student behavior (see Appendix E). During the intervention treatment, the teachers documented the warm-up words, the students’ sentence, coding of the sentence, attendance and additional session notes about student behaviors (see Appendix F). The PI collected all the materials at the end of the research project. Student writing notebooks, teaching logs and video tapes of sessions were used to determine treatment integrity and student attendance.

Groups entered the treatment phase in six week intervals. The first group to demonstrate a downward trend in two data points by two of the participants entered the intervention phase first. All participants were charted separately; however participants entered the intervention phase as a group. The treatment phases of the study were conducted over a period of 18 weeks.

**Treatment Integrity**

*Validation of procedures and measurement techniques.*

Prior to beginning the research study, the teachers received training from the principal investigator (PI). The training covered the four steps of the intervention treatment, recording procedures, confidentiality guidelines and experimental validation issues. The teachers participated as students in two training sessions taught by the PI and then observed the PI teach individual and small groups of children using the intervention. The teachers taught 20 sessions using the prescribed method to individual first grade students. The teachers received additional training from
the PI on how to teach the intervention to groups of three students. The teachers taught at least 20 sessions to small groups of second grade students. These were students who were not selected for the study. The PI observed the teachers during random teaching sessions via video tapes to monitor that all steps of the treatment phases were followed. After viewing the tapes, the PI provided suggestions to the teachers if changes needed to be made. The PI was available for additional training or as a resource if needed and made weekly contact with each of the teachers during the duration of the research project. In the case of a teacher’s absence, another trained teacher conducted the teaching sessions.

The teacher who presented treatment 1, the small group condition, focused on vocabulary/comprehension, was provided training and instruction by the PI. This teacher was observed four times via a taped recording of the teaching sessions to confirm that the teacher refrained from explicitly teaching phonics and decoding skills during the session.

The trained evaluators were not involved in the instruction of the participants and were not knowledgeable about the students’ placement or entrance into the treatment phases of the study. The evaluators demonstrated a 100% accuracy level in the PSF, NWF and ORF subtests before student evaluations began. Accuracy levels were achieved by matching two of each subtest scores with that of another trained evaluator in practice sessions.

*Interobserver agreement.*

Twenty percent of the teaching sessions were videotaped and an independent observer rated the teacher on treatment accuracy using the criteria-rating sheet (see Appendixes G and H). The percent of interobserver agreement was calculated by a point-by-point agreement ratio using the following formula: the number of agreements divided by the number of agreements plus the number of disagreements and the result multiplied by 100 (Tawney & Gast, 1984).
Twenty percent of the DIBELS assessment sessions were attended and scored by an independent observer. The DIBELS scores recorded by the evaluator and that of the independent observer were compared for accuracy. The percent of interobserver agreement was calculated by dividing the number of agreed scores by the number of agreements plus the number of disagreements and multiplying the result by 100 (Tawney & Gast, 1984).

Social Validation

Ten elementary teachers who were involved in teaching reading and writing to struggling young students viewed a video of the treatment session. The teachers rated the appropriateness of the intervention with young readers and its practicability for use in the school setting using a six item Likert Scale questionnaire (see Appendix I).

Generalization

The transference of decoding skills was demonstrated by measures of ORF and spelling. ORF was the least sensitive measure in the research project; however, an improved score on ORF indicated that the student was able to transfer decoding skills to connected text. This was the most desirable outcome measure because increased ORF indicated that the intervention directly impacted a student’s ability to read connected text. Likewise, spelling decodable unfamiliar words demonstrated that phoneme-grapheme relationships were utilized to produce unpracticed and accurate word spellings.

The DIBELS measurements provide grade level indicators. At the school where the research took place, all first grade students were given DIBELS assessments at the beginning, middle and end of the school year. The participants’ highest levels on PSF, NWF, and ORF were evaluated against established benchmark goals for first grade students. Individual student growth across all phases of the study was analyzed.
The PI compared the results of additional assessments administered to the nine students for the purpose of understanding the individual differences of the participants. Standard scores on pre and post reading comprehension and receptive vocabulary measures were compared. A classroom teacher behavior rating scales was analyzed. The instruments used were: Woodcock Johnson III Tests of Achievement-Passage Comprehension subtest (Woodcock, McGrew & Mather, 2001), the Peabody Picture Vocabulary Test-3rd Ed., Form IIIA (Dunn, Dunn, & Dunn, 1997) and the Burks’ Behavior Rating Scales (Burks, 1977).

A preliminary summary of the research results was presented to the elementary staff at the conclusion of the study. Audience members watched a video session of the intervention and were given the opportunity to ask questions. The final written report of the research study was available upon request to elementary staff and other district personnel.
CHAPTER FOUR

RESULTS

This research study investigated the effect of written word work using word boxes on the decoding fluency of young at-risk readers. Nine first grade students who were at-risk for reading difficulties were divided into three equal groups. A multiple baseline across-participants single subject research design was used to measure student responses on reading fluency and spelling measures under three conditions: general education curriculum, small group instruction, and a reading intervention that targeted grapheme-phoneme correspondence using guided sentence writing and word boxes.

Data were collected on the four dependent variables: PSF, NWF, ORF, and spelling. The number of correct responses and the number of errors for each dependent variable were reported. Individual performance was graphed separately and then shown in their respective groups in accordance to the research design.

Effect size is reported as the percentage of non-overlapping data points (PND) (Scruggs, Mastropieri, & Casto, 1987). PND is calculated by a count of treatment data points that exceed the highest baseline data point, divided by the total number of treatment data points then multiplied by 100. PND can range from 0 to 100%. A larger PND indicates that the dependent variable is impacted by the independent variable. Scruggs, Mastropieri, Cook, and Escobar (1986) conclude that a PND at or greater than .90 reflects a highly effective treatment, a PND of .70-.89 is considered a fair treatment outcome, a rating of .51-.69 is questionable/moderate, and a result below .50 indicates an unreliable or ineffective intervention.

Response rates are reported as changes in slopes and calculated using a linear regression analysis of the data across each phase. As described by Richards, Taylor, Ramasamy and Richards
(1999) positive values in slope levels indicate acceleration in the rate of growth over time to the dependent variable whereas negative values in slope levels indicate deceleration in the rate of growth over time to the dependent variable. Slope values that remain near zero signify that the rate of growth remains unchanged.

Additional data were gathered on the participants, on the reliability of the procedures, and on the social validity of the intervention. Information was collected on individual participants at the beginning and conclusion of the study to better understand the students’ learning behaviors, levels of reading comprehension and receptive vocabulary. Design integrity was addressed through inter-rater reliability checks. Results are reported for the four dependent variables, inter-rater reliability, social validation, and participant attributes in the following sections.

Phoneme Segmentation Fluency

PSF measures the speed by which a student is able to listen to a word and orally divide the word into smaller units of speech. The results of PSF measures are reported in Figure 2 and Figure 3. Students 3 and 6 demonstrated significantly high effect sizes for rate and accuracy and student 1 had high effects in rate and less reliable change in accuracy (see Table 1 and Table 2). Student 5 showed a moderate change in rate during the intervention phase but no significant change in accuracy. Students 2, 4, 7, 8, and 9 made gains in PSF before entering the intervention phase. Members of group 1 reached benchmark level of 35, signifying that the skill is established, by probe 4 and consistently remained above that level for the remainder of the study. Seven students recorded ineffective effect size for accuracy during the intervention. This is due to the large fluctuations in the number of errors recorded across all phases of the study resulting in outliers that impacted the effect size calculations (see Figure 3). At the conclusion of the study all of the participants reached the DIBELS benchmark levels of 35-45 word segments per minutes.
Figure 2. Results of phoneme segmentation fluency measures

Group 1 Phoneme Segmentation Fluency

Group 2 Phoneme Segmentation Fluency

Group 3 Phoneme Segmentation Fluency
Figure 3. Results of errors of phoneme segmentation fluency measures

**Group 1 Errors on Phoneme Segmentation Fluency**

Baseline | Intervention
---|---
Student 1 | Student 2 | Student 3

**Group 2 Errors on Phoneme Segmentation Fluency**

Baseline | Small Group Condition | Intervention
---|---|---
Student 4 | Student 5 | Student 6

**Group 3 Errors on Phoneme Segmentation Fluency**

Baseline | Intervention
---|---
Student 7 | Student 8 | Student 9
Table 1

Effect Size of Phonemic Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency and Spelling Measures

<table>
<thead>
<tr>
<th>Student</th>
<th>PSF</th>
<th>NWF</th>
<th>ORF</th>
<th>SPELLING</th>
</tr>
</thead>
<tbody>
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<tr>
<td>9</td>
<td>0</td>
<td>1.0</td>
<td>.33</td>
<td>.67</td>
</tr>
</tbody>
</table>

Note. PND of .90 or greater reflects a highly effective treatment, .70-.89 is considered a fair treatment outcome, .51-.69 is moderate/questionable, and .50 and below indicates an unreliable or ineffective intervention.
Table 2

Effect Size of Errors on Phonemic Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency and Spelling Measures

<table>
<thead>
<tr>
<th>Student</th>
<th>PSF</th>
<th>NWF</th>
<th>ORF</th>
<th>SPELLING</th>
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</thead>
<tbody>
<tr>
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<td>.25</td>
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</tbody>
</table>

Note. PND of .90 or greater reflects a highly effective treatment, .70-.89 is considered a fair treatment outcome, .51-.69 is moderate/questionable, and .50 and below indicates an unreliable or ineffective intervention.
Response rates for PSF measures were mixed (see Table 3). The average growth rate of group 1 decreased during the intervention phase while the average growth rate of group 3 increased. Members 4 and 6 of group 2 registered the strongest rate of growth during treatment 1. Students 3, 7, 8, and 9 documented more accelerated growth during the intervention phase when compared to performance during baseline.

Nonsense Word Fluency

NWF measures the ability to recognize and say letter sound relationships by reading unfamiliar consonant-vowel-consonant (CVC) words. The results of NWF measures are reported in Figure 4 and Figure 5. Students 1, 4, and 9 registered large effects in rate and accuracy, students 2 and 8 had moderate effects in rate and large effects in accuracy, and students 3 and 5 had large effects in rate (see Table 1 and 2).

During the maintenance phase, students 2, 4, and 9 demonstrated retention of NWF skills on probe 13 as indicated by responses at or above the rate level achieved during the intervention phase. This probe was administered at the beginning of second grade following the three month summer break when the students were not involved in formal reading instruction. Students 1, 3, 7 and 8 demonstrated an accelerated rate of growth from the baseline to treatment 2 and the same students with the exception of student 7 maintained a high rate of growth in the maintenance phase (see Table 3). In contrast, student 2, 4, 6, and 9’s growth rate decelerated between baseline and treatment 2.

A change in level occurred for students 1, 3, 5 and 8 on NWF measures of rate when the students entered the intervention phase. Additionally, student 8 demonstrated a change in level on NWF accuracy measures immediately after starting the intervention. Changes in levels were apparent for students 4 and 9 but the fluctuation of previous data points confounded the analysis.
Table 3
Response Rate Indicated by Slope Levels

<table>
<thead>
<tr>
<th>Treatment Phase</th>
<th>Gr 1</th>
<th>Gr 2</th>
<th>Gr 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSF Baseline</td>
<td>2.99</td>
<td>4.76</td>
<td>0.39</td>
</tr>
<tr>
<td>PSF Trt 1</td>
<td>16.0</td>
<td>5.50</td>
<td></td>
</tr>
<tr>
<td>PSF Trt 2</td>
<td>2.07</td>
<td>1.15</td>
<td>1.04</td>
</tr>
<tr>
<td>NWF Baseline</td>
<td>1.68</td>
<td>1.45</td>
<td>1.95</td>
</tr>
<tr>
<td>NWF Trt 1</td>
<td>8.50</td>
<td>1.00</td>
<td>1.50</td>
</tr>
<tr>
<td>NWF Trt 2</td>
<td>2.60</td>
<td>-0.45</td>
<td>4.05</td>
</tr>
<tr>
<td>NWF Maintenance</td>
<td>1.89</td>
<td>6.33</td>
<td>8.00</td>
</tr>
<tr>
<td>ORF Baseline</td>
<td>-1.67</td>
<td>-0.67</td>
<td>1.00</td>
</tr>
<tr>
<td>ORF Trt 1</td>
<td>2.00</td>
<td>0.00</td>
<td>-0.50</td>
</tr>
<tr>
<td>ORF Trt 2</td>
<td>0.29</td>
<td>0.98</td>
<td>2.23</td>
</tr>
<tr>
<td>ORF Maintenance</td>
<td>2.50</td>
<td>3.04</td>
<td>6.38</td>
</tr>
</tbody>
</table>

Note. Slopes represent change in response rate over a two-week period.
Figure 4. Results of nonsense word fluency measures

Group 1 Nonsense Word Fluency

Group 2 Nonsense Word Fluency

Group 3 Nonsense Word Fluency
**Figure 5.** Results of errors of nonsense word fluency measures

**Group 1 Errors on Nonsense Word Fluency**

- Baseline
- Intervention

- Student 1
- Student 2
- Student 3

**Group 2 Errors on Nonsense Word Fluency**

- Baseline
- Small Group Condition
- Intervention

- Student 4
- Student 5
- Student 6

**Group 3 Errors on Nonsense Word Fluency**

- Baseline
- Intervention

- Student 7
- Student 8
- Student 9
The NWF measure allowed students to respond to the written prompt by either saying the sound of each letter or blending the sounds to say a nonsense word. Evaluators recorded the responses by underlining each letter for an individual sound or underlining the word if blending occurred. The PI compiled the number of individual and blended responses by reviewing the DIBELS-NWF scoring booklets. The highest number of blended words on a single probe for each student is recorded in Table 4. The pivotal data probe is defined as the point when a student demonstrated at a least a doubling in the number of words blended from the previous probes.

Table 4

*Phonemic Blending of Nonsense Words on NWF Measures*

<table>
<thead>
<tr>
<th>Student</th>
<th>Blends/Word Prompts</th>
<th>Percent of Blended Words</th>
<th>Pivotal Data Probe #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3/8</td>
<td>.38</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>6/11</td>
<td>.55</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>21/21</td>
<td>1.00</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>5/11</td>
<td>.45</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>3/16</td>
<td>.19</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>2/10</td>
<td>.20</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>14/14</td>
<td>1.00</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>14/15</td>
<td>.93</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>9/14</td>
<td>.62</td>
<td>10</td>
</tr>
</tbody>
</table>
Students attempted very few blends at the beginning of the study and relied on letter-sound response. All participants were able to blend some of the nonsense prompts at the conclusion of the study. Students 3, 7, and 8 blended most of the prompts by the end of the study while students 1, 4, 5, and 6 continued to rely primarily on letter sound responses. Student 4 who scored the highest marks on the NWF measure of 80 phonemes per minute did so by responding with more letters sounds than blends. This indicates that students can reach benchmark levels in the NWF measure without mastering blending skills. Eight of the students’ pivotal data probe occurred during the intervention phase suggesting that the intervention encouraged students to blend letter sounds to form words.

Oral Reading Fluency

ORF records the number of words read correctly in one minute. The results of ORF measures are reported in Figure 6 and Figure 7. Despite the large amount of transfer skills required to substantially affect the ORF of students, student 4 had a large effect of .83 in rate and accuracy and student 5 had a moderate effect in rate and accuracy. Students 6 had a moderate effect in rate and student 2 and 3 demonstrated a moderate effect in accuracy (see Table 1 and 2).

During the maintenance phase, students 1, 2, 3, 4, 6, 8, and 9 retained ORF skills. On probe 13, administered after a three month break from formal reading instruction, the students scored at or above the exit point of the intervention phase. Student 5 was slightly below the exit score. Students 1, 4 and 9 showed strong improvements in ORF during the maintenance phase and student 3, 5 and 8 had good improvement. Student 2 continued a pattern of fluctuating scores and student 6 had unremarkable gains during the first six month of second grade. Students 1, 2, 3, and 8 showed accelerated growth rates across the intervention and maintenance phases and students 1 and 2 changed from a decelerating trend in baseline to an acceleration trend during the intervention.
Figure 6. Results of oral reading fluency measures
Figure 7. Results of errors on oral reading fluency measures

Group 1 Errors on Oral Fluency Measures

Group 2 Errors on Oral Reading Fluency

Group 3 Errors on Oral Reading Fluency
Spelling Words

Spelling accuracy was measured in two ways: the number of correctly placed letters and the number of incorrectly placed letters. For example, a word such as *hat* would count as three correct letters and if misspelled as *huc* would count as one correct letter. The results are reported in Figures 8 and 9. Students 1, 2, 3, and 5 recorded significantly high effect sizes in both measures of spelling accuracy. Students 8 had a high effect size for correct letter placement and a moderate effect size for reduction of errors. Student 4 had a high effect size for reduction of errors. Student 9 had moderate effect for correct letter placement. (see Table 1 and 2). A significant change in level occurred for students 8 and 9 at the beginning of the intervention phase. At the end of the study all the participants showed marked increases in spelling accuracy levels. The baseline data for groups 1 and 2 are limited to one data point and some data points for group 2 are missing.

Small Group Condition

Results of the effect size for the small group condition phase are reported in Tables 4. Small group instruction had no significant effect on ORF for the three students. Student 5 registered no change in any of the four areas of measurement during this phase of the study and response rates were either decelerating or were negligible (see Table 3). Student 6 had moderate to high effect sizes on NWF measures and a moderate effect size for rate on PSF measures. Student 4 demonstrated the most change during small group instruction with moderate to high effect sizes in rate and accuracy on PSF, NWF and spelling measures. Unlike student 5, student 4 and 6 had strong growth rates in PSF and NWF during the small group condition. The three students recorded varying responses to the small group treatment. A visual comparison of the actual gains made across the phases indicates that students reached higher and more consistent levels during the intervention phase.
Table 5

Effect Size of Small Group Treatment on Phonemic Segmentation Fluency, Nonsense Word Fluency, Oral Reading Fluency and Spelling Measures

<table>
<thead>
<tr>
<th>Student</th>
<th>PSF</th>
<th>NWF</th>
<th>ORF</th>
<th>SPELLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct Responses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.67</td>
<td>1.0</td>
<td>.33</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>.33</td>
</tr>
<tr>
<td>6</td>
<td>.67</td>
<td>1.0</td>
<td>.33</td>
<td>.33</td>
</tr>
<tr>
<td>Error Responses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.67</td>
<td>1.0</td>
<td>.33</td>
<td>.67</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>.33</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>.67</td>
<td>.33</td>
<td>.33</td>
</tr>
</tbody>
</table>
Figure 8. Results of spelling measures

Group 1 Spelling Words

Group 2 Spelling Words

Group 3 Spelling Words
Figure 9. Results of errors on spelling measures

Group 1 Errors on Spelling Words

Group 2 Errors on Spelling Words

Group 3 Errors on Spelling Words
Additional Participant Information

Reading Comprehension

The nine participants were evaluated at the initiation and completion of the study using the Woodcock/Johnson Passage Comprehension Subtest (see Table 6 and 7). Pretest results reported in standard scores ranged from 62 to 81 and post test standard scores ranged from 82 and 97 with the overall average gain of 16.33. Students 1, 4, 7, 8 had increases of twenty points or more during the study. All of the students demonstrated gains from 4 to 30 standard score points on the comprehension subtest.

A comparison of the group averages at the initiation of the study showed groups to be similar in reading comprehension skills reporting scores of 72.33, 74.0, and 73.66 respectively. Gains at the end of the study produced more variance with a range of 87.33 to 95.33. Group 1 made an overall gain of 17.33. Group 2 averaged a gain of 13.33. Group 3 demonstrated the largest gain of 21.67.

Vocabulary

Participants receptive vocabulary was measured at the initiation and completion of the study using the Peabody Picture Vocabulary, Form III A (see Table 6 and 7). The results of the receptive vocabulary assessment are reported in standard scores. Student 6 had a remarkably high receptive vocabulary score of 121. Students 1, 3, 4, 5 and 9 had increases of ten or more points at the end of the study. Student 9 made exceptional growth of 26 points. All students registered gains of 3 to 26 points in receptive vocabulary with an average gain of 9.66.

A comparison of group averages pre and post test indicate that groups 1 and 3 had similar scores at the beginning of the study however group 3 ended the study with a four point increase over group 1. Group 2 had a five point higher average at the beginning of the study and remained two to six points above the other two groups.
Table 6

*Standard Scores of Reading Comprehension and Receptive Vocabulary Assessments*

<table>
<thead>
<tr>
<th>Student</th>
<th>Woodcock/Johnson Passage Comprehension</th>
<th>Peabody Picture Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Post</td>
</tr>
<tr>
<td>1</td>
<td>69</td>
<td>92</td>
</tr>
<tr>
<td>2</td>
<td>72</td>
<td>84</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>93</td>
</tr>
<tr>
<td>4</td>
<td>74</td>
<td>95</td>
</tr>
<tr>
<td>5</td>
<td>81</td>
<td>85</td>
</tr>
<tr>
<td>6</td>
<td>67</td>
<td>82</td>
</tr>
<tr>
<td>7</td>
<td>76</td>
<td>97</td>
</tr>
<tr>
<td>8</td>
<td>62</td>
<td>92</td>
</tr>
<tr>
<td>9</td>
<td>83</td>
<td>97</td>
</tr>
<tr>
<td>Group 1</td>
<td>72.33</td>
<td>89.66</td>
</tr>
<tr>
<td>Group 2</td>
<td>74.0</td>
<td>87.33</td>
</tr>
<tr>
<td>Group 3</td>
<td>73.66</td>
<td>95.33</td>
</tr>
<tr>
<td>Overall</td>
<td>73.33</td>
<td>90.77</td>
</tr>
</tbody>
</table>
Table 7

*Raw Scores of Reading Comprehension and Receptive Vocabulary Assessments*

<table>
<thead>
<tr>
<th>Student</th>
<th>Woodcock/Johnson Passage Comprehension</th>
<th>Peabody Picture Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Post</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>17</td>
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<tr>
<td>4</td>
<td>5</td>
<td>16</td>
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<tr>
<td>5</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>18</td>
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<tr>
<td>8</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>16</td>
</tr>
</tbody>
</table>
Behavior Ratings

Student behaviors were rated by their classroom teachers during the first weeks of the study using the Burks Behavior Rating Scales to identify behaviors that might interfere with the learning process (see Table 8). Students 3, 4, and 7 received ratings within the normal range for first grade students. Student 8 was identified with one behavior in the significant range, that of excessive withdrawal. Student 2 was rated with two behaviors in the significant range that of poor academics and poor attention. Students 1, 5, 6, and 9 had a number of behaviors that were identified by their teachers in the significant and very significant ranges. Student 1 was rated with significant levels of poor ego strength, poor intellectuality, poor academics, poor impulse control and excessive aggressiveness and a very significant level of poor attention. Student 5 had significant behaviors related to poor ego strength, poor academics, poor impulse control, poor social conformity, and excessive resistance. Student 5 had very significant ratings for excessive aggressiveness and poor attention. Student 6 demonstrated very significant levels of poor attention and academics skills and significant levels of poor impulse control. Student 9 was rated as having excessive dependency, poor ego strength, poor academics, excessive resistance, and poor social conformity. Student 9 received very significant ratings in poor attention and poor impulse control.

Summary of Pre and Post Assessments

Combined results of the pre and post assessments indicate that student 1, 4, and 9 recorded strong improvement in reading compression and receptive vocabulary measures. The highest levels in reading comprehension were reached by student 7 and 9 and the highest levels reached in receptive vocabulary were students 1, 6 and 9. Students 3, 4, and 7 were evaluated as not having problems behaviors whereas student 1, 5, 6, and 9 were judged as exhibiting behaviors that negatively impacted learning.
Table 8

Results of Burks’ Behavior Rating Scales

<table>
<thead>
<tr>
<th>Student</th>
<th>Not Significant Problem Behavior</th>
<th>Significant Problem Behavior</th>
<th>Very Significant Problem Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>4</td>
<td>2</td>
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<tr>
<td>7</td>
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<td>1</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

Comparison with Peers

Grade level standards developed for the DIBELS were used as benchmark goals and indicators of the participants’ abilities compared to other first grade students. Initially, in the area of PSF, student 1 was at a deficit level, student 3 was consider established, and the other seven students were labeled as emerging. At the end of the study, the nine students had reached the grade level benchmark level of 35-45 word segments per minute.
All students began the study in the deficit range for NWF skills. At the completion of the study, students 3 and 4 had reached the grade level benchmark indicated by 50 phonemes per minute, students 1, 5, 6, 7, 8, and 9 were in the emerging level, and student 2 remained at the deficit skill level. However, during the maintenance phase students 2 and 9 achieved grade level scores on NWF measures.

The first measures of ORF placed students 3, 4, and 9 in the “some risk” status. The other six students read below 8 words per minute and were considered “at risk” for future reading problems. At the end of the study all students increased the number of words they were able to read per minute, however, the students remained in the same initial risk categories for oral reading fluency. During the maintenance phase, students 3, 4, and 9 made extraordinary gains in ORF and were classified as “low risk” for reading failure.

Social Validation

Ten elementary teachers were shown a video-taped session of the teacher instructing a group of students using the intervention and were asked to complete a six item Likert’s scale questionnaire (see Appendix I). On a scale of 1 to 5 with 5 being very acceptable and 1 being not acceptable, the teachers rated the social acceptability at 5 “very acceptable” and described the intervention as not causing undo stress on the participants as evidenced by an averaged rating of 4.6. The acceptability of this intervention when used with struggling young readers was highly rated at an average of 4.8. The acceptability rating of paraprofessionals teaching the intervention was 4.9 and 4.8 for teaching specialist such as special education teachers or reading specialists. When asked the teachers’ opinions of the effectiveness of the intervention to permanently impacting a student’s reading skills, the teachers’ responses averaged 4.5 or “quite likely”. Overall, the social acceptability of the intervention received a high positive response from a small group of experienced educators.
Inter-rater Reliability

Twenty percent of the DIBELS assessment measures were scored by an independent observer and compared to the results of the evaluator. The percent of interobserver agreement was calculated by dividing the number of agreed scores by the number of agreements plus the number of disagreements and multiplying the result by 100 (Tawney & Gast, 1984). The percent of interobserver agreement was .95 for Phoneme Segmentation Fluency measures, .97 for Nonsense Word Fluency measures, and .99 for Oral Reading Fluency measures.

Twenty percent of the sessions taught by each teacher were video taped and checked for procedural accuracy by an observer who completed a treatment checklist (see Appendix G and H). The percent of interobserver agreement was calculated by dividing the number of agreed items by the number of agreements plus the number of disagreements and multiplying the result by 100 (Tawney & Gast, 1984). Each teacher’s accuracy level was calculated separately. Interobserver agreement was .94 for the teacher of group 1, 1.0 for the teacher of group 2 under treatment 1 condition and .97 under treatment 2 condition, and 1.0 for the teacher of group 3.
CHAPTER FIVE

CONCLUSION

This research study attempted to answer the question: Will a reading intervention that provides instruction in written word work using word boxes increase the decoding fluency skills of young at-risk readers? The findings suggest that a positive effect, demonstrated by a measurable increase in rate and accuracy of decoding skills, was evidenced by the nine participants. In addition, spelling accuracy appeared to increase as a result of participation in the intervention. Less effect change was documented in phoneme segmentation and oral reading fluency measures.

An analysis of the results will attempt to answer some obvious and important questions. What results can be anticipated when utilizing this intervention? What type of student benefited from this intervention? How can this intervention be used in the school setting? What future research is prompted by this study? The answers are considered in the following sections that discuss the significance of the findings, limitations of the study, and implications for future applications and investigations.

Findings

The findings of this research study suggest that written word work using word boxes had a positive effect on the decoding fluency of young at-risk readers. However, not all students responded at the same level and in the same way. The results of each dependent variable, phoneme segmentation fluency, decoding fluency, oral reading fluency, and spelling, are analyzed separately and individual responses of the participants are considered.

Phoneme Segmentation Fluency

All students achieved the DIBELS grade level benchmark of 35 word segments per minute by the completion of the study. Students 1 and 6 demonstrated a change in level on the first
assessment in the intervention phase and retained high marks during the remaining trials. This suggests that the intervention caused a positive change in PSF skills for students 1 and 6.

Response rates for PSF measures were inconclusive. For group 1, the rate of growth during the intervention phase was below that of baseline. This is probably due to students achieving high and consistent rates of responses on PSF measures. Toward the end of the study, group 1 students were responding in the range of 50 to 60 sounds per minute (see Table 3). Students 4 and 6 registered strong growth rates during treatment 1. However, in group 3 the rate of growth accelerated during the intervention phase when compared to the baseline. This indicates that for students 7, 8, and 9 learning occurred at a higher rate during the intervention.

Seven students achieved benchmark levels of 35 phonemes per minute before entering the intervention phase. Considering that all three groups continued to receive reading instruction in their classrooms, students likely had opportunities to learn and practice phoneme segmentation skills independent of the intervention. Since during baseline, group 3 demonstrated scores at or above 35 phonemes per minute, comparable to an established skill level, the effectiveness of the intervention was inconclusive. Group 3 did show strong response rates during the intervention phase. This was probably due to more consistency in the responses during the intervention phase compared to the baseline phase. Encouragingly, the strong sustained responses of students 1 and 6 coupled with the two students who recorded moderate to high effect sizes may indicate that the intervention can expedite the acquisition of phoneme segmentation.

Similar to reading research that contends phonemic awareness is an early step in reading acquisition, the students’ attainment of phoneme segmentation skills preceded increases in the other measures (Adams, 1990; Bradley & Bryant, 1983; Lovett, Steinbach, & Frijters, 2000; Nicholas, Rupley, Ricelman & Algozzine, 2004; Snow et al., 1998). Students recorded gains in PSF measures
before substantial increases were recorded in NWF and ORF. Typically, students who were established in phoneme fluency skills made greater gains in NWF and ORF measures. Phoneme segmentation appears to be a reading acquisition cornerstone that, once established, can help students to master more sophisticated reading skills.

**Decoding Fluency**

The students’ decoding fluency did increase when students were exposed to the intervention. Seven participants scattered among all three groups registered moderate to high significant effect sizes in rate. Additionally, six students registered moderate to high significant effect sizes in the number of reduced errors. Reduction of errors is fundamentally important for beginning readers. Young readers who rely on guessing and uncorrected errors are less likely to develop into skilled readers (Foorman, et al., 1997; Torgesen, 1998). Interventions that help students increase accuracy are beneficial in not only building reading skills but also extinguishing poor reading behaviors.

DIBELS benchmark indicators for NWF measures are particularly encouraging. At the beginning of the study, all the participants were placed in the deficit status according to the DIBELS benchmark of less than 30 responses per minute at the mid year measurement. In group 3, two out of three students remained in the deficit status during baseline and moved into the emerging status only after starting the intervention. Remarkably, students 3 and 4 reached levels above 50 responses per minute during the intervention phase suggesting that their decoding skills were clearly established and similar to other typically developing first grade peers. Additionally, students 2, 5, and 9 continued to show improvement during the maintenance phase and reached grade level benchmarks of 50 words per minute before mid year of second grade.

The dual response, allowed by the DIBELS-NWF measure, raises a concern about the way decoding fluency is quantified. Both letter and word decoding are combined as acceptable
responses. Students responded to the nonsense word prompts by saying the sound of each letter or blending all or part of the word. At the beginning of each probe, students were given a standard instruction that explained the response options and were not influenced by the examiners to respond in one particular way. As evidenced by the low number of correct responses and the high error rates during the first probes, nonsense word reading was not an easy task for at-risk first grade readers. The students, who were at-risk for reading failure, started the study by decoding mostly individual letters and attempted only one or two word blends. A point of change was noted when the students began to increase word-blend responses and decrease individual letter sounds. This appears to be a typical developmental sequence as affirmed by Adams (1990) and Rayner et al. (2001).

Interestingly, for eight out of the nine students the critical move from letter sounds to word blending occurred during the intervention phase. Contrary to response levels described by the DIBELS developers, word blending did not immediately increase the students’ number of correct responses (Good & Kaminski, 2002). In fact, for four students, just the opposite occurred as indicated by a small dip in their scores. At the same time, error responses decreased. This may indicate that the students’ rate of responses had slowed however reading was more accurate and purposeful. By the next scheduled probe, students regained rate levels and on subsequent testing responses continued to increase above previous levels. Even more remarkable was the fact that students 8 and 9 in group 3 exhibited this same pattern even though they started the intervention phase toward the end of the instructional year and participated in the intervention phase for only six weeks.

Blending phonemes to create words is a pivotal skill for reading comprehension. Warranting more investigation, the results suggest that the intervention is instrumental in helping students move from decoding individual phonemes to blending phonemes in order to read words. This likely is
attributed to the repeated opportunities students received during the intervention to pull a word apart and then put the sounds back together to form the word. As students gained experience with this skill they were more cognizant of how letter sounds were blended to form words and started combining the letter sounds to read words.

**Oral Reading Fluency**

The results suggest that the intervention had a moderate impact on students’ oral reading fluency. Three students had moderate to fair effect sizes in rate and four students had a moderate to fair response in accuracy. Encouraging are the results of response rates that continued to accelerate for five students from baseline through maintenance. However, since members of group 3 showed erratic responses during the baseline phase, instruction from general education curriculum can not be ruled out as the contributing variable. Worthy to note is that all participants showed a reduction in errors in oral reading measures over the course of the study. As previously discussed, the reduction in errors during reading is important. Furthermore, three students showed amazing gains in oral reading fluency three to six months after leaving the study. The full impact of the intervention on oral reading remains inconclusive and justifies more study.

Despite recorded gains in the participants’ ability to read connected text, the students’ oral reading fluency remained far below grade level expectations during the study. ORF levels of under thirty words per minute were reported for all the participants. DIBELS benchmark indicators consider students who are reading 20 and 40 words per minutes to be in the “some risk” status. Low response levels in oral reading fluency measures were not unexpected. Speece and Ritchey (2005) studied reading fluency in a similar but much larger population of at-risk first graders and found that at-risk students’ word reading rates grew at approximately half the rate of typically achieving peers. Moreover, Speece and Ritchey’s research concurs with that of Stahl (2002) and
Roth et al. (2002) who found that phonological training directly impacts single word decoding but has less direct effect on oral reading fluency. According to Speece and Ritchey, the accuracy and fluency of word-level skills are most directly related to oral reading fluency. Most students in the present study were not established in word-level reading skills as reflected in the nonsense word fluency measures. Understandably, the students performed poorly when asked to read connected text. As pointed out by Katzir et al. (2006) and Hudson, Lane, and Pullen (2005) the transition from word reading to connected text is complex and requires more sophisticated levels of processing of graphemes/phoneme combinations to develop rate as well as comprehension, and prosody.

**Spelling**

The eight students in the study registered moderate to high significant effect sizes on spelling accuracy measures. The limitations of the measuring instrument and the number of probes must be considered and are discussed in the limitation section, however, the results are worthy of interpretation with applied restrictions. High significant effect sizes of 1.0 were recorded for four students in each of measurements: correct letter placement and incorrect letter placement. One strong indicator of effectiveness was the response of student 8 in group 3 who demonstrated no significant growth during baseline and a high effect size as a result of the intervention phase. These are encouraging findings that are well supported in the literature. The correlation between learning to read and learning to spell is documented and the transference of skills is a natural outcome (Hart et al., 1997; Joseph, 2000; Joseph, 2002 a.; O’Connor & Jenkins, 1995; Rayner et al., 2001). Ehri (2000) describes the relationship between reading and spelling as emerging from the same knowledge base. As the students in the study learned to identify phonemes, substitute letters for sounds, and put words back together, both reading and spelling skills were strengthened.

*Small Group Condition*
To control for any change due to instruction offered in small groups outside of the classroom, students in group 2 were exposed to a 1:3 teacher student reading focus group. Instruction was offered in comprehension and vocabulary skills and the teacher refrained from letter/sound instruction or guided sentence writing. This allowed the Principle Investigator (PI) to analyze if the response to the intervention was a result of receiving more teacher attention. This phase of the study was restricted to six weeks. Student 5 was not impacted by the small group instruction. Student 4 responded to the small group condition by increased scores in rate and accuracy on NWF and spelling measures. Student 6 had a high response on NWF rate and a moderate response in accuracy. Response rates were mixed with student 5 registering negative or no growth while students 4 and 6 recorded accelerated growth during the treatment 1 phase in two of the measures. However, important to note is that group 2’s response levels continued to rise during the intervention phase as well and highly significant effect sizes were recorded even when the substantial growth during the small group condition phase was considered. Overall, small group instruction had no impact on one student but may have created a condition of positive change for the other two students in the group. The results have limited interpretation but the experimental variable of meeting with students in small groups outside of the classroom must be considered as a possible reason for increased performance other than the intervention.

*Individual Response Differences*

Dermer and Hoch (1999) point out that single-subject research design has the advantage of documenting individual variability. Analysis of individual responses can provide important insight for educational planning. The results of this research study indicated a variance of response among members in the same group. Students 1 and 3 (group 1), 4 and 5 (group 2) and 7 (group 3) showed steady growth in most of the measures over the course of the study. The performance of student 8
(group 3) was unpredictable during the baseline phase but demonstrated more consistency after entering the intervention phase. Scores of student 2 (group 1) and student 9 (group 3) showed great fluctuation during the entire study. Student 6 (group 2) exhibited the least amount of change through all phases of the study. Encouragingly, one or two students in each grouping registered positive changes in reading skills.

Students in the study were screened for problem behaviors. A comparison of the students’ academic performance and number of identified behavior problems were analyzed. The findings in this study are similar to those reported by Kamps, et al. (2003). Using similar instrumentation and a larger population of at-risk first graders, Kamps, et al. found students who were at-risk for academic and behavior problems made the least amount of progress on DIBELS measures. Similarly, in the present study, students 3, 4, and 7 who were judged as not having problem behaviors were in the group of steady performers. Interestingly, student 1 and 5, both female, who were rated as having significant behavior problems performed with success during the study. The question of gender issues is raised.

Students 2 and 9 were rated with poor attention among other problems behaviors which may account for their erratic performance on assessment probes. Although student 9 had uneven results, he was able to register some of the highest scores in oral reading fluency. He was categorized as a “word caller” by his teacher at the beginning of the study. Student 9 made exceptional gains in reading comprehension and receptive vocabulary growth over the course of the study. This student registered some of the highest receptive vocabulary scores at the conclusion of the study. The follow-up information indicates that student 9 made significant progress during the first part of second grade and moved into the “low risk” category of the DIBELS-ORF during the mid year assessment. At that time, he was reading connected text at a fluency level equal to his peers.
Student 2’s long term outcome was quite different. Student 2 continued the erratic pattern of response on the ORF measures and remained in the “at risk” status at mid year of second grade. Accuracy tended to be a problem for student 2. The percentage of errors was in the .20 to .40 range. At times, this student appeared to reach high levels indicating substantial progress however, repeated measures resulted in large dips. This may be reflective of attention problems more than abilities.

Student 6 is more of a concern. Applying the non responder dual-discrepancy model that compares academic performance and growth rates to that of peers, student 6 lagged behind the others in achievement and rate of growth (Fuch & Fuch, 1998). Student 6 is a good candidate for more intensive instruction. Continued progress monitoring of student 6 during second grade showed even more dismal results. Eight months after the end of the study, student 6 was at the same level on NWF and ORF measures as when he exited the study in May. Importantly, student 6 scored above-average on the receptive vocabulary measure indicating a strong ability to understand language. This could be indicative of a specific learning disability.

Student 6’s profile would likely initiate a referral for special education evaluations and possible services. Student 6 may benefit from an educational plan that offers a more intensive, supportive and explicit reading approach. In a multi-tiered framework as suggested by Al Otaiba and Fuchs (2002) and others (Fuch, et al., 2004; Vaughn & Fuchs, 2003), the researched intervention might be considered a tier two instructional practice in a “response to intervention” model. This intervention offers small group targeted skill based instruction. A poor response to the intervention in phase two may warrant movement to a more inventive instructional approach such as is recommended in tier three.
Limitations of Study

This study is not without limitations. The findings must be qualified in at least four areas: setting, instrumentation, experimental design, and generalization. Each area is discussed in further detail in regard to the extent of the limitation and the impact on the results.

Natural Environment Setting

This research study was conducted in the natural environment of the school setting. Advantages of conducting research in the natural setting are great. In this case, information gleaned from assessing students could be used to continue reading services at the end of the study. School staff was trained to use the assessment instruments and the intervention and to continue research-based techniques after the study was completed. Faculty members observed the project in action which piqued their interest in new ways to conduct and apply assessment information. However, data collected in the natural environment does come with a cost.

Time constraints were an issue in the school setting. School calendars and classroom activities were honored. The intervention phase of this study began in January and continued to the end of May. During this time, schedules were interrupted by vacation days, illness, and special school-wide events. Every effort was made to offer the intervention at least four times each week, however not all students received the same amount of instructional time. In an attempt to finish the study by the end of the school year, the researcher was compelled to move groups into the next phase before a true three data point trend was established. This may have compromised the results particularly in the small group condition phase of group 2.

Instructional groups of three students are an ideal group size according to Elbaum, et al. (2000) and Ehri, Nunes, and Willows (2001) and are a practical approach in the school setting. The arrangement of participants in small groups does deviate from true single-subject design and created
challenges when evaluating the results. The results show that in each group at least one student responded positively to the intervention. Conversely, at least one student in each group recorded a limited response to the intervention. This led to conflicting conclusions about the effectiveness of the intervention. Fortunately, additional individual information was helpful in discerning why response levels may have varied among the participants.

**Instrumentation**

The spelling assessment was problematic. The researcher developed the six word spelling test by choosing phonetically predictable CVC words that varied in the types of vowels and consonants presented. A pilot test of the instrument was not conducted. Additionally, fewer probes were administered for spelling. The spelling test was introduced at the beginning of the intervention phase of the study unlike the DIBELS measures that were conducted two times during the first half of the school year. Furthermore, some information was not collected due to a miscommunication between the teacher and researcher leaving group 2 with fewer spelling probes.

Although the spelling assessment has a number of threats to validity, a substantial amount of previous research supports the findings (Berninger et al., 2001; Ehri & Wilce, 1987; Foorman et al. 1991; O’Connor & Jenkins, 1995; Rayner et al., 2001). Additionally, the strongest evidence is documented by group 3. Students in group 3 had an established even baseline. A change of level occurred, as demonstrated by a significant increase in the number of correct letter placements, after the students entered the intervention phase.

Another instrumentation dilemma was encountered by the DIBELS-NWF measure. The NWF measured two types of decoding fluency: individual phonemes and blended nonsense words. Students could respond either by identifying individual letter sounds or by blending sounds to make a word. The DIBELS evaluators recorded the responses in two ways: individual letter sounds and
blended words. The two-way response system allowed the PI to analyze when students changed from letter-sound identification to the higher skill of blending however a different set of assessment instruments would provide information that is clearer and more decisive. Separate measures for letter sound identification, nonsense word fluency, and real word fluency are suggested as alternative assessment probes for this study.

**Experimental Design**

Single-subject experimental design is characterized by highly controlled variables and close monitoring of data during the experiment. As discussed previously, the natural setting created less control over some of the outside variables. Student attendance, focused attention to instruction, motivation and cooperation were encouraged but could not be fully controlled. Moreover, students still received reading instruction in the classroom as they would in a tier-two school-wide intervention model. Maintaining the students’ general education reading instruction was important and obviously gains in reading skills occurred during baseline as a result. This may explain why the stability of the baseline data points was difficult to achieve for most students across all measures during the study. The PI compromised single-subject design principles of three consecutive data points to signify stability in favor of moving groups to the next phase so the study could be completed by the end of the school year. Additionally, more probes during baseline for groups 1 and 2 and in the spelling measures were needed. As a result in changes to the experimental design, the effectiveness of the intervention is not as convincingly apparent.

**Generalization**

This study was limited in scope due to the number of participants and the restriction to one setting. The results of this study are promising; however they are not strong enough to stand alone. Interpretation of the results is narrow and applies most strongly to the nine students in the study. A
more generalized application of the intervention requires replication to establish external validity. Furthermore, research of this intervention using different populations, settings, and measurements is highly recommended.

In summary, threats to validity are present and impact the strength of the study outcomes. The results and findings are most appropriate when applied directly to the participants of the study. Less confidence in the findings is apparent when applied to different populations and settings. The limitations are a concern and call for further research that can replicate the findings particularly for larger more diverse populations in a variety of school settings.

Implications

System changes in the educational setting are occurring in response to reading research and federal legislation. As tiered reading intervention models and skill-based reading assessments are put in place, teachers are asked to apply research-based interventions to prevent reading failure and to remediate the identified skill deficits of struggling readers. The availability and specificity of such programs are limited. Torgesen (2002) comments, “we must work to find sufficient instructional resources to provide more intensive, explicit and supportive instruction to children who need it” (p. 25). Kamil et al. (2002) conclude from a review of reading instruction strategies that in reference to struggling readers more research is needed in the areas of remediation, problem prevention, and implementation in the classroom setting. McCardle et al. (2001) call for more research in “what to teach” and “at what age” (p. 237). Fletcher and Lyon (1998) state a need for more research to help develop cost-effective models for early identification, prevention, and intervention. In addition, Fletcher and Lyon suggest there is a critical need for information to determine the length and intensity of the instruction required
to remediate individual students as well as how to maintain the gains achieved in remediation programs.

Furthermore, no one strategy works for all children nor is there one intervention that remediates all children back to grade level proficiency (Klenk & Kibby, 2000; McCardle, et al. 2001; Torgesen, 2002). A variety of resources are desirable that are cost-effective and proven to be practical, effective approaches in the school setting.

This research study provides a partial answer in the hunt for reading interventions that are practical, proven, and targeted at the remediation of essential reading skills. The intervention did demonstrate a positive impact on the rate and accuracy of early reading and spelling skills. The findings suggest that explicit instruction that incorporates guided sentence writing and word boxes does increase students’ decoding fluency, particularly for children who are established in phoneme segmentation tasks. For classroom teachers who have identified students with difficulties attaining decoding fluency, this intervention could be embedded in small group instruction or used as a tier two intervention.

The intervention requires few materials and the cost of administration is quite low. The opinions of educators after viewing a taped session of the intervention with first graders were favorable. The teachers judged the intervention as creating low stress for students, useable by teachers and paraeducators, and likely to be effective with struggling readers. Because the study took place in the natural environment of an elementary building and utilized the school staff, the successful application to other school settings is highly likely.

This study revealed other features of instructional delivery that are of interest. First, offering specialized instruction in groups of three allowed comparison of effectiveness within the group. Second, progress monitoring was not difficult to administer and provided important on-going
information about each student. Third, by combining the results of instruction within groups and individual progress monitoring the level of the response-to-intervention compared to the other members in the group was visually apparent in the data. As more schools adopt the response-to-intervention model for identifying students with specific learning disability, this type of intervention paired with progress monitoring can provide data instrumental for the early identification of students who need more intense and specialized reading programs.

The instructional approach of guided sentence writing using word boxes was adapted from the University of Florida Literacy Initiative (UFLI) Teaching for Beginning Readers Program (Hayes, Lane, & Pullen, 1998). The approach was isolated for study to investigate the effectiveness and function when included in a reading program. The findings of this study indicate that guided sentence writing using word boxes has a positive impact on the development of young readers’ decoding and spelling skills. Less change was seen in phonemic segmentation skills and oral reading fluency. Consequently, the findings confirm that this intervention does not work for every student and should not stand alone. Guided sentence writing using word boxes is most beneficial when offered as part of a balanced reading program that includes opportunities for the development of other components of a reading program such as oral reading fluency, vocabulary, and comprehension skills.

Finally, this research study supports the theoretical framework of the Adams reading model (Adams, 1990). Adams suggests that reading begins with the orthographic and phonological processors where letters and sounds are perceived and interpreted. Without this initial ability to decipher written symbols into related sounds, students are severely limited in their attempts to make sense out of what is on the page. Likewise, the students in this study were challenged when trying to develop meaning from connected text due to poor development of letter-sound relationships. During
the duration of the study, as students acquired adequate phonemic segmentation skills they moved on to mastering decoding skills and subsequently oral reading fluency increased. As Adams points out, automaticity depends on the strength and speed of the linkage between the processors. The at-risk readers participating in this study lacked strong connections between the orthographic and phonological processors as evidenced by poor decoding skills. After receiving more opportunities to identify, say, write, and read grapheme-phoneme combinations using word boxes, the students demonstrated increased decoding rates. Three students increased the speed of the connections to a more acceptable rate of automaticity and appeared to be reading at grade level by mid year of second grade. The Adams model provides an applicable reading framework for understanding the students’ response to the reading intervention.

Future Research

The findings of this study suggest that when provided a small group intervention using guided sentence writing with word boxes at-risk first grade students demonstrate beneficial reading outcomes. Less is known about the use of guided sentence writing using boxes with other populations such as low ability students, students with specific learning disabilities, and English language learners. Instructional methods and materials for English language learners is a current interest in the reading literature (Linan-Thompson, Vaughn, Prater & Cirino, 2006; Neufeld, Amendum, Fitzgerald, & Guthrie, 2006; Vaughn, et al., 2006). The materials and procedures of the intervention are easily adapted to other languages and for use with English language learners. Furthermore, the intervention may be effective in transitioning students from first languages to literacy skills in English. Word boxes provide explicit teaching of vowel and consonant letter-sounds that often pose problems for readers whose first language use the same written symbols for
different sounds. Additional research is needed to further understand the effectiveness and usefulness of this intervention with other populations of students.

This research study focused on reading outcomes. Less is known about this intervention in regards to writing outcomes. The increase in spelling accuracy coupled with opportunities to express original ideas in written form, prompts questions about the effect of the intervention on writing abilities. Moreover, the strong link that exists between reading and writing would support the investigation into the effects of guided sentence writing using word boxes on the writing skills of young children.

An unexpected outcome of the study revealed that students behavior seemed closely tied to reading success. Those students who were rated as having no behavior problems tended to have greater success then their counterparts. This was not true however for the two female participants. A call for more research in behavior, motivation, and gender as they relate to reading outcomes are substantiated by the findings in this study as well as other notable researchers in the reading arena (Kamps et al., 2003; Levy & Chard, 2001). From a review of the literature, Levy and Chard conclude that in the wealth of reading research less in known about the impact of behavior on reading acquisition. Appropriate reading interventions that address motivation and behavior and promote positive reading outcomes appear lacking.

Clearly, the results of this study, although encouraging, are limited and cannot be fully understood without additional research. Replication of the experimental design that considers three participants per group is interesting, practical for school settings, and informative. More research into the challenges and benefits of single-subject experimental design that incorporates small groups of students is warranted. Continuation of this research premise by correcting the flaws that limited the findings would provide important comparative data. The inclusion of school personnel in the
research process posed few problems and appeared to result in enthusiasm, increased interest, and the continuation of programming for students. Research that addresses the effectiveness of performing single-subject experimentation in the natural setting of the school is justified and of interest.

Concluding Remarks

Researchers continue to probe into the reasons why nearly one third of American children find reading a difficult task. For struggling readers, the mastery of early reading skills impacts their ability to gain fluency and comprehension of written text. Furthermore, when reading is a strenuous task, a child is less likely to freely engage in reading activities. Early identification and interventions that begin before third grade appear highly beneficial for preventing later reading failures.

Toward this end, an intervention for students who are at the partial alphabetic stage that addresses phonemic awareness, letter-sound recognition, and connects the reader to meaningful text was studied. Sound instruction practices that were supportive, explicit, systematic, and intensive were incorporated into the intervention. The findings indicate that for these students decoding fluency and spelling accuracy increased as a result of explicit written word work instruction that incorporated guided sentence writing using word boxes. The outcomes and knowledge gained from this research study may prove beneficial to future struggling readers.
REFERENCES


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Torgeson, J. (2004). Lessons learned from research on interventions for students who have difficulty learning to read. In P. McCardle & V. Chhabra (Eds.), *The voice of evidence in reading research* (pp. 355-382). Baltimore, MD: Paul H. Brookes.


Appendix A

*Word List for Spelling Assessment*

1. ask, did, jump, get, must, box
2. last, into, got, cut, web, fly
3. his, fan, run, lot, task, best
4. rod, hid, tan, just, left, cot
5. him, long, help, wax, fun, let
6. tug, bed, gas, sky, slim, frog
7. top, has, plum, jig, sled, try
8. sit, until, bong, went, rut, zap
9. nut, wag, next, jot, cry, help
10. end, shop, wind, yak, fix, tug
11. best, cop, pun, fist, blot, sax
12. upon, set, map, cut, rock, with
13. crop, slit, jet, sag, jug, hem
14. log, pit, shed, ham, dump, pry
Appendix B

Spelling Test Form

Student Name______________________________

1.________________________________________

2.________________________________________

3.________________________________________

4.________________________________________

5.________________________________________

6.________________________________________
Appendix C

Materials

The following materials are used for the assessment phase of the study:

Timer that can be set for exactly one minute and has an audible signal
Red pen or pencil for recording DIBELS responses
DIBELS-PSF student and observer forms
DIBELS-NWF student and observer forms
DIBELS- ORF student and observer forms
List of spelling words (Appendix H)
Spelling test form (Appendix I)

The following items are used for the delivery of the intervention:

Student writing notebook – standard paper notebook containing at least thirty sheets of plain white paper
Four 12” white boards and four dry erase markers
Pencils, glue stick, scissors, plain white envelopes
Computer and paper for preparing sentence strips
Sentence strips prepared before each session by the teacher (Sentence strips can be offered in a variety of font styles, colors, and sizes, within the range to 18 point to 28 point font)
List of warm-up words (Appendix E)
Session notebook (Appendix F)

The following items are used for the baseline treatment phase of the study:

Session notebook for baseline treatment form (Appendix G)
Teacher selected picture book
Paper, pencils, and crayons for drawing activity

The following items are used for consistency and validation evaluations:

Video camera, video player and monitor

Observer Treatment Checklist Form (Appendix B)

Observer Baseline Checklist Form (Appendix C)

Social Validation Questionnaire Form (Appendix D)
Appendix D

Prescribed Word List for Word Box Warm-ups

1. (a) ant, at, map, rat, van
2. (a) dad, can, tax, yam, and
3. (i) it, dip, bib, kit, rig,
4. (i) zig, did, lip, quit, fit
5. (o) mop, not, job, fox, log
6. (o) pot, top, hog, box, stop
7. (u) up, rug, fun, bus, buzz
8. (u) cup, gum, mud, yum, slug
9. (e) elm, yes, jet, hem, pep
10. (e) web, step, bed, end, next
11. (a-i) zap, big, yak, six, dip
12. (o-u) bug, pop, hot, punt, got
13. (e) let, fed, met, gem, them
14. (i) icky, fin, pit, mix, crib
15. (e-i) whiz, bed, elf, beg, fix
16. (CVCC) bolt, nuts, gang, jump, must
17. (CVCC) beds, pink, went, jolt, next
18. (CVCC) lump, wind, pups, cast, zips
19. (CVCC) plug, slip, blot, grit, plan
20. (CVCC) clap glad flat, step, drop
21. (CVy) my, sky, fry, cry, spy,
22. (th) that, this, with, than, path

23. (CVCe) make, take, rate, face, wave

24. (CVCe) hide, bite, kite, like, side

25. (CVCe) vote, joke, cone, tone, poke

26. (CVCe) dune, duke, cute, huge, mute

27. (CVe, CCVe) eve, these, theme, ice, size

28. (wh) whim, white, when, whip, whine

29. (mix) act, bake, sent, fun, lamp

30. (mix) flip, pile, wax, quack, line

31. (mix) ham, jetty, take, nice, blip

32. (ing) ring, sing, going, wing, riding

33. (mix) zing, that, when, strip, but

34. (ch) chip, chat, chop, chin, match

35. (ck) sick, duck, sack, clock, pluck

36. (mix) next, crime, them, zip, twig

37. (sh) she, dish, cash, shape, shine

38. (mix) jack, sing, day, this, ship

39. (mix) chick, luck, fix, wish, find

40. (oy) boy, toy, joy, Roy, coy

41. (mix) drip, bang, clock, toy, just

42. (mix) into, got, ping, can, spell

43. (mix) cake, bell, quiz, drape, fry

44. (mix) bell, clock, three, like, came
45. (CCVCC) bell, clock, three, like, came
46. (CCVCC) bland, twigs, bring, sticks, stand
47. (mix) things, never, jingle, long, mother
48. (mix) nice, fish, beds, batch, father
49. (mix) shade, wild, smile, dry, cost
50. (mix) golf, front, push, lunch, twist

For word lists 51-64, the students were asked to box the first word and then change the sound in the box or add boxes to make the next word.

51. cup, zip, tip, ted., bid
52. tux, tex, tilt, top, pep
53. rack, rock, track, sick, suck
54. lit, let, pot, pit, vet
55. hut, hog, fig, lug, leg
56. wag, wit, wig, wet, quit
57. pep, pip, drip, trap, flip
58. kit, hit, bet, nit, net
59. flag, flap, slap, glad, fad
60. mush, must, just, jug, slug
61. plane, crane, crop, drop, drag
62. book, hook, hike, bike, bite
63. smile, pile, pole, volt, bolt
64. three, tree, trip, trim, slim
Appendix E

Teacher Session Notes: Vocabulary and Comprehension

Date__________________      Session Time ___________ to _____________   Student  ________________   ...  5.___________________________________  Discussion Questions 1.  2.  3.  4.  Activity     Teacher

Teacher’s observations:

<table>
<thead>
<tr>
<th>Spelling Test Results (two weeks or 8th session)</th>
<th>Student</th>
<th>Errors</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Attach students’ spelling tests
Appendix F

Teacher Session Notes: Word Box/Guided Sentence Writing

Date_________________ Session Time ____________ to ____________

Students_________________ ________________________ ________________________

Step 1: Read and assemble the previously written sentence

Step 2: Warm-up for word boxes

1._________________ 2._________________ 3._________________ 4._________________

5._________________

Notes:

Step 3: Elicit a sentence

____________________________________________________________
Code words in sentence familiar
Number of word in sentence _______

sound
sight

Step 4: Guide each student in writing sentence in the student notebook.

Step 5: Ask student to reread sentence and previous sentences at a quick pace.

Teacher’s observations:

Spelling Test Results (two weeks or 8th session) Student Errors Correct

_____________ ______  ______

_____________ ______  ______

_____________ ______  ______

Attach students’ spelling tests
### Appendix G

Observer Checklist: Word Box/ Sentence Writing Treatment

<table>
<thead>
<tr>
<th>Step</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Teacher asked student to read sentence from previous session</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher prepared three sentence strips to use with student</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student read cut up sentence word-by-word</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student reassembled sentence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student read the reassembled sentence</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Teacher explicitly taught 3-5 words using word boxes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student identified each phoneme</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student used fingers to count the number of phonemes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The student drew word boxes for each phoneme</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The student wrote letter(s) for each phoneme</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The student wrote the word at least one time under the word box</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Teacher helped student decide on an original sentence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher recorded the sentence and marked words (circle, square, underline) according to difficulty</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Teacher guided student in writing the sentence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student practiced sight words on word working page</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student used word boxes on at least two words</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Student identified each phonemes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Student used fingers to count the number of phonemes</td>
<td></td>
</tr>
<tr>
<td>c. The student drew word boxes for each phoneme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. The student wrote a letter for each phoneme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. The student wrote the word at least one time under the word box</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Student read sentence to teacher |  |

| Total |  |
### Observer Checklist: Small Group Treatment

<table>
<thead>
<tr>
<th>Teacher # ______</th>
<th>Video # ______</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher selected an age appropriate book to read to the students</td>
<td></td>
</tr>
<tr>
<td>Teacher engaged the students in vocabulary and comprehension activities</td>
<td></td>
</tr>
<tr>
<td>Teacher refrained from teaching phoneme awareness, letter-sound correspondence, and word attack skills.</td>
<td></td>
</tr>
<tr>
<td>The session lasted twenty-five minutes</td>
<td></td>
</tr>
</tbody>
</table>
Appendix I

Intervention Social Acceptability Measure

Please complete the items below by circling the number under the question that best indicates your opinion of the teaching approach.

1. Is this reading intervention socially acceptable?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Neutral</th>
<th>Very Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

2. Does this reading intervention cause undo stress on the participants?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Some</th>
<th>Very Stressful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

3. Would this be an acceptable reading intervention to be used by teaching specialist (reading teachers, special education teachers)?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Neutral</th>
<th>Very Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

4. Would this be an acceptable to be reading intervention used by paraprofessionals?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Neutral</th>
<th>Very Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

5. In your opinion, how likely do you think this reading intervention would be in permanently impacting a student’s reading skills?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Neutral</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likely</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

6. How acceptable do you find the teaching technique to be for struggling young readers?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Neutral</th>
<th>Very Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>