THE USE OF PSEUDOWORDS FOR DECODING INSTRUCTION

By

KERI MARIE MADSEN

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This work is dedicated to my mom – one of the strongest, most intelligent, and hard-working women I will ever know. You have inspired me to push myself beyond what was even imaginable, and I simply could not have made it this far without you.

I also dedicate this to the memory of my dad. It fills my heart to know how proud you would be if you were here today.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

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By

Keri Marie Madsen

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Children who fall behind in reading during the elementary years often remain poor readers, and the effects can be detrimental to future success in school and in life. A primary deficit experienced by many struggling readers is poor development of skills that lead to decoding and word recognition. Efforts to promote the development of these foundational reading skills are critical, particularly for at-risk and struggling readers. Studies have shown that interventions that teach decoding, including word work with manipulatives, are effective at improving reading and spelling outcomes in at-risk or struggling readers. However, there is still much to learn about what specific aspects of instruction make these interventions effective.

This study serves to extend our understanding of decoding development by exploring the role of pseudowords in decoding instruction for beginning readers. Specifically, this study examines the effects of incorporating pseudowords during decoding instruction on the decoding accuracy and automaticity performance of kindergarteners who were not yet demonstrating full-alphabetic word recognition. An experimental pre-test post-test group design was used to compare the decoding outcomes of three groups of students: (a) a treatment group receiving 15 sessions of word work instruction with real words and pseudowords, (b) a comparison group receiving 15 sessions of word work instruction with real words only, and (c) a business-as-usual control group. Participants were assessed at pre- and post-test using a battery of researcher-developed and standardized assessments of decoding accuracy and automaticity.

Analysis of covariance (ANCOVA) was used to test for statistical difference between post-test group means while controlling for pre-test scores. Results indicate statistically significant differences between groups on researcher-developed measures of real-word accuracy, real-word automaticity, and pseudoword automaticity, with follow-up comparisons indicating both treatment and comparison conditions performed significantly better at post-test than students in the control group. No significant difference was found between treatment and comparison groups on these measures. There was also a group by covariate interaction for on the Word Attack subtest of the *Woodcock Reading Mastery Tests*. There were no significant differences found for a pseudoword accuracy measure or for the Phonemic Decoding Efficiency subtest of the *Test of Word Reading Efficiency*. Overall, the results suggest that incorporating pseudowords during decoding instruction with kindergarteners in the early stages of decoding development is just as effective as using real words alone. Implications for practice and directions for future research are discussed.

CHAPTER 1
INTRODUCTION

Reading is among the most essential skills to develop during the early school years. Without the ability to read, students have limited access to the content of every other academic subject. Unfortunately, children who fall behind in reading during the elementary years often remain poor readers throughout school (Juel, 1988; Snow, Burns & Griffin, 1998; Stanovich, 1986), with as many as 70% of older students struggling with reading (Biancarosa & Snow, 2004). Once these reading trajectories are established, they are difficult to change (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Good, Baker, & Peyton, 2009). Moreover, reading failure is likely to lead to negative consequences such as grade retention, dropout, limited employment opportunities, and difficulties with basic life activities (Lyon, 2001). Clearly, the long-term effects of early reading difficulties can be devastating.

Efforts to promote the development of foundational reading skills are critical for beginning and at-risk or struggling readers. To be skillful at reading, one must be able to extract meaning from written language; however, understanding print is dependent upon the abilities to first recognize the symbols of print and convert these symbols into meaningful units of oral language (Gough & Tunmer, 1986). When a reader has learned to perform these foundational tasks, he or she is able to decode print. Decoding ability is an early and strong predictor of future success in reading (Juel, 1988); yet, the primary deficit identified in many struggling readers is poor development of skills that lead to decoding and word recognition (Chall, 1983; Henry, 1993; Torgesen, 1999). Fortunately, cumulative research spanning across the past three decades has provided educators with a better understanding of effective instruction to promote these foundational literacy skills.

Reports generated by the National Research Council (NRC, Snow et al., 1998) and the National Reading Panel (NRP, 2000) have examined a sizable body of evidence on effective early reading instruction and made recommendations for practice. The NRP report focused on five core areas of reading: phonemic awareness, phonics, fluency with connected text, vocabulary and language development, and comprehension of text. While instruction in each area is important for success in reading, phonemic awareness and phonics instruction contribute most to the development of decoding, and this is especially true for students who are struggling to learn how to read (Adams, 1990; Snow et al. 1998; NRP, 2000).

Decoding instruction may be approached in a variety of ways, but word work is one instructional method that is used widely to help make explicit connections between phonemes (i.e., the discrete sounds of speech) and graphemes (i.e., the single letters or letter combinations that represent individual phonemes) through multisensory techniques using manipulative materials. Throughout the literature, methods to promote decoding often make use of magnetic letters (Campbell, Helf, & Cooke, 2008; O'Connor & Jenkins, 1995; Tunmer & Hoover, 1993); letter tiles or cards (Blachman, Tangel, Ball, Black, & McGraw, 1999; Blachman et al., 2004; Ehri & Wilce, 1987a; McCandliss, Beck, Sendak, & Perfetti, 2003); colored chips or blocks (Linan-Thompson & Hickman-Davis, 2002; Uhry & Shepherd, 1993); and Elkonin boxes (Joseph, 1998, 2000a, 2000b, 2002a; Maslanka & Joseph, 2002; Ryder, Tunmer, & Greaney, 2008; Tunmer & Hoover, 1993; Vadasy, Sanders, & Peyton, 2005). During word work, materials such as these are used to manipulate (i.e., delete, substitute, add, blend, and/or segment) phonemes within words, thereby connecting an otherwise abstract auditory task with a concrete visual-kinesthetic task for enhanced memory and learning (Campbell et al., 2008). Researchers have shown that decoding interventions that include the use of word work with manipulatives are beneficial for at-risk and struggling readers (Campbell et al., 2008; Iversen & Tunmer, 1993; Joseph, 1998; Lane et al., 2009; McCandless et al., 2003; Pullen, 2000; Pullen et al., 2005). Furthermore, word work with manipulatives has been identified as an integral component within a multi-component literacy intervention (Lane et al., 2009) as well as an effective independent intervention (Joseph, 2000a, 2000b; Pullen, 2000).

Although studies have identified word work as an effective instructional method for teaching decoding to beginning or struggling readers, very few studies have examined what features of word work contribute to effectiveness. The present study intended to extend the research on word work by investigating an aspect of words used for instruction. Specifically, this study examined the role of pseudowords in decoding instruction with beginning readers. Currently, there is limited research on the use of pseudowords for instructional purposes despite theoretical support for potential benefits in the development of decoding skill.

Research Problem and Professional Significance

Studies have shown that interventions including word work are effective at improving reading and spelling outcomes in at-risk or struggling readers; however, research has provided limited insight into what makes word work more or less effective. Most published studies that include word work, do so as part of a multi-component literacy intervention; and, of the few that have isolated word work as an independent variable (i.e., Lane et al., 2009; Pullen, 2000), none have sought to examine the type of words used during word work. It is common for teachers, researchers, and developers of phonics programs to place emphasis on the use of real words or even recommend against the use of pseudowords for decoding instruction. This practice is largely based upon conventional wisdom, or a reasonable belief that practice with real and meaningful words will promote the reading of real and meaningful text (Adams, 2011). Yet, using pseudowords during decoding instruction may prove to be beneficial for students who are just beginning to learn how to decode.

In English, pseudowords, sometimes called nonsense words or non-words, consist of a pronounceable string of letters that conforms to the orthographic patterns of the language but holds no meaning ("Pseudowords," n.d.). To illustrate, *wub*, *flot*, and *straff* adhere to the spelling patterns of English and are pronounceable but have no meaning in the English language. Pseudowords are often used in psycholinguistic studies of lexical processing to examine or compare the neural pathways evoked by words (Cibelli, 2012). In studies of word reading, theories of processing have been proposed in which pseudowords utilize either separate processing pathways from real words (i.e., the dual-route theories; see Coltheart et al., 1993) or shared processing pathways with real words (i.e., the connectionist theories; see Seidenberg & McClelland, 1989). These theories have provided a foundation upon which much of the current literature on reading has been built (Perfetti, Van Dyke, & Hart, 2001).

Pseudoword reading has long been regarded as a reliable predictor of reading proficiency (Gough, 1983). As such, pseudoword reading is widely used in the measurement of decoding (e.g., Ehri et al., 2007; Pullen et al., 2005; Shankweiler et al., 1999; Snowling, 1981; Uhry & Shepherd, 1993). According to Good, Baker, and Peyton (2009), the rationale for using pseudowords as a measure of decoding skill is "derived from the extensive research base on learning to read in an alphabetic writing system, such as English" (p. 35). These researchers suggest that skills that are necessary for decoding are isolated from the ability to read words by sight during pseudoword reading because the reader cannot rely on past experience with a pseudoword. Instead, the reader relies on their understanding of the letter-sound relationships (i.e., the alphabetic principle) and the rules that govern those relationships and then applies this knowledge to decode.

A similar rationale can be proposed for using pseudowords in decoding instruction, particularly for students who are in the beginning phases of learning to decode. For beginners, the use of pseudowords during instruction limits the possibility to rely upon memory for a word and instead forces the novice reader to apply knowledge of the alphabetic principle to decode (Cardenas, 2009). While it is possible that knowledge of real words may assist a more advanced reader to identify pseudowords through analogy, beginners will not have a large enough lexicon or the skills necessary to read pseudowords this way (Ehri, 2005). Therefore, pseudoword reading ensures that beginning readers are truly tapping into phonemic awareness and application of the alphabetic principle – skill areas specific to decoding – and, once learned, these skills can be applied to any word. Moreover, pseudowords offer increased opportunities to practice decoding through exposure to more letter and sound combinations than would be provided with real words alone. As such, experience with pseudoword reading may increase independent decoding success and generalization of decoding skill to a wider variety of unfamiliar words. Because of these potential benefits, research that examines the use of pseudowords for decoding instruction has the potential to contribute to improved practices in decoding instruction.

A few researchers have mentioned including pseudowords in studies of decoding intervention, and participants who have been exposed to these interventions have improved on measures of reading (e.g., Ehri & Wilce, 1987b; Pullen et al., 2005), but only one study has specifically examined the effects of pseudoword instruction (Cardenas, 2009). In her dissertation, Cardenas investigated whether or not a phonics curriculum comprised only of pseudowords would increase kindergarteners' success in phonetic decoding. This researcher found that students who were provided pseudoword phonics for 28 school days in place of real-word phonics made greater gains during and after the treatment than students who received only real-word phonics. The findings of this study offer preliminary support for the use of pseudowords during phonics instruction with beginning readers.

This present study serves to extend the examination of pseudowords to teach decoding to beginning readers by comparing decoding outcomes of three groups of students: those who receive word work with real words and pseudowords, those who receive word work with real words only, and those who receive no word work at all. Broadly, this study examined the effects of incorporating pseudowords during decoding instruction on the decoding development of kindergarteners who are at risk for reading difficulties. Specifically, the following four research questions were addressed:

1. What are the effects of decoding instruction that includes pseudowords on real-word decoding accuracy?
2. What are the effects of decoding instruction that includes pseudowords on pseudoword decoding accuracy?

3. What are the effects of decoding instruction that includes pseudowords on real-word decoding automaticity?

4. What are the effects of decoding instruction that includes pseudowords on pseudoword decoding automaticity?

Theoretical Framework

This study draws on three different theories: Connectionist Theory, Ehri's Phases of Word Reading, and the theory of Recombinative Generalization. The following section outlines the key tenets of each theory and how each relates to this study.

Theorists of reading development largely agree on at least one thing – the ultimate goal of reading is to comprehend written language. While it is true that reading comprehension involves the synergy of many complex mental processes, the complexities of reading can be simplified into two primary parts: word recognition and linguistic comprehension (Gough & Tunmer, 1986). Each part is critically important to reading ability, but linguistic comprehension will serve little value if printed words are not first recognized.

In order to recognize and ultimately understand printed words, multiple sources of information must be processed. As Adams (1990) proposes in her model of parallel-distributed processing of skilled reading, word recognition involves a system of associative orthographic, phonological, semantic, and contextual processing. This model is connectionist in nature in that these four processors work in mutual coordination to send and receive information to and from one another (Adams, 2001). Visual observation of the spelling of a word will activate the system at the level of the orthographic processor, but recognition of the word will require associative connections with one or more of the other processors. The semantic processor will be activated with the reader's accumulated knowledge of the word's meaning; the phonological processor will be activated with the pronunciation of the word; and the context processor will be activated when the word has been primed or can be anticipated from within context.

Early phonemic activation during word recognition is known to play a major role in the processing of letter strings (Perfetti & Bell, 1991; Perfetti, Bell, & Delaney, 1988; Ziegler & Jacobs, 1995). Thus, the formation of strong connections between the phonological and orthographic processors is foundational to word recognition. The more frequently these processors exchange information, the stronger the connections become, and the stronger the connections between any two processors, the more automatic and accurate word recognition will be (Adams, 1990).

The development of word recognition is often explained through developmental phase theories. Although many developmental theories of word recognition have been proposed in the literature, the work of Linnea Ehri (1991, 1998, 2005) generates one of the most widely recognized and accepted. Through years of research, Ehri proposes five phases through which readers pass during the development of word recognition. During the pre-alphabetic phase, beginners have no working knowledge of the alphabetic system and are able to identify commonly encountered environmental words based upon non-alphabetic salient visual features alone. As these beginners learn a limited number of letters and corresponding sounds and use this limited knowledge to help in the identification of words, they enter the partial-alphabetic phase. Once complete and functional knowledge of letters and sounds develops, readers enter the full-alphabetic phase. This marks a critical transition in the development of word recognition because readers are finally able to fully decode words through spellings during the full-alphabetic phase. With practice, and as reading becomes more accurate and automatic, readers will eventually pass from full-alphabetic reading into the consolidated-alphabetic phase. During this phase, they learn to recognize and use multi-letter units within words and to read words by analogy. Finally, readers enter the automatic phase where reading is highly accurate and automatic, and they have many strategies they can use to identify occasional unknown words.

The transition from partial-alphabetic to full-alphabetic word recognition has significant implications for the proposed study. This transition marks the point in development when beginning readers learn to use alphabetic information to decode unknown printed words. In order for readers to become sufficient at word recognition, they must make this critical transition.

Because proficient decoding requires strong orthographic and phonemic skills, efforts to strengthen the associations between the orthographic and phonological processors are important during this transition. Including pseudowords during decoding instruction is one way to ensure that these associations are being activated. Once a word becomes familiar, beginning readers can become reliant on the other sources of information (i.e., semantic and contextual sources) to identify the word. With a pseudoword, the correspondence between spelling and sound offers the only source for reading the word (Adams, 2011). Thus, reading pseudowords requires activation of the orthographic and phonological processors.

An argument against using pseudowords for instruction exists among some researchers and educators based upon a conventional assumption that instructional stimuli for decoding must be real in order to be of value to students. For example, Adams (2011) makes the case against using only pseudowords for instruction, indicating that real words in meaningful contexts are better for beginning readers. While it is true that skill instruction should be paired with opportunities for application in meaningful context (NRP, 2000), the potential contribution of pseudowords should not be dismissed. A goal of skill instruction is to promote generative responses from students. Generative responses demonstrate transfer of behavior or learning from trained stimuli to stimuli that have not been directly trained or practiced (Schumaker & Sherman, 1970). In other words, familiar stimuli are recombined in novel ways. The process by which generative responses are formed is referred to as recombinative generalization (Suchowierska, 2006).

In linguistics, recombinative generalization plays a role in the development of language as previously learned language units are formed into novel arrangements (Goldstein, 1983). Instruction that promotes recombinative generalization should contribute to functional, rather than rote, knowledge that can generalize across stimuli, responses, and time (Suchowierska, 2006). For decoding instruction, this implies that, as graphophonemic units are learned, they will be useful to students when encountered in novel arrangements, or unfamiliar words. Because pseudowords conform to the orthographic and phonemic patterns of English, decoding instruction and practice with the graphophonemic units in pseudowords should result in generative responses.

Conclusion

This chapter provided an overview of the problem addressed by this study. Despite a wealth of research literature on the topic of beginning reading instruction, many children continue to struggle. Effective decoding instruction is essential for the development of proficient word reading. A more complete understanding of the salient features of effective decoding instruction will help improve instructional practices, and ultimately eliminate many of the struggles common to beginning readers. This study aims to elucidate the role of pseudowords in decoding instruction with beginning readers.

Chapter 2 will present the literature on early reading development, beginning with a focus on Linnea Ehri's phases of word recognition and the importance of decoding development. Next, the deficits leading to poor decoding will be summarized. Then, the findings of research on effective decoding instruction and intervention for at-risk and struggling readers will be presented. Chapter 3 will describe the methods used to conduct this study. Chapter 4 will present results of the data analysis. Chapter 5 will discuss the findings and provide the limitations and implications of this study.

CHAPTER 2
REVIEW OF RELATED LITERATURE

To be proficient at reading, one must ultimately be able to comprehend the meaning of print, yet the ability to comprehend print is largely dependent upon the ability to first convert print into recognizable spoken words (Hoover & Gough, 1990). Accordingly, word recognition has been credited as the foundation of the reading process (Gough, 1984; Stanovich, 1991). Reading words may be approached in several ways (Ehri, 2004; Ehri & Snowling, 2004; NRP, 2000). Readers may decode words by converting letters into speech sounds (i.e., phonemes) and then blending those sounds to form words. They may also read words through analogy, which involves accessing from memory the spellings and phonemes of words already learned to help read unfamiliar words that contain similar spellings. Context clues and background knowledge may also be used to anticipate or guess unfamiliar words. These three approaches to word reading are useful when reading words that have not been read before; however, as spellings and sounds within words that have been read before become familiar, words are stored in memory (Ehri, 2004; Ehri & Snowling, 2004). These words become part of the reader's lexicon and can be read more rapidly and efficiently by sight.

The ability to read words by sight offers the greatest automaticity during reading and frees cognitive resources for text comprehension (Ehri & Snowling, 2004). Skilled readers recognize most words by sight because they have already formed complete connections between letters and sounds and have many words stored in memory. They may use decoding, analogy, and/or prediction, but they do so infrequently when encountering unfamiliar words in text. However, beginning readers must rely on these three approaches when reading because they have not yet stored the written form of many words in their lexicon. Although all three of these approaches have value, decoding provides the most accurate and reliable approach to reading unfamiliar words for the beginning reader because it provides the most reliable cues – letters and their corresponding sounds (Ehri, 2004). With practice, decoding leads to greater accuracy in word reading, which contributes substantially to the storage of more words in memory, thereby promoting the development of sight word recognition.

Ehri's Phases of Word Recognition Development

Over the years, several researchers have examined the process of developing word recognition, but the work of Linnea Ehri has made some of the most substantial contributions to our current understanding of the development of word recognition. Ehri (1995; 1999) has proposed a set of discernable phases of word recognition that develop over time as beginning readers experience print. Ehri and her colleagues (i.e., Ehri & Snowling, 2004; Ehri & McCormick, 1998) have described these phases with each successive phase varying by the degree to which a reader uses the alphabetic system. As developing readers pass through the phases, their command of the alphabetic system becomes stronger and word reading becomes more skilled. While the characteristics that define each phase are unique, a developing reader transitioning from one phase to another may demonstrate characteristics from both phases simultaneously. These phases of word recognition are the pre-alphabetic phase, the partial-alphabetic phase, the full-alphabetic phase, and the consolidated-alphabetic phase. On occasion, Ehri has also discussed a fifth phase, which she refers to as the automatic phase (Ehri & McCormick, 1998).

Pre-alphabetic Phase

According to Ehri (1995,1999), the pre-alphabetic phase of word recognition is characterized by a minimal working knowledge of the alphabetic system. Beginners in this phase have limited knowledge of letters and lack knowledge of the connections between letters and phonemes. As such, alphabetic knowledge cannot be used to read words. Instead, these beginners attend to and memorize extraneous visual features unrelated to the printed word and associate these features with the spoken word (Ehri & Wilce, 1985; Gough, 1993). They commonly recognize visual stimuli associated with words in their environment such as familiar logos and may appear to be reading words – not by recognizing or attending to any of the letters – but rather by recognizing the colors, images, or patterns that remain consistent in those logos. Salient visual features within some words may also serve as cues, and some printed words may be memorized with practice but are quickly forgotten due to weak connections in memory. Consequently, connected text cannot be read during the pre-alphabetic phase (Ehri & Snowling, 2004).

Because beginners in the pre-alphabetic phase rely on salient visual cues to remember words rather than their knowledge of connections between letters and sounds, it is particularly important during initial reading instruction to reduce or eliminate extraneous cues that may detract from the alphabetic features of letters. To illustrate this, a child in this phase who learns the alphabet using a set of colorful manipulative letters may attend to the color of a given letter rather than the letter shape. This cue will not be sufficient for the child as he or she encounters the same letter in different contexts. In order to move beyond the pre-alphabetic phase of word reading, beginners must shift their attention from non-alphabetic visual cues to the letters in words and their corresponding sounds (Ehri & Wilce, 1985).

Partial-alphabetic Phase

The second phase of word recognition proposed by Ehri (1995, 1999) is characterized by the shift from reliance on visual cues to the use of phonetic cues to recognize words (Ehri & Wilce, 1985). During the partial-alphabetic phase, developing readers begin to recognize some letters in words and associate those letters with their corresponding letter names and phonemes. This knowledge allows these beginners to use partial-alphabetic cues – often initial and final letters in words – in combination with other contextual clues to predict unfamiliar words (Ehri, & Snowling, 2004). In doing this, they begin to move beyond the unreliable associations they have formed between non-alphabetic visual cues and meaning to more reliable graphophonemic associations. Development of graphophonemic associations is often facilitated for beginning readers when letter names contain relevant speech sounds because many children learn letter names prior to learning phonemes associated with letters (Ehri & Wilce, 1985, 1987; Templeton & Bear, 1993; Treiman, 1993). For example, the name for the letter *k* (i.e., *kay*) contains the sound /k/ in its pronunciation. Thus, recalling the correct phoneme can be facilitated when encountering the letter *k* in a word as opposed to encountering a letter such as *w*, which does not contain the sound /w/ in its name (i.e., *double u*). As graphophonemic associations are made, partial-alphabetic readers may begin to use the alphabetic system to support their reading efforts.

Movement into the partial-alphabetic phase will begin with the recognition of a few letters and phonemes. In fact, many beginners moving into this phase learn to recognize the letters and sounds in their own names first (Ehri & Snowling, 2004).

However, having partial knowledge of correspondence between letters and phonemes will limit accuracy when reading, particularly as the reader encounters new words, words with unfamiliar letters or sounds, or words with similar spellings. To illustrate, the word *crane* may easily be confused with similarly spelled words such as *cane* or *can* when the reader is only able to attend to some of the letters in the spelling. Thus, partial-alphabetic readers are not yet able to decode words. Movement from the partial-alphabetic phase into the full-alphabetic phase requires extensive knowledge of how the letters are represented by phonemes in the conventional spelling system (Ehri & Snowling, 2004).

Full-alphabetic Phase

Readers in the full-alphabetic phase have formed complete connections between letters and sounds as well as the blending skills necessary to analyze and decode complete words (Ehri, 1999; Ehri & Snowling, 2004). Because full-alphabetic readers are able to use complete spellings to read, similarly spelled words may now be differentiated (Ehri & Wilce, 1987a). During this phase, readers also possess sufficient knowledge to decode spellings that they have never seen before (Ehri & Wilce, 1983, 1987b) and to read new words by analogy to words they already know (Ehri & Snowling, 2004). This promotes greater accuracy and increases reading opportunities, allowing full-alphabetic readers to be exposed to many new words. With practice, the ability to decode aids the reader in the recognition of words as spellings become bonded with pronunciations in memory (Ehri & Snowling, 2004). Therefore, during the full-alphabetic phase, repeated exposure to words allows words to be committed to memory. As more words are stored in memory, word spellings, pronunciations, and meanings may be accessed automatically upon sight (Ehri & Snowling, 2004) resulting in faster reading that no longer requires the decoding of every word (Ehri & Wilce, 1983). For this reason, word recognition will become more accurate and automatic during the full-alphabetic phase with sufficient practice.

Consolidated-alphabetic Phase

As a reader rapidly encounters and stores more new words in memory, they begin their transition into the consolidated-alphabetic phase. According to Ehri & Snowling (2004), working knowledge of recurring letter sequences is a hallmark characteristic of this phase. This may include knowledge of syllable patterns, affixes, roots, and onset-rime combinations (Ehri & McCormick, 1998). As a reader is exposed to the same spelling patterns repeatedly and across many different words, the patterns become consolidated units in memory that are bonded with pronunciations. This bonding allows readers to recognize units within words that are larger than single letters, thereby speeding access of words from memory (Ehri & Robbins, 1992; Juel, 1983). Consolidated units also assist in reading multisyllabic words. Readers in the consolidated-alphabetic phase read with greater accuracy and fluency not only because they have learned how to use the alphabetic system, but also because they now read words by analogy, they have had sufficient exposure to and practice reading many words, and they continue to rapidly develop their lexicon during this phase. As a result, basic decoding skill is no longer necessary to read most words but may be used and further developed as readers encounter new and unfamiliar words.

Automatic Phase

The final phase of word recognition, as described by Ehri and McCormick (1998), is the automatic phase. This phase is characterized by rapid and automatic identification of words that are both familiar and unfamiliar to the reader (Chall, 1983;

Ehri & McCormick, 1998). Readers in this phase are able to read words effortlessly in or out of context, and when an unfamiliar word is encountered, they have multiple strategies involving the use of semantic and syntactic clues to help them identify and verify the word. This level of automatic and fluent reading allows the reader to direct their full attention to the meaning of the word for comprehension of the text.

The Critical Transition to Skilled Decoding

Ehri's phases of word recognition provide an understanding of the development from non-reader to proficient reader, but it is the point of transition between partial- and full-alphabetic word recognition – the point when decoding skill develops – that is known to be particularly problematic for many struggling readers (Chall, 1983; Henry, 1993; Torgesen, 1999). To make this transition and to become a skillful decoder, readers must develop skill in phonemic awareness as well as an understanding of the alphabetic principle, both of which are known early predictors of later reading development (Ehri et al., 2001).

Phonemic awareness is the awareness of the speech sounds in spoken language. It includes the ability to identify, isolate, and otherwise manipulate individual phonemes in spoken language (Ehri et al., 2001; NRP, 2000). These skills become instrumental during early reading of an alphabetic language because decoding requires the ability to identify the letters in a printed word, isolate the individual speech sounds associated with each of those letters, and then blend them together to form the word. To do this, a reader must have an understanding of the alphabetic principle, which is knowledge of letters in the alphabet as well as the understanding that individual letters and combinations of letters, otherwise referred to as graphemes, are used in written language to represent phonemes in spoken language (Adams, 1990).

As previously discussed, a developing reader in the partial-alphabetic phase will know some letters and the sounds commonly associated with those letters, thus, using partial-alphabetic cues along with other clues to identify words encountered in print. Because their knowledge of the alphabetic principle is not yet broad enough to decode words or to recognize words by larger units of spelling, partial-alphabetic readers are limited to anticipating and guessing words using incomplete information from the spelling.

The partial-alphabetic phase is important because it is the point in development when phonemic awareness, letter knowledge, and preliminary connections between letters and sounds begin to emerge. During this phase, it is important for readers to first develop the phonemic understanding that spoken words are made up of discrete sounds that can be blended and segmented. Isolating discrete sounds from within spoken language is a difficult task (Liberman, Shankweiler, Fischer, & Carter, 1974). This may be because phonemic awareness is largely abstract, and phonemes are not typically isolated for any reason during the flow of normal continuous speech (Moats, 1998, Ehri et al., 2001). To make the abstract more concrete and to facilitate the transition from partial- to full-alphabetic reading, auditory and verbal information can be represented by visual and tactile supports such as manipulative sound markers or letters.

Once initial letter-sound connections have been established for a few consonants and at least one vowel, letters may be combined to form simple words for decoding practice (Beck, 2006). However, as Ehri (1995, 1999, 2005) has explained, partial knowledge of the letters and their corresponding sounds will be insufficient to rely upon during reading for several reasons. First, knowing only some of the letters and sounds contained within a word leaves a reader with no choice but to guess the word, which decreases accuracy during reading. Second, many words share similar letters and sounds, so confusion between similarly spelled words is inevitable. If the reader has seen the word *house* and knows it contains the letters *h* and *s*, other words that are visually similar (e.g., *horse* or *hose*) or words that are not-so-similar but contain the letters *h* and *s* (e.g., *has* or *his*) are likely to be confused for *house.* Third, there is no way for readers with only partial-alphabetic knowledge to read all of the unfamiliar words they will encounter in print with accuracy and automaticity. To avoid these problems, developing readers must eventually learn how most conventional spelling patterns correspond to the sounds in spoken words.

The transition from partial- to full-alphabetic reading begins as readers start to fill in the gaps that exist in their knowledge of the alphabetic system. Full-alphabetic reading is not completely developed until all of the letters of the alphabet and the most common letter-sound relationships are learned. According to Ehri and Snowling (2004), word reading is generally slow and lacks fluency during the early part of the full-alphabetic phase. This is attributed to the attention the emerging reader may be affording to every letter encountered in print as they deliberately sound out every word. However, this characteristic of full-alphabetic reading should be temporary as the alphabetic system is applied repeatedly and words are stored in memory (Ehri & Snowling, 2004). As the transition culminates, full-alphabetic readers will be able to move beyond basic decoding and begin to recognize spelling patterns across words, which may then be applied when reading new and unfamiliar words.

Learning to decode marks a critical point in the development from partial- to full-alphabetic reading because it allows increased accuracy and automaticity with word reading, which in turn allows for greater opportunity to read more words. With sufficient practice, the sight word vocabulary of the full-alphabetic reader should grow rapidly and more attention may be shifted to comprehension of text (Ehri & Snowling, 2004). Reading connected text may continue to be slow and lack fluency at times depending upon how many unfamiliar words the reader encounters in text; thus, further development of a reader's lexicon will depend upon sufficient practice with text at appropriate reading levels (Ehri & Snowling, 2004).

Problems Learning to Decode

Unfortunately, many children experience difficulty learning to read, and word recognition is the most common source of difficulty among struggling readers (Chall, 1983; Torgesen, 1999). Because decoding and word recognition are critical to reading development (Adams, 1990; Ehri, 1995, 1999), deficits that interfere with the development of decoding have been of great interest to researchers.

It is a widely held view that "most children with reading disabilities have a core phonological deficit that interferes with their ability to develop phonological awareness, discover the alphabetic principle, and learn to decode" (McCardle, Scarborough, & Catts, 2001, p.233). According to Blachman (1994), as many as 90% of children and adults with serious reading difficulties demonstrate problems with phonological processing. Dyslexia, a well-researched specific learning disability that primarily affects the ability to read, has been most strongly associated with impairments in phonological processing, and particularly at the phoneme level (Ehri & Snowling, 2004).

Other deficit models of reading implicate auditory, visual, or linguistic processing; processing speed; or memory as core deficits for reading disabilities; however, there is less evidence supporting causation for these models (Ehri & Snowling, 2004; McCardle et al., 2001). Moreover, while there are many models or theories that seek to explain reading difficulties, most account for a weakness in the ability to process the phonological features of language (McCardle et al., 2001).

Instruction that Promotes Decoding

Because decoding is the most common area of difficulty for struggling readers, instruction that facilitates the skills needed for decoding is beneficial to all beginning readers and critical for struggling readers (Adams, 2001). Although decoding may emerge for some students without much instruction, gaining a complete understanding of the alphabetic system offers the most promising results and is best achieved through explicit, systematic instruction (Adams, 1990; Ehri & Snowling, 2004; Snow, Burns, & Griffin, 1998), and this type of instruction is particularly important for struggling readers (Chall, 1967, 1983; Tunmer & Hoover, 1993). The *National Reading Panel* completed an extensive examination and meta-analyses of controlled experimental research to evaluate the effectiveness of phonemic awareness and phonics instruction. They published their findings in *The Report of the National Reading Panel: Teaching Children to Read* (2000). In the sections that follow, phonemic awareness and phonics instruction will each be discussed, and the findings of the NRP in each area of instruction will be summarized.

Phonemic Awareness Instruction

The goal of phonemic awareness instruction is to foster an awareness of and the ability to manipulate the sounds in spoken language (Ehri, 2004). Specific skills associated with phonemic awareness include detecting, identifying, isolating, deleting, blending, and segmenting discrete phonemes in spoken words. Awareness of spoken language at the phoneme level is instrumental in preparing beginning readers for the blending and segmenting skills they will use when decoding and encoding words in written language. However, discovery of the discrete phonemic units of language is not always obvious to developing readers and should be aided by explicit instruction that teaches how the system of speech sounds work (Ehri et al., 2001).

The value of phonemic awareness skill as a predictor of reading development has been demonstrated repeatedly in the research (Blachman, 1984, 1994; Hulme et al., 2002; Lenchner, Gerber & Routh, 1990; Mann, 1993; McCardle, Scarborough, & Catts, 2001; Nation & Hulme, 1997; Share, Jorm, Maclean, & Matthews, 1984). Consequently, phonemic awareness instruction has also gained appreciable attention from reading educators and researchers alike. Prior to the work of the NRP, numerous experimental studies were conducted to evaluate the effectiveness of phonemic awareness instruction, but not all adhered to acceptable levels of methodological rigor (Ehri et al., 2001; Troia, 1999). For this reason, the NRP set out to examine the methodological design of controlled experiments that had been conducted as well as to determine the overall effectiveness of phonemic awareness instruction.

The overall findings of the NRP (2000) meta-analysis support the consensus of many researchers that phonemic awareness instruction is beneficial for helping children develop as readers. The NRP reported that phonemic awareness instruction was found not only to improve phonemic awareness skills, but it was also found to facilitate transfer to various reading and spelling skills in preschool and elementary students, including normally progressing readers as well as younger at-risk and older struggling readers. Many studies included in the analysis had already independently concluded that phonemic awareness instruction consistently produced reading outcome advantages over comparison approaches or no instruction at all (Ball & Blachman, 1991; Blachman et al., 1994; Bradley & Bryant 1983, 1985; Byrne & Fielding-Barnsley 1991, 1993, 1995; O'Connor & Jenkins, 1995; Urhy & Shepherd, 1993). The NRP meta-analysis found significant, moderate effect sizes for word reading (d = 0.61) and pseudoword reading (d = 0.56) (i.e., measures of word recognition and decoding skill), strengthening the claims of these and other studies. Furthermore, even though the NRP reported larger effect sizes for studies with stronger designs, significant effects were found regardless of how rigorous studies were designed. This finding is promising because it suggests that weaknesses of some studies do not undermine claims of effectiveness of phonemic awareness instruction (Ehri et al., 2001).

Although there is strong evidence that phonemic awareness instruction is beneficial during the early development of reading, the application of phonemic awareness skills must remain the ultimate goal of instruction. Ehri et al. (2001) warns that phonemic awareness should not be "taught for its own sake but rather for its value in helping children understand and use the alphabetic system to read and write" (p. 279). Larger effects of phonemic awareness instruction on reading outcomes have been found when children are taught not only phonemic awareness, but also the correspondence of speech sounds to letters as well as how to apply phonemic awareness skills to reading and writing (Cunningham, 1990). As such, the NRP (2000) recommends that letters be incorporated into phonemic awareness instruction to provide visual stimuli and a concrete medium for the otherwise abstract tasks of phoneme manipulation and to help beginners establish initial connections between speech sounds and letters. As the connections between phonemes and letters are formed, phonemic awareness skills may be applied for decoding and the focus of instruction may shift toward phonics (Ehri et al., 2001; NRP).

Phonics Instruction

Phonics refers to instruction that teaches the associations between letters and sounds as well as how to use the alphabetic system to read and spell (Ehri, 2004). Specifically, the goal of phonics instruction is to teach beginners how to decode print. Approaches to phonics instruction are characterized throughout the literature in a variety of ways. For example, Stein, Johnson, and Gutlohn (1999) discuss two contrasting approaches to phonics instruction known as implicit phonics and explicit phonics. In an implicit approach to phonics, students learn letter-sound connections indirectly and always through the context of whole words rather than in isolation, whereas, in an explicit approach, the teacher directs student attention to the connections between letters and sounds. Phonics instruction is generally considered explicit when individual letters and corresponding sounds are taught in isolation, usually through direct instructional approaches, and then applied to and practiced in whole words and text (Mesmer & Griffith, 2005). Explicit phonics approaches are considered to be superior to indirect, implicit approaches, particularly for students who are at-risk or struggling (Adams, 1990; Chall, 1967, 1983).

A systematic approach to phonics instruction is also described often throughout the literature (NRP, 2000). Phonics instruction is systematic when all of the major letter-sound associations are presented in a clearly defined sequence (Ehri, 2004; Ehri &

Snowling, 2004). In a well-designed systematic phonics approach, lessons are taught in a sequence that “reveals the logic of the alphabetic system” and allows students to apply what has already been learned to new learning (Adams, 2001, p.66). Although there has been disagreement in the past about the best method for teaching beginning reading, phonics instruction that is both explicit and systematic is known to be highly effective in promoting the development of decoding in beginning readers as well as in struggling readers (NRP).

Several variations to systematic phonics instruction are found throughout the literature included in the NRP (2000) meta-analysis. The report identifies the most common variations as synthetic phonics, analytic phonics, embedded phonics, analogy phonics, and phonics through spelling. Common to all of these approaches is the planned, sequential, and explicit presentation of phonic elements; however, these approaches also vary in one or more ways. Synthetic approaches to phonics instruction teach learners to focus on individual letters and sounds and to blend sounds to form words. In contrast, analytic phonics teaches learners to analyze letter-sound relationships, but only after words are identified. Individual letter-sound relationships are not taught in isolation with this approach. Embedded phonics teaches letter-sound correspondences in the context of reading. During this approach, learners are encouraged to use knowledge of letters and sounds as well as context clues to identify unfamiliar words. The analogy approach to phonics emphasizes the use of familiar word parts to identify unknown words. Phonics through spelling teaches learners to segment spoken words into letters and write words. Most phonics programs include one or any combination of these systematic approaches.

The results of the NRP (2000) meta-analysis indicate that phonics instruction has a significant, moderate effect on reading and benefits decoding and word reading as well as text comprehension and spelling in many readers including young at-risk students as well as older students with reading disabilities. In addition, synthetic and larger-unit approaches to phonics (i.e., analogy using onset-rime or phonograms) produce similar advantages, as do individual, small-group, and whole-class delivery methods. More importantly, systematic phonics produces greater reading outcomes than non-systematic approaches to phonics and all other forms of instruction.

Although it is clear that struggling readers need effective decoding instruction, and the NRP (2000) helps to establish that phonemic awareness and phonics instruction are both effective and important for the development of decoding skill, questions remain about what specific aspects or features of instruction contribute to its effectiveness. In the next section, several features of instruction for improving decoding and word recognition in at-risk and struggling students will be discussed. Because the NRP has already summarized findings of a large body of experimental research conducted prior to 2000, the following review will focus primarily on research that has been conducted since that time. Finally, implications for future research and practice will be discussed.

Intervention to Develop Decoding Skills in Struggling Readers

The studies on phonemic awareness and phonics interventions that have been conducted in the 12 years since the report of the NRP have several things in common. Most of the studies have concentrated on instruction for at-risk or struggling first- and second-grade students. Most have implemented supplementary interventions with small-groups of students or one-on-one. Many have studied interventions that focus solely on phonics while others have investigated more comprehensive interventions that include phonics as one component. Almost all have incorporated the use of manipulatives to teach phonemic awareness and/or phonics. Although there are commonalities throughout this body of research, there is variability as well, making it difficult to draw conclusions about specific features that may or may not contribute to the effectiveness of instruction. The following sections will focus on several common features of decoding instruction found within the literature.

Phonics with Phoneme Level Instruction

One study investigated the effects of phonological awareness intervention when added to an early reading program. Hatcher, Hulme, and Snowling (2004) were interested in the inclusion of supplemental phonological awareness instruction for young beginning readers participating in a structured reading program with a strong phonics component. Classes of 4- to 5-year-old children were divided into matched groups and randomly assigned to one of 4 conditions. Three conditions received 10 minutes of supplemental phonological awareness instruction varying by phonological unit (i.e., one condition received rhyme instruction, one received phoneme instruction, and one received both rhyme and phoneme instruction). Students in the control condition received the same amount of supplemental time participating in more of the regular reading program. Supplemental instruction was provided to groups of 10 to 15 students 3 times per week for 14.5 months over the first 2 years of school.

Hatcher et al. (2004) found that phonological training had no significant impact upon the reading outcome of normally developing readers; a highly structured phonics program was sufficient for most students to master the alphabetic principle and learn to read. However, students at risk for reading problems who received phonological awareness instruction at the phoneme level made significant gains in word reading, whereas, at-risk students who received only rhyme instruction or no phonological awareness instruction did not. Furthermore, the level of phoneme awareness skill attained by at-risk students at the end of the intervention period proved to be a powerful predictor of final word and non-word reading at follow-up. These findings indicate that young students struggling to develop reading skills may need something more than typically developing readers, and instruction that focuses on the phoneme unit may be a critical component for students who are at-risk.

Multisensory word work

Several studies included in the NRP report provided interventions that included word work as a method of decoding instruction (e.g., Blachman, Ball, Black, & Tangel, 1994; Blachman, Tangel, Ball, Black, & McGraw, 1999; Iversen & Tunmer, 1993; O'Connor & Jenkins, 1995; Tunmer & Hoover, 1993). Word work is an instructional approach commonly used to teach students how to decode by making connections between phonemes and graphemes explicit through the use of manipulative materials that provide tactile and visual phoneme representations. A multisensory word work approach is particularly beneficial for struggling students because it provides a concrete medium for teaching the abstract tasks of phoneme manipulation (Campbell, Helf, & Cooke, 2008). Throughout the literature, word work is conducted in a variety of ways that typically make use of magnetic letters, letter tiles, colored chips or blocks, and/or Elkonin boxes during tasks that involve the manipulation of phonemes within words.

Most of the studies in this review incorporate one of two common multisensory approaches to word work during decoding instruction. In the first approach, Elkonin boxes, also referred to as word boxes or graphic boxes, are used to assist in the development of phonemic awareness. Elkonin boxes are a series of connected squares drawn on paper to represent a word, with each individual square representing a single speech sound (i.e., phoneme) within the word (Joseph, 2002b; Williams, 1984). Students begin by placing small discs or other place-markers, one at a time, into the squares as they segment the word into its phonemes. Later, discs are replaced with letters to represent each phoneme. Elkonin (1973) reported that students who were taught with this method of phonemic segmentation improved in other areas of literacy beyond segmenting.

One of the first researchers to use Elkonin boxes was Marie Clay (1993) in her work with Reading Recovery, a one-on-one tutoring model. In Reading Recovery, Elkonin boxes are incorporated as a method to help students spell by segmenting words into their individual sounds. Several other one-on-one tutoring models have also included Elkonin boxes as part of a comprehensive intervention including Reading Rescue (Hoover & Lane, 1997), Sound Partners (Vadasy, Sanders, & Peyton, 2005), and University of Florida Literacy Initiative (UFLI; Hayes, Lane, & Pullen, 1999). The research on these models has demonstrated efficacy.

Ehri, Dreyer, Flugman, and Gross (2007) conducted a study of Reading Rescue and found it to be effective for increasing word reading as well as comprehension skills. Sound Partners was investigated by Vadasy et al. (2005) and found to be effective for increasing decoding, spelling, fluency, and comprehension, especially when paired with passage reading in decodable text. While both of these tutoring models were found to be effective, neither study specifically examined the unique contributions of Elkonin boxes.

In a study conducted by Lane, Pullen, Hudson, and Konold (2009), the effects of Elkonin boxes were specifically examined within the UFLI model. These researchers found word work with Elkonin boxes to be an integral component of UFLI. When all components of this model were provided to participants, UFLI tutoring was effective; yet, when word work with Elkonin boxes was removed from the model, participants who received the reduced model failed to demonstrate significant improvements in decoding or word recognition.

Other researchers have examined the use of Elkonin boxes as an isolated instructional approach. In an early study, Joseph (1998) introduced word boxes to six second- through fourth-grade students who were identified as having learning disabilities. Using a multiple-baseline design across participants, Joseph measured word identification and spelling for each participant across baseline, treatment, and maintenance conditions. Through visual inspection of the data, a functional relationship was observed between instruction using word boxes and student performance. For each participant, a notable increase in performance was observed for word identification and spelling. More recently, Joseph extended her research and found word boxes to be effective in combination with word sorts for elementary-aged children with mental retardation (Joseph, 2002a) and in combination with repeated readings for adolescent struggling readers (Devault & Joseph, 2004). Schmidgall and Joseph (2007) compared the use of word boxes to drill and practice and interspersing techniques and found word boxes to be more effective than the other methods of decoding instruction. In addition, a social validity measure indicated that students preferred word boxes over the other instructional methods.

The second popular approach to conducting word work makes use of manipulative letters, or individual moveable letters such as magnetic letters, tiles or cards with letters printed on them, or letter blocks. In this approach, letters are used to form a word, and then one or more letters are removed and replaced to form a new word. The process is repeated to provide multiple opportunities for decoding, and each successive word typically shares one or more sounds in common with the previous word to demonstrate relationships between common sounds and spellings.

Several early studies have used word work with manipulative letters as an approach to phonics instruction, but without providing any empirical evidence to specifically support the use of this type of word work. For example, Cunningham, Hall, and Defee (1991) developed *Making Words*, an approach to word work that employs letter cards to help students learn to decode and spell words. Students are given a limited number of letters and begin by making short, simple words, which they later build upon to make longer, more complex words. *Making Words* activities have been used as part of a multi-component instructional model (Cunningham & Cunningham, 1992) that has become popular among classroom teachers; however, no empirical studies have been conducted to examine the effectiveness of this approach (Rasinski, 1999).

Several studies identified by the NRP (2000) also included phonemic awareness instruction that incorporated the use of manipulative letters (e.g., Bradley & Bryant, 1985; Ehri & Wilce, 1987a; O'Connor & Jenkins, 1995; Uhry & Shepherd, 1993). Perhaps the earliest support for the use of manipulative letters during phonemic awareness instruction was offered by Bradley and Bryant (1985). From experience, these authors believed manipulative letters were an extremely effective approach for helping students struggling with reading to make the connection between sounds of speech and print during reading and spelling tasks. They rationalized that struggling readers often have difficulty with the phonological aspect of reading because it is abstract; thus, by incorporating letters into sound categorization, students would be provided a concrete medium with which to work. As such, Bradley and Bryant (1985) compared the reading and spelling performance of children across four experimental conditions: (a) children trained to categorize words based upon sounds, (b) children trained to categorize words based upon sounds using plastic letters, (c) children trained to categorize words based upon concepts, and (d) children who received no training. After two years of training, these researchers found that children trained in both sound categorization conditions read and spelled better than children trained with conceptual categorization, and children trained to categorize sounds using plastic letters surpassed all groups on reading and spelling measures.

Ehri and Wilce (1987) also conducted an early experiment using letter tiles to train kindergarten students to either match letters with isolated sounds or spell nonsense words. They found that students who learned to spell words learned to read words more effectively at posttest than students who learned to match letters to sounds. Uhry and Shepherd (1993) also examined the effects of segmenting and spelling instruction that used manipulative letter blocks with first-grade students. Students in the control group received the additional instructional time without segmenting or spelling using manipulative letters. These researchers found that segmenting and spelling instruction using the manipulatives resulted in significant gains and better performance on measures of timed word reading, nonsense word reading, and timed oral passage word reading. Finally, O'Connor and Jenkins (1995) examined the effects of providing supplemental segmenting and spelling instruction with manipulative letters to kindergarten students with developmental disabilities who were receiving Reading Mastery instruction. They found no difference between treatment and control on phonological blending and segmenting tasks; however, they did find that treatment students made significant improvements over control students on measures of spelling and reading familiar and new words.

Although most studies conducted since the report of the NRP have included some form of word work with manipulatives, three studies were identified that specifically examine word work with manipulative letters. In the first study, Pullen (2000) specifically examined the effect of instruction using letters to manipulate, blend, and segment letters and sounds with first-grade students struggling to learn to read. Three groups were compared: (a) an intervention including repeated reading and manipulative letter practice, (b) an intervention using only repeated reading, and (c) a no-treatment control. Results indicated that both intervention groups outperformed the control group on measures of phonological awareness and sight word knowledge, and the intervention group that used manipulative letters outperformed both the comparison and the control group on measures of decoding. No difference was found across groups on reading fluency and comprehension.

In an attempt to replicate the findings of the first study, Pullen Lane, Lloyd, Nowak, and Ryals (2005) conducted a multiple-baseline single-subject experiment that examined the functional relationship between the introduction of word work instruction using manipulative letters and the decoding ability of first-grade students struggling to read. These researchers found that decoding skill increased as students learned to manipulate, blend, and segment the sounds of words using manipulative letters.

In this review, the only study to isolate the effects of word work with manipulative letters in a multi-component intervention was conducted by Lane, Pullen, Hudson, and Konold (2009). These researchers examined the components of a one-on-one tutoring model (i.e., the University of Florida Literacy Initiative), which was designed to help novice teachers to tutor struggling readers in first grade. They were particularly interested in determining if the removal of word work, sentence writing with word work, or genre and text structure instruction from the UFLI model would affect reading outcomes. One hundred participants were randomly assigned to one of four experimental conditions or a control group. Lane et al. found that students who received all five of the UFLI steps performed better on decoding and word recognition tasks than control students who did not receive UFLI tutoring. However, when either word work using manipulative letters or written word work during sentence writing was removed from the model, there were no significant differences between the treatment and control conditions. The findings provide evidence that word work is an integral component of this multi-component tutoring model when implemented in a one-on-one setting.

From this research, there is an abundance of evidence to suggest that specific methods of instruction can be highly effective with students who are struggling to learn to read. Interventions that explicitly addressed phoneme manipulation were most beneficial for struggling students, and this was particularly true when multisensory support was incorporated into instruction. Word work using either Elkonin boxes or manipulative letters – two common approaches to multisensory instruction – was found to be beneficial for struggling students learning to decode.

Using Pseudowords

A few researchers have incorporated pseudowords as part of a decoding intervention, and participants who have been exposed to these interventions have improved on measures of reading. However, research examining the role of pseudowords in decoding skill development is extremely limited.

Ehri and Wilce (1987b) conducted an experiment to identify differences between readers who were at two different developmental points in word reading: phonetic-cue reading and cipher reading. The participants were kindergarteners who knew most letters, some letter-sound pairs, and could read at least three primer-level words, but few of the words to be taught during training. Participants were pre-tested and then half of them were trained to mastery on decoding basic nonsense words (i.e., cipher training), while the other half were trained to mastery on certain letter-sound relationships (i.e., cue training). On post-test, the cipher readers were stronger at printed real-word learning, decoding nonsense words, and spelling.

In a few of the previously described studies, interventions included pseudowords, but specific information about how they were used was not provided. For example, in the Pullen et al. (2005) study, pseudowords were included in word work instruction using manipulative letters, but there was no information provided regarding the number of pseudowords or the number of opportunities for practice. The intervention used in the Lane et al. (2009) study also included pseudowords during word work with manipulative letters, but the description of the intervention does not provide details about how pseudoword practice is incorporated. Both studies found positive outcomes in decoding.

The only study to specifically examine pseudowords as a dependent variable was conducted by Cardenas (2009). Thirty kindergartners in two intact classes participated in the study. All students were assessed at four points in time using the Phonetic Word List Assessment (PWLA), which was created by the researcher. Following Test 1, both classes received an introductory phase of phonics instruction that used real words only. Following Test 2, the second phase of instruction, which lasted 28 school days, began. In this phase, one class received a pseudoword phonics intervention, while the other class continued working with real words only. Following Test 3, the third and final phase began, in which both classes received instruction with real words only. All students were assessed again (Test 4) at the conclusion of the third phase of instruction. The findings indicate that students who were provided pseudoword phonics in place of real-word phonics made greater gains from Test 2 to Test 3 and from Test 3 to Test 4 than students who received only real-word phonics. Although this study did not include random assignment to treatment, the findings indicate that phonics instruction that included pseudowords was beneficial in the development of decoding skill.

Instructional Time

An important instructional variable that was addressed in the report of the NRP (2000) is the amount of instructional time needed to develop phonological and alphabetic proficiency in beginning or struggling readers. The NRP draws two general conclusions concerning the amount of phonemic awareness instruction needed to be effective. First, they indicate that studies providing anywhere from 5 to 18 total hours of instruction yielded the largest effects on phonemic awareness acquisition, and transfer to reading was greatest when less than 20 hours of instruction were provided. Second, they point out that average training sessions lasted 25 minutes with few lasting more than 30 minutes. From this conclusion, they make the recommendation that sessions last no more than 30 minutes. For phonics instruction, the NRP provides even less direction with no conclusions or specific recommendations made regarding instructional time. Unfortunately, these conclusions shed very little light on the amount of time needed to sufficiently develop decoding skill. The reasons for this may be that very few researchers have specifically examined instructional time as an independent variable. It may also be that the research demonstrating effective phonemic awareness and phonics instruction varies in the amount of instruction that has been provided as well as in confounding variables (i.e., amount of time needed may vary depending upon student age or ability, teacher or program quality, etc.).

Most research that has examined phonemic awareness and phonics instruction in the last 12 years has provided supplemental instruction to at-risk or struggling readers for 30 minutes or less per session. However, across studies, there is a range of instructional time that has been effective for students who are at-risk or struggling. For example, the results from the study by Hatcher et al. (2004) suggest that adding as little as 10 minutes of supplemental phonemic awareness instruction 3 times per week for 14.5 months can result in significant reading improvements for struggling beginners who are already receiving phonics instruction. Berninger et al. (2003) also found 10 minutes of supplemental instruction in the alphabetic principle with 10 additional minutes of reflective work 2 times per week to be beneficial for second-grade struggling readers, and this was after only 24 sessions. In contrast, McCandliss, Beck, Sendak, and Perfetti (2003) found 50-minute phonics sessions to be effective with second-grade struggling readers when provided 3 times per week for a total of 20 sessions.

Two studies that specifically manipulated instructional time as an independent variable were identified for this review. Simmons et al. (2007) examined instructional time along with specificity of program design to determine if supplemental code-based programs that vary in amount of instructional time and specificity result in different outcomes in kindergarteners identified at risk for reading difficulties. They compared three conditions: 30 minutes of highly-specified code-based instruction, 15 minutes of highly-specified code-based instruction and 15 minutes of non-code-based instruction, and 30 minutes of moderately-specified code-based instruction. These researchers found that 15 minutes of highly-specified instruction was sufficient for increasing phonemic awareness in at-risk kindergarteners, but 30 minutes of highly-specified code instruction was significantly more effective for increasing decoding and word reading skills in the students who entered kindergarten most at-risk. Furthermore, highly-specified instruction was significantly more effective at increasing phonemic decoding for all at-risk kindergarteners, and word attack and word reading for most-at-risk kindergartners, than 30 minutes of moderately-specified instruction.

Vadasy, Sanders, and Peyton (2005) also compared three conditions that varied in instructional time, but participants were first graders scoring in the lowest quartile for reading. Treatment groups received either (a) 30 minutes of *Sound Partners* (i.e., a phonics-based program teaching letter-sound correspondence and providing word reading opportunities), or (b) 15 to 20 minutes of *Sound Partners* and 10 to 15 minutes of practice reading decodable text. The control group received no supplementary intervention. The instruction was provided 4 times per week for 30-minute sessions for a total of 8 months. Following the intervention, both treatment groups significantly outperformed the control group on reading accuracy, comprehension, fluency, and spelling measures with greater effects for word reading accuracy than for word or passage reading fluency. The treatment groups performed comparably on most other measures, but the group that received reading practice with decodable text significantly outperformed the Sound Partners-only group on passage reading fluency and accuracy. The findings here support the recommendations of the NRP (2000) and Ehri et al. (2001) in that less time may be required to teach specific phonics skills when students are also given time to apply those skills in real text.

Although more research is needed to determine the most effective amount of supplemental instruction for decoding development, the growing evidence seems to suggest sessions lasting 30-minutes or less will be sufficient for most students struggling with reading. This factor will ultimately depend upon additional variables such as student ability or need, teacher quality, and program design. What remains unknown from the existing research is the frequency of sessions and/or duration of program that are optimal for improving decoding in struggling readers.

Group Size

Research has supported the value of alternatives to whole-group instruction for teaching reading to students with disabilities (Elbaum, Vaughn, Hughes, & Moody, 1999). While it is true that interventions provided to individual students can significantly improve reading outcomes, small-group instruction may be just as beneficial for students struggling with reading when instruction is well designed and provided by a highly-qualified instructor (Elbaum, Vaughn, Hughes, & Moody, 2000). The NRP (2000) also acknowledges student-grouping practices as a variable worth examining for phonemic awareness and phonics instruction. They included three instructional group sizes for comparison in their analyses. For phonemic awareness instruction, they found small-group instruction resulted in larger reading effect sizes than instruction with individuals or whole classes. Group size did not make a difference for phonics instruction though, with all group sizes producing significant moderate effects that did not differ statistically.

Most of the studies identified for this review implemented interventions with small groups or individual students with positive results. Hatcher et al. (2004) conducted the only study in which phonemic awareness instruction was provided to larger groups of 10 to 15 students, and found improved phonemic awareness and reading skills in young students who were at-risk for reading delay. Only one study specifically included group size as an independent variable. Vaughn et al. (2003) compared the reading outcomes of students receiving supplemental reading intervention provided one-on-one or in groups of three or ten students. The intervention was comprehensive in that it included fluency practice, phonemic awareness instruction, leveled reading, and explicit instruction in the alphabetic principle (i.e., word study). These researchers found that most students made significant gains from pre- to post-test on all reading outcome measures including measures of decoding and word recognition regardless of group size, and these gains were maintained four to five weeks later at follow-up. Based on effect sizes, individual instruction and instruction with groups of three were each highly effective, and neither was superior to the other.

From the converging evidence on instructional group size, it is clear that struggling readers can benefit from explicit instruction regardless of group size. However, recent evidence suggests struggling students may benefit most when instruction is provided to smaller groups. Furthermore, it is of practical importance that small-group instruction may be just as effective as individual instruction.

Instructor Variables

The NRP (2000) report does not provide conclusions about teachers that are most effective at providing decoding instruction. They do, however, provide a few recommendations for future research in this area. First, the NRP recommends that more research is needed to determine what teachers need to know to provide effective phonics instruction. In addition, they suggest that research is needed to determine what motivates teachers to provide explicit and systematic phonics instruction, which is often scripted and lacks appeal to many teachers.

Since the publication of the NRP report, a few researchers have demonstrated that supplemental phonemic awareness and phonics instruction may be provided effectively by paraprofessionals. Three studies were found that examined the effects of systematic and scripted instruction provided by trained paraprofessionals. Ryder, Tunmer, and Greaney (2008) studied supplementary phonemic awareness and phonemically-based decoding instruction for 6-7 year old children with early reading difficulties in a whole-language environment. The treatment consisted of 56 highly-sequenced and scripted small-group lessons delivered 4 times per week for 20- to 30-minute sessions by a trained and monitored teacher’s aide. Matched controls continued to receive whole-language instruction and supplementary activities for struggling readers as provided by their classroom teachers. Results indicated that treatment students significantly outperformed controls on phonemic awareness, decoding, and context free word reading, though no significant differences were found for reading words in context or for comprehension. At two-year follow-up, the treatment continued to significantly outperform control on context-free word recognition and also on reading words in context.

Two studies conducted by Vadasy and colleagues also explored the effectiveness of supplementary phonics-based interventions provided by paraprofessionals. In a study described earlier, Vadasy, Sanders, and Peyton (2005) compared two phonics-based intervention groups to a control that received no supplementary intervention. First graders struggling with reading who received supplementary, one-on-one, phonics-based intervention from trained paraprofessionals significantly outperformed controls on decoding measures as well as various reading and spelling measures. In a second study, Vadasy, Sanders, and Tudor (2007) examined the effects of one-on-one supplementary phonics intervention provided by trained paraprofessionals to second- and third-grade struggling readers. The treatment group received 15 minutes of phonics instruction and 15 minutes of passage reading 4 times per week and the control received no supplementary intervention. Students who received the phonics intervention outperformed control students on post-test measures of reading accuracy and fluency, and performance levels were maintained at follow-up three months later.

Taken together, the results of these three studies provide evidence that paraprofessionals can successfully provide phonics instruction to at-risk and struggling students. However, the generalizability of these findings must be considered. The programs used in these studies were scripted, each paraprofessional was trained to use a specific program, and they were either monitored by an on-sight literacy resource teacher or provided weekly or bi-weekly coaching and modeling throughout the year. In addition, these paraprofessionals were monitored for fidelity by research staff. Therefore, it is unclear whether interventions can be successfully provided by paraprofessionals under less structured conditions.

Summary and Conclusions

Learning to decode marks a critical milestone in the development of reading. Without decoding skill, readers are not well equipped to tackle new and unfamiliar words, and this becomes increasingly problematic as text becomes more difficult (Ehri, 1995, 1999). Moreover, when word recognition is compromised, reading comprehension is likely to suffer.

Instruction that promotes phonemic awareness and an understanding of the alphabetic system is paramount for many developing readers (Adams, 1990). Decades of research provide strong support for explicit and systematic phonemic awareness and phonics instruction (NRP, 2000). However, there is still much to learn about the aspects of instruction that facilitate learning.

Research conducted after the NRP report on reading instruction continues to shed light on some specific features of effective decoding instruction. For students who are at-risk for reading difficulties, instructional methods that explicitly teach phonological awareness at the phoneme level are found to be beneficial. There is also evidence to support methods that utilize multisensory word work as part of a comprehensive reading intervention or as an isolated instructional approach with students who are either learning to read or struggling to learn.

Recent research also suggests that the amount of supplementary phonemic awareness and phonics instruction needed to improve decoding and word reading will vary; however, there is growing support that interventions lasting 30-minutes or less per session are sufficient for most students struggling with reading. In addition, it is promising for teachers that, given the numerous demands and time constraints inherent in the school day, students benefit from instruction provided in a variety of grouping formats and by a variety of instructional providers. Contrary to common belief, struggling students may not necessarily require one-on-one instruction. Growing research continues to suggest that small-group instruction can be just as effective, and paraprofessionals are able to provide effective phonics instruction to at-risk and struggling students when given adequate training and support. Finally, there is preliminary evidence for the use of pseudowords during decoding instruction with beginning readers. The Cardenas (2009) study challenges a widespread belief that phonics instruction should involve real words only.

Improving our understanding of various aspects of effective decoding instruction is important for improving instructional practices. Of course, these research findings should be received with caution because the effectiveness of any practice will ultimately depend upon other contextual variables such as student ability or need, teacher quality, and program design. However, these studies also provide important clues about how to provide effective decoding instruction to emerging readers, and they provide direction for future research.

Implications for Research

Although research continues to provide direction for educators and researchers to improve decoding instruction, there is still more to learn. We may have more information now about how long intervention sessions should last, but uncertainty remains about the frequency of sessions and the duration of programs. There is a great deal of variability in the research making it difficult to draw any specific conclusions about these variables. It is unknown if more lessons help consolidate the skills being taught or if interventions should continue beyond the early elementary school years. More research is needed to investigate session frequency and program duration.

Questions also remain regarding the characteristics of teachers who provide the most effective decoding instruction. Despite the recommendations of the NRP (2000), there is still a paucity of research that empirically examines the relationships between teachers' knowledge and practice and student reading growth because research in this area is complicated by many confounding variables. It would be important to learn what teachers need to know to provide effective decoding instruction to students beginning and struggling to learn to read. In addition, research is still needed to determine what will motivate teachers to provide explicit and systematic phonics instruction, which is often scripted and lacks appeal.

Finally, many studies have demonstrated the importance of systematic and explicit instruction in phonemic awareness and phonics for the development of phonemic awareness, decoding, and word reading; yet, few studies have isolated specific instructional features to explore what makes this instruction most effective. There may be more to learn about effective decoding instruction by isolating discrete features of instruction that is effective, such as the number of words practiced or the type of words presented during instruction.

This study aimed to add to the current knowledge base about decoding development by examining a discrete feature of explicit decoding instruction. The purpose was to delineate the role of pseudowords in decoding instruction at a specific phase in early reading development. Identifying ways to improve the quality of decoding instruction is important for beginning readers, particularly because so many continue to struggle with the skills needed to become effective at decoding.

CHAPTER 3
METHODS

The purpose of this study was to investigate the impact of including pseudowords during decoding instruction on decoding outcomes of developing readers who are transitioning from the partial-alphabetic to the full-alphabetic phase of word reading. An experimental pre-test post-test control group design with random assignment was used to compare three groups: a treatment group that received decoding instruction using a combination of real words and pseudowords during word work activities; a comparison group that received decoding instruction using only real words during word work activities; and a control group that did not receive instruction from the researcher. This design was selected to allow for the comparison of post-test scores while controlling for pre-test group differences. In the sections that follow, the research questions and hypotheses will be presented. Then, the methods used to conduct the study will be described.

Hypotheses

To examine the effects of incorporating pseudowords during decoding instruction on the reading development of kindergarteners in the partial-alphabetic phase of word recognition, the following four research questions were addressed:

1. What are the effects of decoding instruction that includes pseudowords on real-word decoding accuracy?
2. What are the effects of decoding instruction that includes pseudowords on pseudoword decoding accuracy?
3. What are the effects of decoding instruction that includes pseudowords on real-word decoding automaticity?
4. What are the effects of decoding instruction that includes pseudowords on pseudoword decoding automaticity?

The following null hypotheses were tested to address these research questions:

H_1: There is no statistically significant difference between groups on measures of real-word decoding accuracy.

H_2: There is no statistically significant difference between groups on measures of pseudoword decoding accuracy.

H_3: There is no statistically significant difference between groups on measures of real-word decoding automaticity.

H_4: There is no statistically significant difference between groups on measures of pseudoword decoding automaticity.

Setting

One primary school located in north central Florida was selected for this study. This school was selected in part due to a large kindergarten enrollment, which offered a promising pool from which to draw participants. The centralization of a large participant pool in one location also made the study more feasible given limited resources. In addition, the principal and teachers at this school communicated a willingness to support implementation of the study.

At the initiation of the study, the participating school had a total of 513 students enrolled in kindergarten through second grade. The racial and ethnic profile for the student population was 49% Caucasian, 29% African American/Black, 13% Hispanic, 7% Multiracial, 1% Asian, and less than 1% Native American. Of the total population, 19% were receiving Title I services, 13% were receiving exceptional student education (ESE) services, and 5% were identified with English as a second language. Approximately 65% of the students were receiving either free or reduced-price lunch.

There were 156 students attending kindergarten at the initiation of the study. To ensure that a sufficient number of kindergarteners were within the desired developmental phase of word recognition for the study, results from the mid-year administration of the Broad Screen/Progress Monitoring Tool (BS/PMT) of the *Florida Assessments for Instruction in Reading* (FAIR, Florida Department of Education, 2009) were examined. In kindergarten, the BS/PMT assesses letter-sound knowledge and phonemic awareness during the mid-year administration. The measure yields a Probability of Reading Success (PRS) score, which indicates a student's chance of scoring at or above the 40^{th} percentile on end-of-year reading assessments. Kindergarteners with a score of 85% or above on the BS/PMT are considered to have a high PRS. Examination of the mid-year BS/PMT scores indicated that at least 58 kindergarteners were not demonstrating a high PRS.

Participants

A total of 72 kindergarten students participated in the study. An a priori power analysis was conducted prior to initiation of the study to determine the sample size needed to achieve desired power. Based upon the recommendations of Cohen (1988), power should be no less than .80 to reduce the probability of making a Type II Error to .20. To complete the analysis, an effect size of .60 was estimated based upon studies of similar interventions with decoding outcomes that yield effect sizes ranging from .35 to 2.06 (Scammacca, Vaughn, Roberts, Wanzek, & Torgesen, 2007). The effect size was then converted into an effect size f for the analysis. Using the computer program, G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007), with power at .80, an effect size f of .34, and alpha level at .05, a total sample size of 87 was needed to achieve the desired power of .80.

Students in the partial-alphabetic phase of word recognition were sought for participation in this study. As such, kindergarten was selected for the study because many students in kindergarten have limited decoding skill (i.e., they are not yet full-alphabetic readers) in the spring, but have prerequisite alphabet and letter-sound knowledge to begin learning to decode. A screening process was used to identify all kindergarteners meeting these criteria. The students were identified based upon the results of an invented spelling screening, which is described in full detail in the next section of this chapter. Invented spellings provide information about a student's level of development in the areas of phonemic awareness and letter-sound knowledge; thus, invented spelling scores were used to identify students performing within the partial-alphabetic phase. In addition, all spellings were inspected by the researcher to ensure all potential participants were indeed demonstrating spellings that were characteristic of the partial-alphabetic phase. Therefore, if a student's invented spelling score was marginal, but his or her spellings were largely characteristic of the partial-alphabetic phase, then the student was invited to participate in the study. A total of 96 kindergarteners met these criteria and were recruited to participate.

As required by the University of Florida Institutional Review Board, approval from the IRB and the school district were obtained to complete the study. Documentation of approval from the IRB is provided in Appendix A. Informed consent letters were provided to parents or guardians of all recruited kindergarteners. A total of 73 students returned informed consent to participate in the study. Each student who returned informed consent also provided verbal assent to participate prior to the initial assessment. Of the 73 original participants, one student moved from the school prior to the completing all of the lessons for the study, and data for that student is not included in the descriptive or statistical data reported in this paper.

All 73 original participants were assigned by chance to one of three conditions using a set of random numbers (Gall, Gall, & Borg, 2007). This set of numbers was obtained using the number sequence generator located on random.org, a free Internet service. Participant names were listed in alphabetical order by last name and numbered. The set of random numbers was then used to assign a near equal number of students to each condition. Demographic data were collected for the 72 participants who completed the study. These data, which are reported by group in Table 3-1, reveal that all three groups were similar in demographic composition, with the exception of the treatment group, which contained notably more females and more students identified as African American/Black than the other two groups.

Table 3-1. Demographic information for sample by group

	Treatment Group	Comparison Group	Control Group	Total Sample
Total Participants	25	23	24	72
Mean Age (years-months)	6-2	6-2	6-4	6-3
Sex				
Male	11 (44%)	17 (74%)	17 (71%)	45 (62%)
Female	14 (56%)	6 (26%)	7 (29%)	27 (38%)
Race/Ethnicity				
African American/Black	10 (40%)	4 (17%)	7 (29%)	21 (29%)
White	12 (48%)	14 (61%)	13 (54%)	39 (54%)
Hispanic/Latino	2 (8%)	3 (13%)	4 (17%)	9 (13%)
Mixed Race	1 (4%)	2 (9%)	0 (0%)	3 (4%)
Lunch Status				
Full-price	11 (44%)	9 (39%)	9 (38%)	29 (40%)
Free or reduced-price	14 (56%)	14 (61%)	15 (62%)	43 (60%)
ESOL	1 (4%)	2 (9%)	1 (4%)	4 (18%)
ESE (Speech-Language)	2 (8%)	1 (4%)	2 (8%)	4 (6%)
Title I	7 (28%)	3 (13%)	2 (8%)	12 (17%)

Measures

Screening Measure

As previously mentioned, scores from a measure of invented spelling (Lane & Pullen, 2004) were obtained for all kindergarteners to identify potential participants for this study. An invented spelling measure assesses an individual's abilities to process phonemes in words and represent those phonemes with graphemes. Thus, invented spellings provide specific information related to a respondent's developmental phase of word recognition. In addition, an invented spelling measure may be group administered making it the most practical means for screening a large number of students in a short period of time. The invented spelling measure used for this study consisted of 10-items that were administered in the same manner as a traditional spelling test. These items were scored based upon the graphophonemic accuracy of the student's written response (Lane & Pullen). In other words, if a student represented each sound in a word with a viable grapheme, then they would earn a score of 4 out of 4 for the word. Partial-alphabetic representation would earn a score less than 4. A student may earn up to 40 points on the measure, and a score of 19.5 in the spring of kindergarten places a student at the 50th percentile.

Students scoring within the range of 15 to 28 on this screening generally demonstrated partial-alphabetic knowledge, and thus, most of these students were recruited for participation in this study. Students scoring above 28 generally demonstrated or were approaching full-alphabetic spellings, and were not eligible for the study. Students with scores that fell below 15 were not likely to have enough letter-sound knowledge to participate in the study intervention. However, to ensure that any student meeting the criteria for inclusion in the study was not overlooked, all spellings were inspected by the researcher, and several students with marginal scores (e.g., a score of 29 or 30) but with spellings indicating partial-alphabetic knowledge were also invited to participate. In addition, for all students with scores below 15 on the invented spelling measure, FAIR BS/PMT scores were inspected. The purpose of this inspection was to determine if any low-scoring spellers possessed sufficient phonemic awareness and knowledge of letter sounds for participation in the study.

The FAIR is comprised of screening, diagnostic, and progress monitoring assessments that are administered to students in grades K through 12 in Florida (Florida Department of Education, 2009). The Broad Screen/Progress Monitoring Tool (BS/PMT) is typically administered to students three times per year. As mentioned earlier in this chapter, this measure yields a Probability of Reading Success (PRS) score, which indicates a student's chance of scoring at or above the 40th percentile on end-of-year reading assessments. In kindergarten, the BS/PMT assesses letter-name knowledge and phonemic awareness in the fall, letter-sound knowledge and phonemic awareness in the winter, and phonemic awareness and word reading in the spring. This measure is administered through standardized procedures, and reliability and validity have been well established, as detailed in the FAIR Technical Manual (Florida Department of Education, 2009).

The PRS score is interpreted in the following way: kindergarteners with a score of 85% or above on the BS/PMT demonstrate high probability of success; kindergarteners with a score between 16% and 84% demonstrate moderate probability for success; and kindergarteners scoring 15% or below demonstrate a low probability for success on end-of-year reading assessments. Students who score below 85% on the mid-year BS/PMT are likely to be experiencing difficulty on tasks that are highly predictive of reading success (i.e., letter-sound and phonemic awareness) and may be considered “at risk” for later reading difficulties. For the purpose of this screening and to include students for participation in this study, any student earning a score below 15 on the invented spelling measure but with a FAIR score of 75 or greater was also invited to participate. The rationale for this was that, regardless of their low invented spelling scores, these students likely possessed sufficient phonemic awareness and letter sound knowledge to participate in the intervention planned for this study.

Pre-test/Post-test Measures

The Word Attack subtest (WRMT-WA) of the *Woodcock Reading Mastery Tests – Revised/Normative Update* (Woodcock, 1998) was administered at pre- and post-test. This subtest measures a student’s ability to apply phonic and structural analysis skills to decode unfamiliar words. Students are required to read aloud a list of pseudowords or words with very low frequency of occurrence in English. The list contains 45 pseudowords of increasing difficulty and students earn a raw score (i.e., total number of words read correctly), which may also be converted into a standard score that is centered around a mean of 100 with a standard deviation of 15. According to the publisher’s technical information, this subtest correlates with several other tests of reading including *Woodcock-Johnson Psycho-Educational Battery* (WJ), *Iowa Tests of Basic Skills* (ITBS), *Iowa Tests of Educational Development* (ITED)*, Peabody Individual Achievement Test* (PIAT), and *Wide Range Achievement Test* (WRAT). In addition, internal consistency for the test median is reported to be .91, and split-half reliabilities range from .86 to .99 (Woodcock, 1998). For this study, the WA subtest served as a standardized measure of decoding accuracy. Raw scores were converted to standard scores for the analysis of data. Alternate forms of this assessment were used for pre- and post-test.

The Phonetic Decoding Efficiency subtest (TOWRE-PDE) of the *Test of Word Reading Efficiency, Second Edition* (Torgesen, Wagner, & Rashotte, 2012) was also administered pre- and post-test. This subtest is an assessment of word-level decoding automaticity. Specifically, it measures the number of pseudowords that can be accurately decoded in 45 seconds. Students are provided a list of words to read aloud. After 45 seconds, the test is discontinued and the number of words read correctly is totaled. Average alternate-forms and test-retest reliabilities reportedly exceed .90 for this subtest (Torgesen et al.). For this study, the PDE subtest served as a standardized measure of decoding automaticity. However, raw scores were used in the analysis because the conversion table in the examiners manual did not provide discrete standard scores for some of the lowest raw scores obtained by participants. Alternate forms of this assessment were used at pre- and post-test.

In addition to these standardized measures, several researcher-developed decoding measures were administered at pre- and post-test. These measures were created to provide more sensitive measures of decoding accuracy and automaticity than would be expected when using standardized measures. In other words, the items on the standardized decoding assessments quickly become increasingly more difficulty, and kindergarteners would not be expected to read many words on these measures. Thus, decoding probes were designed to be more sensitive to the specific word structures targeted in the lessons created for this study. Probes consisted of words with patterns that were included in the lessons, which were carefully selected to represent a wide variation of decodable letter-sound combinations that appear in English.

The probes were also designed to assess decoding skill across three dimensions: word type (i.e., real words vs. pseudowords), word complexity (i.e., linear vs. nonlinear words), and decoding task (i.e., accuracy vs. automaticity). For the purpose of this study, accuracy refers to the student's ability to decode words correctly, and automaticity refers to the rate with which a student decodes words and is an indication of confidence with a skill. Word linearity is described and examined by Uhry and Shepherd (1993). Words that are linear consist of one-to-one letter-sound relationships permitting the reader to sound out each letter from left to right to blend the sounds together. Thus, linear words represent basic consonant-vowel-consonant (CVC) short-vowel words and their variations, including CCVC and CVCC combinations. Nonlinear words are phonetically regular, but letter sounds are dependent upon other letters within the word. For example, the long */i/* sound in the word *kite* is determined by the final silent *e*, and the sound of the */a/* in *rain* is determined by the adjacent *i*. Although the effects of word linearity were not specifically tested in the analysis of this study, it was important to include both non-linear and linear words in assessment because both were included in the instructional intervention.

Eight probes were developed: linear real-word accuracy, nonlinear real-word accuracy, linear pseudoword accuracy, nonlinear pseudoword accuracy, linear real-word automaticity, nonlinear real-word automaticity, linear pseudoword automaticity, and nonlinear pseudoword automaticity. The accuracy probes consisted of four plates containing five words each for a total of 20 words per probe. Administration of an accuracy probe was discontinued if a participant did not read any of the words on a given plate correctly. This ceiling rule was established to reduce participant fatigue and frustration. Each accuracy probe yielded a total number of words read correctly with a total possible score of 20. Automaticity, or rate, probes contained 50 words each and yielded a total number of words read correctly during a one-minute timed reading. For all probes, words were randomly ordered using a set of random numbers obtained from the number sequence generator located on random.org. The probes were administered to all participants in the same order at pre- and post-test. In addition, alternate forms were created for use at pre- and post-test by randomly altering the order of word presentation. The probes were administered to all participants in the same order at pre- and post-test.

For the analysis of this study, participants' raw scores on each pair of linear and nonlinear probes were combined to create four researcher-developed measures: real-word accuracy (R-Acc), pseudoword accuracy (P-Acc), real-word automaticity (R-Auto), and pseudoword automaticity (P-Auto). Forms A and B of these researcher-developed measures are included in the appendices. Appendix B contains the real-word accuracy protocols and stimulus plates; Appendix C contains the pseudoword accuracy protocols and stimulus plates; Appendix D contains the real-word automaticity protocols and stimulus plates; and Appendix E contains the pseudoword automaticity protocols and stimulus plates.

Assessment Procedure

All measures were administered to participants individually by either the researcher or another test administrator trained in proper assessment procedures. Assessment administrators were doctoral students and undergraduate students completing coursework to obtain their reading endorsement. The assessment environment was one of two large, well-lit rooms with adequate seating and table space. The standardized measures were administered according to the procedures detailed in the examiner's manuals. For the researcher-developed probes, scripted oral directions were provided to assessors prior to testing. Measures were administered in the same order for each participant over approximately two testing sessions. Assessors were instructed to try to complete half of the assessments during the first session; however, if a participant began exhibiting signs of fatigue or frustration at any given point in time, testing was postponed until another day.

Intervention

Participants in the treatment and comparison conditions were scheduled to receive 15 instructional sessions of approximately 20 minutes in duration. All instruction was provided by the researcher in small-group format with 3 to 5 students per group. The small groups were formed based upon (a) skill level as determined by the invented spelling screening measure and (b) student location within the school. In other words, participants were grouped together with others of similar invented spelling scores within the same kindergarten quad.

The sessions occurred daily as school and classroom schedules allowed. In order to fit all groups in per day, participants had to be pulled from all academic subject areas. To avoid pulling particular students from the same academic subject (i.e., reading, math, science/social studies) every day, each small group was pulled on an alternating schedule, thereby missing a different subject on each consecutive day. School administration and the classroom teachers preferred this scheduling method, and this also ensured that participants received a comparable amount of classroom reading instruction throughout the course of the study.

Due to absences and occasional conflicts with classroom schedules, some individual participants or small groups missed planned sessions. In order to be included in the analysis for this study, participants were required to receive at least 13 out of the 15 instructional sessions, with no more than one lesson missed per each of the three lesson types. Therefore, many make-up sessions were conducted over the course of the instructional term of the study. Some make-up sessions were conducted one-on-one and others were conducted with small-groups of 3-5, and this was determined by lesson need. The average number of sessions completed for the treatment group was 14.36. The average number of sessions completed for the comparison group was 14.09 after dropping one student who moved, thereby missing the last three lessons and the post-test assessment.

Treatment and comparison lessons were planned for each session and included a list of words and the order of presentation. These lessons were followed closely to ensure a systematic presentation of word patterns across time as well as a consistent presentation of words across treatment and comparison groups to eliminate the possibility of contamination in the comparison group. Details about instruction for each condition will be presented in the following sections.

Treatment Condition

Participants in the treatment condition received approximately 20 minutes of small-group word work instruction that incorporated real words and pseudowords equally. Each lesson provided participants with multiple opportunities to decode and encode words using manipulative letters and Elkonin boxes. An instructional word list was generated for each lesson, and the presentation of words across lessons followed an orthographic progression from simple to more complex (i.e., basic linear words preceded nonlinear words). Specifically, the first five lessons targeted basic, short-vowel CVC words; the next five lessons targeted CCVC and words; and the last five lessons targeted nonlinear words (i.e., CVVC words containing vowel teams and CVCe words).

Each of the first 10 lessons in the treatment condition exposed students to a total of six real words and six pseudowords, which were derived from two or three letter patterns. For example, the first lesson included CVC words from the letter patterns –*ap*, –*at*, and –*it*. The last five lessons exposed students to a total of eight real words and eight pseudowords, with all derived from two letter patterns except the last lesson, which incorporated several of the previously learned letter patterns. Words selected for all treatment lessons are provided in Appendix F.

Word patterns were carefully selected for instruction based upon their frequency in English and their utility to students. The patterns offering the most possible real-word and pseudoword choices were selected to ensure enough words for instruction as well as for assessment purposes. To the greatest extent possible, real words were selected based upon their utility and likeliness that they would be known or used by kindergarteners in their oral language. A few words did not meet these criteria due to limited word possibilities for some word patterns. Participants in the treatment group were exposed to each word one time during a word work lesson resulting in a total of 12 different practice items for the first 10 lessons and 16 different practice items for the last

5 lessons. Different letter patterns were introduced during each lesson, exposing students to new words during every lesson.

Each lesson began with word work using manipulative letters. The instructor and participants in the group used a small magnetic board and magnetic letters to construct the words selected for the lesson. The instructor presented the first word by placing, and having participants place, the letters for the word onto their own boards in the correct order. The instructor modeled decoding the word by verbalizing each sound and blending the sounds together, demonstrating to students how to use the index finger as a guide while blending. The participants were then asked to help the instructor read the word by verbalizing each sound and blending the sounds together while using their index fingers as a guide. Then, the instructor asked the participants to read the word on their own. After this initial training with the first word, the instructor asked students to change the first letter of the word to form the next word on the list, and the process was repeated until all students demonstrated understanding. Once the participants were given several opportunities to blend words this way, the instructor incorporated encoding into the lesson by asking students to change individual letters to make a specific word. For example, with the word *sit* on the white board, the instructor would ask, “What letter do we need if we want to change the word *sit* to *lit*?” [Students respond with *l*.] “Good, show me where to put *l* to make the word *lit*.” All subsequent word work with manipulative letters was conducted in this way, alternating between decoding and encoding practice after every two to three words until all words for the lesson were presented. For the treatment group, half of the real words and half of the pseudowords selected for the lesson were presented during word work with manipulative letters.

Once work with manipulative letters was completed, participants were provided with a dry-erase board and a marker to conduct word work with Elkonin boxes. The instructor began this portion of each lesson by verbalizing the first word from the list and demonstrating to the participants how to segment the word verbally while using his or her fingers to count the phonemes in the word. To preserve time, the dry-erase boards contained a set of three and a set of four connected boxes so the students would not need to draw their own boxes. The instructor modeled selecting the correct number of boxes to represent each sound in the word by verbally segmenting each sound in the word while counting the sounds and then counting the number of boxes that were needed. Next, the instructor modeled the process of identifying the letter that corresponded with each sound, and guiding the students in writing each corresponding letter into the corresponding box. Finally, the students were given the opportunity to do each step independently. This process was repeated for all subsequent words until students demonstrated understanding and gradually assumed responsibility for segmenting the words with limited instructor modeling. Participants segmented and wrote all words into Elkonin boxes following these procedures with guidance and prompting from the instructor as needed. For the treatment group, half of the real words and half of the pseudowords selected for the lesson were presented during word work with Elkonin boxes.

To promote decoding automaticity, a word-reading task was also prepared for each lesson using the words that were taught in the lesson. The task involved the presentation of index cards with one taught word printed on each card. One-by-one, individual students were asked to decode the presented word. After a word was decoded, all students in the group were asked to repeat the word. When a student was unable to decode the word independently, the instructor guided the group in decoding that word sound-by-sound and then saying the word quickly as a whole. As a result of time constraints, and to ensure that all the target words for a lesson were presented during word work, this lesson component was not completed daily as planned. Instead, it was completed during the last lesson for each of the three lesson types and as time permitted. Thus, for all small groups in the treatment condition, this word-reading task occurred a total of three times.

Comparison Condition

Participants in the comparison group also received approximately 20 minutes of small-group word work instruction using manipulative letters and Elkonin boxes. The procedures for the comparison condition were identical to those described for the treatment condition; however, participants in the comparison group were provided with opportunities to decode and encode real words only. An instructional word list was generated for each lesson, and the presentation of words across lessons followed the same orthographic progression from simple to more complex (i.e., basic linear words preceded nonlinear words) as was followed for the treatment group. Each of the first 10 lessons in the comparison condition exposed students to the same six real words presented in the corresponding treatment group lesson. Each of the last five lessons exposed participants to the same eight real words presented in the corresponding treatment lesson. Words for each lesson were derived from two or three different letter patterns. Words selected for all comparison lessons are provided in Appendix G.

In this condition, all real words were practiced two times during a word work lesson – once using manipulative letters and once using Elkonin boxes – for a total of 12 practice opportunities during the first 10 lessons and 16 practice opportunities during the last five lessons. Thus, participants in the comparison group were provided with the same number of practice opportunities as participants in the treatment group, but they were exposed to repetition of the same real words resulting in less words overall and fewer letter-sound combinations. The treatment group was not exposed to repetition of words but was exposed to the addition of pseudowords, which provided more words overall and a greater variety of letter-sound combinations.

Students in the comparison condition also completed the word-reading task with lesson words printed on cards. However, as with the treatment condition, this activity was only conducted with comparison participants during the last lesson for each lesson type for a total of three times.

Control Condition

Participants in this group were assessed at pre- and post-test but did not receive any instruction from the researcher, thereby serving as a no-treatment control. This group of students remained in their classrooms and completed all regularly planned classroom instruction for the duration of the study. Although providing the control group with the same amount of additional time spent on a reading-related activities was initially considered to control for the effects of the additional time provided to both intervention groups as well as to control for reactivity (i.e. Hawthorne Effect), providing instruction to this group was not feasible due to limited resources. This must be recognized as a possible limitation of the study.

Instructional Fidelity

To assess fidelity, a total of 36 out of 180 scheduled lessons were observed by a graduate student who was trained on the lessons and procedures of this study. Half of the observations were completed during treatment lessons and half during comparison lessons, resulting in fidelity for 20% of the lessons in each condition. Two fidelity instruments were designed (i.e., one for treatment and one for comparison) to address five of elements of fidelity identified by the Institute of Education Sciences (IES). These elements included adherence, quality, responsiveness, exposure, and contamination. The observer was asked to indicate whether or not (a) lessons were followed closely and completed (i.e., adherence); (b) the instructor provided adequate direction, wait time, feedback, etc. (i.e., quality); (c) the instructor made efforts to include all students in the lessons (i.e., responsiveness); (d) lessons lasted approximately 20 minutes and all target words were presented (i.e., exposure); and (e) pseudowords were taught in the treatment condition only (i.e., contamination). Each item required a yes or no answer. Lesson plans for both conditions were provided to the observer during observations to use as a reference while completing the fidelity forms. The fidelity instruments for the treatment and comparison conditions are provided in Appendix H and Appendix I, respectively. Using these methods, instructional fidelity was calculated to be 98% for the treatment group and 100% for the comparison group.

Analysis

Analysis of covariance (ANCOVA) was selected as an omnibus test of the hypothesized intervention effect to analyze each post-test score in this study, with corresponding pre-test score as covariate and condition as independent variable. ANCOVA is used to determine if there are statistically significant differences between adjusted means of multiple groups. It is an extension of a one-way analysis of variance (ANOVA) in that it incorporates a covariate that is linearly related to the dependent variable. As such, ANCOVA is appropriate when post-test performance on a measure is believed to depend in part on pre-test performance of that same measure; thus, the pre-test score is included as a covariate to statistically reduce error variance and remove the effect of extraneous variables.

To determine if ANCOVA is suitable for analyzing data, several assumptions must be met. As with a one-way ANOVA, the assumptions of normality, homoscedasticity (i.e., homogeneity of variances), and independence must be met. In addition, linearity and homogeneity of regression slopes must also be evaluated when using ANCOVA. There are standard procedures for testing these assumptions and evaluating the appropriateness of ANCOVA for the data. In general, the assumptions of linearity and homogeneity of regression slopes must be tested using the pre-test and post-test scores. If either assumption is violated, the ANCOVA model should not be used to explain the data. If the relationship between pre- and post-test scores is linear, and if there is no interaction in the regression slopes, then ANCOVA is a suitable method of analysis. The assumptions of normality and homoscedasticity should then be examined using residuals from the ANCOVA model.

For this study, a separate ANCOVA was performed for each post-test measure using the procedures described above with each corresponding pre-test score as the covariate to determine whether or not there were statistically significant differences between the group means. The scores from the four researcher-developed measures (i.e., R-Acc, P-Acc, R-Auto, and P-Auto) and from the two standardized measures (i.e., WRMT-WA and TOWRE-PDE) each served as dependent variables in this series of analyses. SPSS software was used to complete the analyses.

For each analysis, linearity was assessed first through the visual inspection of scatterplots of post-test scores against corresponding pre-test scores. The assumption of homogeneity of regression slopes was also tested to determine if there were any statistically significant interaction terms between pre-test scores and the independent variable (i.e., groups). In cases where the interaction term was significant, the interaction model was used to explain the data. When there was no significant interaction term, the ANCOVA procedure was performed and standardized residuals were plotted and then inspected visually to assess the assumptions of normality and homoscedasticity. Levene's Test of Homogeneity of Variance was also reported to verify homoscedasticity. When a statistically significant difference between group means was detected, follow-up pairwise comparisons were also completed using adjusted means for each ANCOVA.

Because multiple ANCOVAs were applied to the data in this study, the probability of a Type I error was inflated. Type I error accumulates for each statistical test that is applied; thus, the probability level at which a null hypothesis will be incorrectly rejected (i.e., α) should be set more stringently (Rutherford, 2011). For this analysis, the Bonferroni adjustment was applied to control for an inflated Type I error rate. This adjustment is determined by dividing a standard alpha of .05 by the total number of tests run on a family of statistical tests. The dependent variables in this study, as measured by the researcher-created probes and the selected subtests of the WRMT and the TOWRE, are all theoretically related decoding measures. However, decoding accuracy is distinctly different from decoding automaticity in the way it is assessed and in the type of information it provides about decoding. For these reasons, the three accuracy measures (i.e., R-Acc, P-Acc, and WRMT-WA) were analyzed as one family and the three automaticity measures (i.e., R-Auto, P-Auto, and TOWRE-PDE) were analyzed as a separate family. As such, the Bonferroni adjustment was set at .017 using $\alpha/3$, or .05/3 for each analysis. This adjustment was used for the omnibus tests and also for follow-up pairwise comparisons.

CHAPTER 4
RESULTS

The purpose of this study was to examine the effects of using pseudowords during decoding instruction on the decoding outcomes of kindergarteners in the early development of word recognition. Specifically, students in the partial-alphabetic phase of word recognition were selected for the study, many who demonstrated signs of risk for reading difficulties on the mid-year *Florida Assessments for Instruction in Reading* (FAIR) screening. Four null hypotheses were formulated and tested to examine the effects of pseudoword instruction on real-word and pseudoword decoding accuracy and automaticity. The specific research questions addressed through hypothesis testing were:

1. What are the effects of decoding instruction with pseudowords on real-word decoding accuracy?
2. What are the effects of decoding instruction with pseudowords on pseudoword decoding accuracy?
3. What are the effects of decoding instruction with pseudowords on real-word decoding automaticity?
4. What are the effects of decoding instruction with pseudowords on pseudoword decoding automaticity?

To answer the research questions, decoding post-test performances were compared for 72 participants randomly assigned to one of three conditions: treatment, comparison, and control. In the treatment condition, participants received explicit instruction in segmenting and blending real words and pseudowords. In the comparison condition, students received the same instruction with real words only. A total of 15 instructional sessions were provided to participants assigned to the treatment and comparison groups. A third group was included in the study but did not receive any instruction from the researcher, thereby serving as a business-as-usual control group.

Real-word and pseudoword decoding accuracy and automaticity were measured at pre-test and post-test. Decoding accuracy was assessed using the Word Attack subtest (i.e., WRMT-WA) of the *Woodcock Reading Mastery Tests* and four researcher-developed probes. These accuracy probes were designed to assess linear real-word accuracy, non-linear real-word accuracy, linear pseudoword accuracy, and non-linear pseudoword accuracy. To address the research questions guiding this study, raw scores for linear and non-linear probes were combined prior to analysis to yield one measure of real-word accuracy (R-Acc) and one measure of pseudoword accuracy (P-Acc).

Decoding automaticity was assessed using the Phonemic Decoding Efficiency subtest (i.e., TOWRE-PDE) of the *Test of Word Reading Efficiency* and four researcher-developed probes designed to assess linear real-word automaticity, non-linear real-word automaticity, linear pseudoword automaticity, and non-linear pseudoword automaticity. To address the research questions, raw scores for linear and non-linear probes were combined prior to analysis to yield one measure of real-word automaticity (R-Auto) and one measure of pseudoword automaticity (P-Auto).

In the following sections, the results of this study are presented beginning with preliminary data that serve to describe the groups. Then, the results of the statistical analyses for decoding accuracy and decoding automaticity will be presented.

Pretest Findings

The scores for pretest assessments serve as a means for describing the sample in this study. Table 4-1 provides descriptive statistics for the treatment, comparison, and control groups on all decoding pre-test probes and measures. Means and standard deviations are reported.

Table 4-1. Descriptive statistics for pre-tests by group

Pre-test Measure	Treatment Group Mean (SD)	Comparison Group Mean (SD)	Control Group Mean (SD)
WRMT – Word Attack	108.12 (8.03)	107.74 (8.76)	107.96 (9.12)
TOWRE – Phonemic Decoding Efficiency	6.20 (3.18)	5.83 (3.23)	6.13 (4.23)
Real-word Accuracy	8.96 (5.47)	9.83 (5.19)	10.13 (7.58)
Linear Real-Word Accuracy	8.88 (5.53)	9.83 (5.19)	9.38 (6.19)
Nonlinear Real-Word Accuracy	0.08 (0.28)	0.00 (0.00)	0.75 (2.69)
Pseudoword Accuracy	7.52 (5.36)	8.35 (5.36)	8.38 (8.07)
Linear Pseudoword Accuracy	7.24 (5.07)	8.00 (5.29)	7.29 (6.64)
Nonlinear Pseudoword Accuracy	0.28 (0.61)	0.35 (0.93)	1.08 (2.62)
Real-word Automaticity	6.68 (4.20)	8.35 (8.90)	8.13 (8.12)
Linear Real-Word Automaticity	6.48 (3.94)	7.52 (6.91)	7.38 (7.09)
Nonlinear Real-Word Automaticity	0.20 (0.65)	0.83 (2.39)	0.75 (1.59)
Pseudoword Automaticity	3.80 (2.38)	5.35 (5.02)	5.79 (5.56)
Linear Pseudoword Automaticity	3.76 (2.37)	5.00 (4.59)	5.42 (5.26)
Nonlinear Pseudoword Automaticity	0.04 (0.20)	0.35 (0.71)	0.38 (0.71)

To examine the possibility of statistical difference between the three groups at pre-test, each pre-test score was analyzed using a separate one-way analysis of variance (ANOVA) with condition as independent variable. Table 4-2 provides the results of the ANOVA for each pretest mean. As expected with random assignment to condition, these analyses reveal no statistically significant differences between groups on any of the pretest measures.

Table 4-2. One-way ANOVA for pre-test means

Pre-test Measure	*df*	*F*	*p*
WRMT- WA	2, 69	.012	.988
TOWRE – PDE	2, 69	.072	.930
R-Acc	2, 69	.235	.791
P-Acc	2, 69	.141	.868
R-Auto	2, 69	.375	.689
P-Auto	2, 69	1.320	.273

Analysis of Hypothesized Intervention Effect

Analysis of covariance (ANCOVA) was selected to test the hypothesized intervention effects. Post-test scores were analyzed through a series of omnibus comparisons, with corresponding pre-test scores as covariates and condition as the independent variable, to determine if there were statistically significant differences between adjusted post-test means of the three experimental groups. Pre-test scores were included as covariates to statistically reduce error.

Following standard procedures, the assumptions of linearity and homogeneity of regression slopes were assessed first for each comparison to determine if ANCOVA was suitable for explaining the data. When these assumptions were met, ANCOVA was performed, and the standardized residuals were used to assess the assumptions of normality and homoscedasticity. If significant main effects were found, then follow-up comparisons were also completed. These analyses and the results will be presented for each dependent measure in the following sections.

Results for Decoding Accuracy

Three measures of decoding accuracy were administered at pre-test and post-test. They included the real-word accuracy (R-Acc) and pseudoword accuracy (P-Acc) measures developed by the researcher and the Word Attack subtest of the Woodcock Reading Mastery Tests (WRMT-WA), which served as a standardized measure of pseudoword decoding accuracy. A series of ANCOVAs was conducted to determine if significant differences between groups existed at post-test for decoding accuracy. For the purposes of this analysis, the three measures of decoding accuracy were used to make the Bonferroni familywise adjustment for Type I error.

Real-Word Accuracy

Preliminary analyses verified a linear relationship between pre- and post-test R-Acc for each group, as assessed by visual inspection of a scatterplot. In addition, homogeneity of regression slopes was verified as the interaction term was not statically significant, $F(2,66) = .469$, $p = .628$. Standardized residual scatterplots revealed the assumptions of normality and homoscedasticity were met. However, there was one outlier observed in the data with a standardized residual greater than three standard deviations above zero. As a result, this outlier was removed from the data and the analysis was repeated.

With the outlier removed, linearity was verified again through visual inspection of a scatterplot. Homogeneity of regression slopes was also verified as the interaction term was not statically significant, $F(2,65) = .037$, $p = .963$. As such, ANCOVA was performed with the interaction term removed to determine the main effect of decoding instruction with pseudowords on post-test R-Acc after controlling for pre-test R-Acc. The summary of the ANCOVA for R-Acc is provided in Table 4-3.

The assumptions of normality and homoscedasticity were met based upon visual inspection of scatterplots of the standardized residuals. Levene's Test of Homogeneity of Variance further verified the assumption of homoscedasticity, $F(2,68) = .282$, $p = .755$. Using the Bonferroni adjustment ($\alpha = .05/3 = .017$), the results of the ANCOVA reveal a statistically significant difference between groups on the R-Acc measure, $F(2,67) = 7.680$, $p = .001$. The effect size is large ($\eta_p^2 = .187$) based upon standards for partial eta squared established by Cohen (1969).

Table 4-3. Summary of analysis of covariance for R-Acc

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Pre R-Acc	2725.476	1	2725.476	241.489	.000	.783
Group	173.358	2	86.679	7.680	.001*	.187
Error	756.141	67	11.286			

*Significant at $p < .017$

Follow-up pairwise comparisons were also performed using the Bonferroni adjustment ($\alpha = .05/3 = .017$). The summary of pairwise comparisons for R-Acc is provided in Table 4-4. A statistically significant difference was found between the treatment and control groups ($p = .002$) and between the comparison and control groups ($p = .001$), with adjusted post-test R-Acc means for the treatment group ($M = 14.650$) and the comparison group ($M = 15.019$) significantly higher than for the control group ($M = 11.540$). There was no statistically significant difference between treatment and comparison groups ($p = .708$). Adjusted group means are provided in Table 4-5.

Table 4-4. Pairwise comparisons for R-Acc

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	*p*
Control	Treatment	-3.110*	.971	.002
	Comparison	-3.479*	.980	.001
Treatment	Control	3.110*	.971	.002
	Comparison	-.369	.981	.708
Comparison	Control	3.479*	.980	.001
	Treatment	.369	.981	.708

*Significant at $p < .017$

Table 4-5. Adjusted group means for R-Acc

Group	n	Mean	Std. Error
Control	24	11.540	.686
Treatment	24	14.650	.686
Comparison	23	15.019	.701

Pseudoword Accuracy

Preliminary analysis verified a linear relationship between pre- and post-test P-Acc scores for each group, as assessed by visual inspection of a scatterplot. The interaction term was not statistically significant, $F(2,66) = .295$, $p = .745$, thereby verifying homogeneity of regression slopes. Thus, an ANCOVA was performed with the interaction term removed to determine the effect of decoding instruction with pseudowords on post-test P-Acc after controlling for pre-test P-Acc. Standardized residuals for the interventions and for the overall model were normally distributed and there were equal variances as assessed visually through inspection of a scatterplot. Levene's Test of Homogeneity of Variance also verified homoscedasticity, $F(2,69)$, = .212, $p = .809$. There were no outliers as all standardized residuals fell between plus and minus three standard deviations from zero.

Using the Bonferroni adjustment (α = .05/3 = .017), the results reveal no statistically significant difference between groups on P-Acc, $F(2,68) = 2.970$, $p = .058$, partial $\eta^2 = .08$; thus, post-hoc analyses were not performed. The summary of the ANCOVA for P-Acc is provided in Table 4-6. Adjusted group means are provided in Table 4-7.

Table 4-6. Summary of analysis of covariance for P-Acc

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Pre P-Acc	1814.483	1	1814.483	67.986	.000	.500
Group	158.515	2	79.258	2.970	.058	.080
Error	1814.867	68	26.689			

Table 4-7. Adjusted group means for P-Acc

Group	n	Mean	Std. Error
Control	24	10.172	1.055
Treatment	25	12.681	1.035
Comparison	23	13.733	1.078

Woodcock Reading Mastery Tests – Word Attack

Preliminary analyses indicated a linear relationship between pre- and post-test WRMT-WA for each group, as assessed by visual inspection of a scatterplot. However, the test for homogeneity of regression slopes revealed a statistically significant interaction term, $F(2,66) = 3.963$, $p = .024$. Upon further inspection, two outliers were observed with standardized residuals greater than three standard deviations from zero. These outliers were removed from the data and the analysis was repeated.

After removing the outliers, linearity was verified again for each group through visual inspection of a scatterplot of the relationship between pre- and post-test WRMT-WA. Inspection of a standardized residual scatterplot indicated the assumptions of normality and homoscedasticity were both met, and Levene's Test of Homogeneity of

Variance also verified the assumption of homoscedasticity, $F(2,67) = .582$, $p = .562$. However, the test for homogeneity of regression slopes indicated another statistically significant interaction term, $F(2,64) = 6.977$, $p = .002$. As a result, the ANCOVA model was not suitable for analyzing the data for WRMT-WA. Instead, the interaction model was used and plotted for interpretation. Table 4-8 provides the summary of the ANCOVA with the interaction term for WRMT-WA. The interaction between group and the pre-test covariate is plotted in Figure 4-1.

Table 4-8. Summary of analysis of covariance for WRMT-WA

Source	*SS*	*df*	*MS*	*F*	*p*
Condition	217.700	2	108.850	7.803	.001
Pre WRMT	1680.530	1	1680.530	120.468	.000
Group*Pre WRMT	194.659	2	97.330	6.977	.002*
Error	892.798	64	13.950		
Total	895213.000	70			

*Significant at $p < .05$

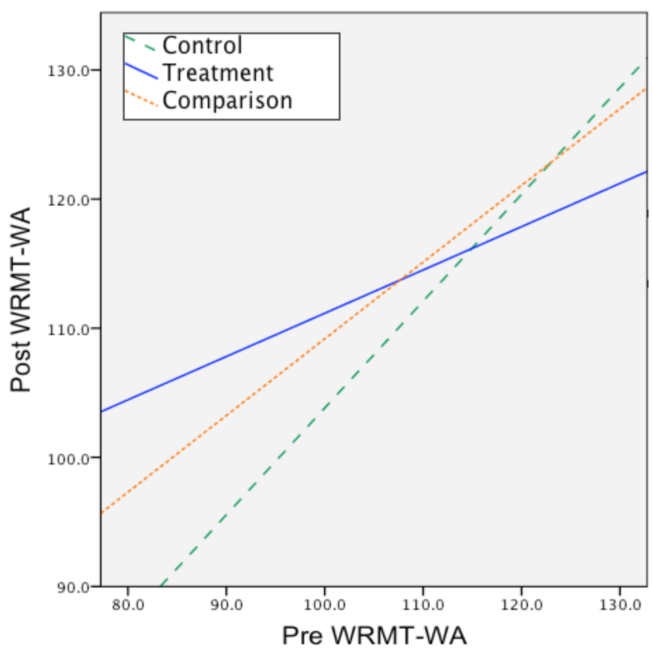

Figure 4-1. Interaction between group and pre-test covariate for WRMT-WA. The interaction depicts standard scores for the WRMT-WA, which are based on a mean score of 100 with a standard deviation of 15.

The interaction illustrates that differences between groups on post-test WRMT-WA are greater when pre-test scores are low than when pre-test scores are high. Of the participants with low pre-test scores, those in the comparison group scored higher at post-test than those in the control group, and those in the treatment group scored the highest of all three groups on post-test WRMT-WA. For participants with high pre-test scores, there are minimal differences between groups at post-test.

Results for Decoding Automaticity

Three measures of decoding automaticity were administered at pre-test and post-test. They included the real-word automaticity (R-Auto) and pseudoword automaticity (P-Auto) measures developed by the researcher and the Phonemic Decoding Efficiency subtest of the Test of Word Reading Efficiency (TOWRE-PDE), which served as a standardized measure of pseudoword decoding automaticity. A series of ANCOVAs was conducted to determine if significant differences between groups existed at post-test for decoding automaticity. Three measures of decoding automaticity were used to make the Bonferroni familywise adjustment for Type I error.

Real-word automaticity

Preliminary findings indicated a linear relationship between pre- and post-test R-Auto scores for each group, as assessed by visual inspection of a scatterplot. However, the test for homogeneity of regression slopes revealed a statistically significant interaction term, $F(2,66) = 6.160$, $p = .004$. Upon inspection of the standardized residuals from the ANCOVA model, two outliers were noted and removed from the data and the analysis was repeated.

After removing the outliers, linearity was verified through visual inspection of a scatter plot, and the test for homogeneity of regression slopes verified no significant interaction term, $F(2,64)$, = 1.121, p = .332. The assumptions of normality and homoscedasticity were also met, based on visual inspection of the standardized residual scatterplots. Levene's Test of Homogeneity of Variance further verified the assumption of homoscedasticity, $F(2,67) = 2.666$, $p = .077$.

As a result, the ANCOVA model was performed again with the interaction term and two outliers removed to determine the main effect of decoding instruction with pseudowords on post-test R-Auto after controlling for pre-test R-Auto. The summary of ANCOVA for R-Auto is provided in Table 4-9. Using the Bonferroni adjustment (α = .05/3 = .017), the analysis reveals a statistically significant difference between groups on the R-Auto measure, $F(2,66) = 5.121$, $p = .009$. There is a large effect size (η_p^2 = .134) based upon the standards for partial eta squared established by Cohen (1969).

Table 4-9. Summary of analysis of covariance for R-Auto

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Pre R-Auto	2778.292	1	2778.292	305.165	.000	.827
Group	93.592	2	46.796	5.121	.009*	.134
Error	603.073	66	9.137			

*Significant at $p < .017$

Follow-up pairwise comparisons were also performed using the Bonferroni adjustment (α = .05/3 = .017). The summary of pairwise comparisons for R-Auto is provided in Table 4-10. A statistically significant difference is found between the treatment and control groups (p = .009) and between the comparison and control groups (p = .006), with adjusted post-test R-Auto means for the treatment group (M = 10.413) and the comparison group (M = 10.612) significantly higher than the control group (M = 8.067). There is no statistically significant difference between treatment and comparison groups (p = .825). Adjusted group means are provided in Table 4-11.

Table 4-10. Pairwise comparisons for R-Auto

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	*p*
Control	Treatment	-2.346*	.876	.009
	Comparison	-2.544*	.895	.006
Treatment	Control	2.346*	.876	.009
	Comparison	-.198	.892	.825
Comparison	Control	2.544*	.895	.006
	Treatment	.198	.892	.825

*Significant at $p < .017$

Table 4-11. Adjusted group means for R-Auto

Group	n	Mean	Std. Error
Control	24	8.067	.619
Treatment	24	10.413	.618
Comparison	22	10.612	.645

Pseudoword Automaticity

Preliminary findings verified a linear relationship between pre- and post-test P-Auto for each group, as assessed by visual inspection of a scatterplot. Homogeneity of regression slopes was verified by an interaction term that was not statistically significant, $F(2,66) = .778$, $p = .464$. As such, an ANCOVA was performed with the interaction term removed to determine the effect of decoding instruction with pseudowords on post-test P-Auto when controlling for pre-test P-Auto. The summary of ANCOVA for P-Auto is provided in Table 4-12.

Visual inspection of scatterplots of the standardized residuals indicated that the data were normally distributed and there was equal variance for all three groups. Levene’s Test of Homogeneity of Variance further verified the assumption of homoscedasticity, $F(2,69) = .859$, $p = .428$. There were no outliers in the data as all standardized residuals fell between plus and minus three standard deviations from zero.

Using the Bonferroni adjustment (α = .05/3 = .017), the analysis reveals a statistically significant difference on post-test P-Auto between the groups, $F(2,68) = 4.970$, $p = .010$. The effect size is large ($\eta_p^2 = .128$) based upon the standards for partial eta squared established by Cohen (1969).

Table 4-12. Summary of analysis of covariance for P-Auto

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Pre P-Auto	2335.513	1	2335.513	117.515	.000	.633
Group	197.537	2	98.769	4.970	.010*	.128
Error	1351.440	68	19.874			

*Significant at $p < .017$

Follow-up pairwise comparisons were also performed with the Bonferroni adjustment (α = .05/3 = .017). The summary of pairwise comparisons for P-Auto is provided in Table 4-13. A statistically significant difference exists for P-Auto post-test means between treatment and control groups ($p = .014$) and between comparison and control groups ($p = .005$), with adjusted post-test P-Auto means for the treatment group ($M = 9.735$) and the comparison group ($M = 10.236$) significantly higher than the control group ($M = 6.466$). There is no statistically significant difference between treatment and comparison groups ($p = .702$). Adjusted group means are reported in Table 4-14.

Table 4-13. Pairwise comparisons for P-Auto

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	*p*
Control	Treatment	-3.270*	1.296	.014
	Comparison	-3.770*	1.302	.005
Treatment	Control	3.270*	1.296	.014
	Comparison	-.501	1.301	.702
Comparison	Control	3.770*	1.302	.005
	Treatment	.501	1.301	.702

*Significant at $p < .017$

Table 4-14. Adjusted group means for P-Auto

Group	n	Mean	Std. Error
Control	24	6.466	.915
Treatment	25	9.735	.902
Comparison	23	10.236	.931

Test of Word Reading Efficiency – Phonemic Decoding Efficiency

Preliminary analysis verified a linear relationship between pre- and post-test TOWRE-PDE scores for each group, as assessed by visual inspection of a scatterplot. The interaction term was not statically significant, $F(2,66) = .998$, $p = .374$, thereby verifying homogeneity of regression slopes. Standardized residual scatterplots verified the assumptions of normality and homoscedasticity were met. However, there was one outlier observed in the data with a standardized residual greater than three standard deviations below zero. As a result, this outlier was removed from the data and the analysis was repeated.

With the outlier removed, visual inspection of a scatterplot verified a linear relationship between pre- and post-test TOWRE-PDE for each group. Homogeneity of regression slopes was also verified as the interaction term was not statically significant, $F(2,65) = .299$, $p = .742$. As such, ANCOVA was performed with the interaction term removed to test the main effect decoding instruction with pseudowords on post-test TOWRE-PDE after controlling for pre-test TOWRE-PDE. The summary of ANCOVA for TOWRE-PDE is provided in Table 4-15.

Based on visual inspection of standardized residual scatterplots, the data were normally distributed and equal variance was observed, but Levene's Test of Homogeneity of Variance indicated that the assumption of homoscedasticity was violated, $F(2,68) = 4.161$, $p = .020$. Using the Bonferroni adjustment ($\alpha = .05/3 = .017$), results indicate no statistically significant difference for the TOWRE-PDE between groups, $F(2,67) = 1.756$, $p = .181$, partial $\eta^2 = .05$; thus, post-hoc analyses were not performed. Adjusted group means are provided in Table 4-16.

Table 4-15. Summary of analysis of covariance for TOWRE-PDE

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Pre TOWRE	540.329	1	540.329	82.991	.000	.553
Group	22.868	2	11.434	1.756	.181	.050
Error	436.214	67	6.511			

*Significant at $p < .017$

Table 4-16. Adjusted group means for TOWRE_PDE

Group	n	Mean	Std. Error
Control	23	5.305	.532
Treatment	25	6.152	.511
Comparison	23	6.704	.532

Summary

The purpose of this study was to determine the effect of decoding instruction with pseudowords on the decoding outcomes of kindergarteners in the partial-alphabetic phase of word-reading development. Two instructional groups were exposed to 15 sessions of word work instruction with manipulative letters and Elkonin boxes. Lessons for the treatment group exposed participants to pseudowords and real words, while lessons for the comparison group included only real words. A business-as-usual control group was included for comparison. Decoding accuracy and automaticity were assessed at pre- and post-test using researcher-developed measures of pseudoword and real-word decoding as well as standardized measures of pseudoword decoding.

The results indicate the adjusted means of the treatment and comparisons groups are significantly higher than the adjusted means of the control group for the researcher-developed measures of real-word accuracy (R-Acc), real-word automaticity (R-Auto), and pseudoword automaticity (P-Auto). For the Word Attack subtest of the *Woodcock Reading Mastery Tests* (WRMT-WA), there is a statistically significant interaction term with treatment participants who scored low at pre-test scoring the highest of all three groups at post-test, and control participants who scored low at pre-test scoring the lowest of all three groups at post test. There is minimal difference between groups for participants with high pre-test scores on the WRMT-WA. The adjusted post-test means for the pseudoword accuracy (P-Acc) measure and the Phonemic Decoding Efficiency subtest of the *Test of Word Reading Efficiency* (TOWRE-PDE) are not significantly different across groups, though treatment and comparison group means are higher than the control group means for both measures.

CHAPTER 5
DISCUSSION

The development of early decoding skills is fundamental to reading success for beginning readers (Ehri, 1995, 1999), and particularly for those who are at risk for reading difficulties (Adams, 1990). Many students who struggle with reading have a primary deficit in the foundational skills that lead to decoding (Chall, 1983; Henry, 1993; Torgesen, 1999). Effective efforts to improve these skills are paramount.

Numerous studies have shown that interventions that include word work are effective at improving decoding in at-risk or struggling readers (Campbell et al., 2008; Iversen & Tunmer, 1993; Joseph, 1998; Lane et al., 2009; McCandless et al., 2003; Pullen, 2000; Pullen et al., 2005). However, few of these studies have provided insight into what specific aspects of instruction make word work more or less effective. There has been only one study to investigate the value of pseudowords for decoding instruction; yet, the results suggest that pseudowords have a promising role in the early development of decoding (Cardenas, 2009). This finding is of interest, given that pseudowords are seldom used during instruction and have even been discouraged based upon the conventional belief that only real words should be used for their practical utility (Adams, 2011). Nevertheless, it is known that, during pseudoword reading, the possibility to rely on memory is eliminated and the skills required for decoding (i.e., phonemic awareness and application of the alphabetic principle) are isolated (Good, Baker, & Peyton, 2009). Thus, decoding instruction tasks with pseudowords force the student to decode. For students who are in the early phases of learning to decode, it may be effective to include pseudowords during decoding instruction for this reason.

The purpose of this study was to investigate the effects of including pseudowords during decoding instruction on several decoding outcomes of beginning readers. Participants were 72 kindergarteners in the partial-alphabetic phase of decoding development. A pre-test post-test control group design with random assignment was used to compare three groups: a treatment group that received decoding instruction using a combination of real words and pseudowords during word work activities; a comparison group that received decoding instruction using only real words during word work activities; and a control group that did not receive instruction from the researcher. Decoding accuracy and automaticity measures were administered at pre- and post-test. This design was selected to allow for comparison of groups on post-test performance while controlling for pre-test performance.

In this chapter, a discussion of the findings and implications of the effects of including pseudowords during small-group decoding instruction are presented. Each research question is addressed first with a summary of related findings. Then, limitations of the study are presented. Finally, implications for practice and implications for future research are discussed.

Summary of Findings

This study was designed and conducted specifically to address the following research questions:

1. What are the effects of decoding instruction with pseudowords on real-word decoding accuracy?
2. What are the effects of decoding instruction with pseudowords on pseudoword decoding accuracy?
3. What are the effects of decoding instruction with pseudowords on real-word decoding automaticity?

4. What are the effects of decoding instruction with pseudowords on pseudoword decoding automaticity?

Each research question was addressed through a separate researcher-developed decoding measure. Standardized measures of pseudoword accuracy and pseudoword automaticity were also administered to address the effects of instruction on pseudoword decoding outcomes for the second and fourth questions, respectively, though these measures were expected to be less sensitive to the early decoding abilities of the participants in this study. The following is a presentation and discussion of findings for each research question.

The Effects of Decoding Instruction with Pseudowords on Real-Word Accuracy

Participant performance on a researcher-developed measure of real-word accuracy (i.e., R-Acc) was used to address the first research question: What are the effects of decoding instruction with pseudowords on real-word decoding accuracy? An ANCOVA was used to test the main effect of instruction with pseudowords on post-test R-Acc while controlling for pre-test R-Acc. The results indicate a statistically significant difference between groups with a large effect size. Follow-up comparisons reveal statistically significant differences, with both the treatment and comparison groups outperforming the control group on real-word accuracy. There was no statistically significant difference between the treatment and comparison groups. This finding indicates that kindergarteners in the treatment and comparison conditions benefitted equally from small-group decoding instruction, regardless of whether they were exposed to real words and pseudowords or real words alone.

The Effects of Decoding Instruction with Pseudowords on Pseudoword Accuracy

Participant performances on a researcher-developed measure of pseudoword accuracy (i.e., P-Acc) and the Word Attack subtest of the Woodcock Reading Mastery Tests (WRMT-WA), a standardized measure of pseudoword accuracy, were used to address the second research question: What are the effects of decoding instruction with pseudowords on pseudoword decoding accuracy? An ANCOVA was used to test the main effect of instruction with pseudowords on post-test performance of each measure while controlling for pre-test on the same measure. The analyses for these two measures offer differing results. Results for the P-Acc measure reveal no statistically significant difference between groups. This indicates that neither instruction with or without pseudowords had an effect on this pseudoword decoding accuracy measure. However, the adjusted group means of both the treatment and control groups were better than the adjusted mean of the comparison group.

For the WRMT-WA measure, the ANCOVA reveals a statistically significant group by covariate interaction with the means of all three groups differing more for participants with low pre-test scores and very little for participants with high-pre-test scores. Moreover, participants with low pre-test scores in the treatment group had the highest post-test scores of all three groups, whereas participants with comparably low pre-test scores in the control group had the lowest post-test scores of all three groups. This finding is unexpected because standardized assessments are sometimes not sensitive enough to measure the early decoding skills of beginning readers.

The Effects of Decoding Instruction with Pseudowords on Real-Word Automaticity

Participant performance on a researcher-developed measure of real-word automaticity (R-Auto) was used to address the third research question: What are the effects of decoding instruction with pseudowords on real-word decoding automaticity? An ANCOVA was used to test the main effect of instruction with pseudowords on post-test R-Auto while controlling for pre-test R-Auto, and results indicate a statistically significant difference between groups with a large effect size. Follow-up comparisons reveal that both the treatment and comparison groups statistically significantly outperformed the control group on R-Auto; however, there was no statistically significant difference between the treatment and comparison groups. This finding indicates that kindergarteners in the treatment and comparison conditions benefitted equally from small-group decoding instruction, regardless of whether they were exposed to real words and pseudowords or real words alone.

The Effects of Decoding Instruction with Pseudowords on Pseudoword Automaticity

Participant performances on a researcher-developed measure of pseudoword automaticity (P-Auto), and the Phonemic Decoding Efficiency subtest of the Test of Word Reading Efficiency (TOWRE-PDE), a standardized measure of pseudoword automaticity, were used to address the fourth research question: What are the effects of decoding instruction with pseudowords on pseudoword decoding automaticity? An ANCOVA was used to test the main effect of instruction with pseudowords on post-test performance of each measure while controlling for pre-test on the same measure. Similar to the results for the pseudoword accuracy measures, the results of the analyses for these two pseudoword automaticity measures vary.

For the P-Auto measure, the results reveal a statistically significant difference between groups with a large effect size, and follow-up comparisons reveal that both the treatment and comparison groups statistically significantly outperformed the control group on real-word accuracy. There was no statistically significant difference between the treatment and comparison groups. Similar to the findings for the R-Acc and R-Auto measures, these findings indicate that kindergarteners in the treatment and comparison conditions benefitted equally from instruction, regardless of whether they were exposed to real words and pseudowords or real words alone.

Results for the TOWRE-PDE reveal no statistically significant difference between groups, though the adjusted group means show that both the treatment and control groups performed better than the comparison group. Although these two pseudoword automaticity measures yielded conflicting results, it was suspected that the standardized measures would not be sensitive enough to detect the early decoding skills of the participants in this study. Therefore, the findings for the TOWRE-PDE are not surprising.

Discussion and Interpretation

The significant effects that were found for both groups receiving decoding instruction in this study align with the findings of numerous studies that have investigated similar instruction for beginning and at-risk readers (e.g., Campbell et al., 2008; Iversen & Tunmer, 1993; Joseph, 1998; Lane et al., 2009; McCandless et al., 2003; Pullen, 2000; Pullen et al., 2005). These researchers concur that explicit decoding instruction that focuses on word work activities and includes manipulatives helps students build decoding skill. Participants in both the treatment group and the comparison group of the present study significantly outperformed the control group on measures of real-word decoding accuracy (i.e., R-Acc), real-word decoding automaticity (i.e., R-Auto), and pseudoword decoding automaticity (i.e., P-Auto). These results imply that the addition of pseudowords during small-group decoding instruction was just as effective as using real words alone with students in the partial-alphabetic phase of word recognition.

Furthermore, the group-by-covariate interaction for the standardized measure of pseudoword decoding accuracy (i.e., WRMT-WA) indicates a greater positive effect for participants with low pre-test scores in the treatment group than in the comparison group, and almost no effect for those in the control group with low pre-test scores. Across all three groups, there was little difference in post-test scores for participants with high pre-test scores. This finding is somewhat surprising given the expectation that a standardized measure might not be sensitive enough to detect differences among beginning decoders with such a brief intervention period between pre-test and post-test. It is promising that, for this measure, the inclusion of pseudowords was more beneficial for students who started out with the lowest performance. This finding provides some evidence that students with the poorest decoding skills may benefit the most from small-group, explicit instruction when this instruction incorporates pseudowords.

While most of the findings from this study are promising, the analysis revealed no significant results for two measures. First, there was no significant difference between groups on the standardized measure of pseudoword decoding automaticity (i.e., TOWRE-PDE) in this study. Although it would seem logical that pseudoword-trained participants would do better than non-pseudoword-trained participants on pseudoword measures, the results of the TOWRE-PDE are not surprising because this standardized measure was not expected to be sensitive enough for these beginning readers to progress beyond the first few items of the measure. As with many standardized measures, the items on the TOWRE-PDE rapidly become more difficult. For beginning readers, this generally means that they will not be able to read many of the test items correctly before reaching items that are beyond their abilities.

Second, there was no difference between groups on the measure of pseudoword decoding accuracy (i.e., P-Acc). These results are somewhat unexpected because they conflict with the results of all three of the other researcher-developed measures. One possible explanation for the low P-Acc performance is that almost all participants receiving instruction in this study had difficulty learning more complex word patterns, such as the consonant blend patterns in CCVC and CVCC words and the non-linear word patterns. In addition, many participants demonstrated a common confusion between similar short vowel sounds (i.e., short *a* and *e* were confused and short *i* and *e* were confused). It was clear that these participants would need more time practicing these particular patterns to become proficient at decoding them.

The linear accuracy probes created for this study presented words in random order, so simple CVC words were mixed in with more complex CCVC and CVCC words. It is possible that broad difficulties with these specific patterns affected participant performance on the P-Acc measure. Although this would be interesting to investigate further, test administration for all accuracy measures included a discontinuation rule for students who missed all of the words on any given stimulus plate. Thus, some students with low scores did not have a chance read all of the words. If they had, the CVC words could have been examined further to explore this possibility. Again, if more time was available to develop some of the more complex word patterns, it is quite possible that participants receiving instruction would have performed better than control participants.

Finally, the significant results for the measures of real-word accuracy and automaticity are of particular interest. These results indicate that instruction supported the development of skills for decoding real words, regardless of whether it involved real words only or real words and pseudowords. Because this study drew upon theories of reading development and the theory of recombinative generalization, these findings are of particular interest. It is clear that both instructional approaches in this study helped students to progress within the partial-alphabetic phase of word recognition described by Ehri (1991, 1998, 2005). As expected, instruction in the treatment and comparison conditions worked to strengthen the connections between the phonologic and orthographic processors resulting in greater accuracy and automaticity when decoding. Furthermore, it was proposed that students who were exposed to instruction and practice using pseudowords would be able to generalize their learning to new stimuli, novel arrangements, or unfamiliar words (Goldstein, 1983; Suchowierska, 2006). From the present findings, it is clear that participants in the treatment and comparison conditions were equally capable of reading real words. Therefore, learning with pseudowords would indeed seem to generalize to decoding real words, as the theory of recombinative generalization suggests.

Given more time, instruction with pseudowords may have yielded different results. In this study, students received daily instruction for approximately 15 total sessions. In contrast, Cardenas (2009) implemented phonics instruction with pseudowords for 28 days and found greater results for the pseudoword-trained group.

It is possible that the longer instructional period in the Cardenas study contributed to those positive results. Also, the present study integrated pseudowords with real words for the duration of instruction with the treatment group. In the study conducted by Cardenas, treatment participants were provided instruction with only pseudowords during the treatment phase. Perhaps that period of concentrated focus on pseudowords made a difference. Finally, Cardenas provided a period of real word phonics instruction before and after the pseudoword instruction was implemented. It is possible that sequence of instruction had an effect on the outcome of that study.

The present study sought to integrate Pseudowords and real words for treatment participants to determine if the addition of pseudowords would add any value to the instruction. This was thought to be important because using pseudowords only during instruction has been contraindicated in the past by reading experts (Adams, 2011). Given what has been learned from the results of this study, 15 daily lessons may not have been enough to determine specifically whether or not the addition of pseudowords is more beneficial than using real words alone. However, this study does demonstrate the value of a short, intensive intervention using manipulatives to teach early decoding skills to students in the early development of word recognition.

Overall, the findings from this study add to the body of research on decoding instruction by offering evidence that instruction including pseudowords can be effective for students who are in the beginning phases of decoding development. Although the findings of the present study do not suggest that instruction with pseudowords is superior to instruction without pseudowords, the limitations of this study must be taken into consideration. Taken together, this study and the study conducted by Cardenas

(2009) provide preliminary empirical support for pseudoword use and a basis for additional research on this approach.

Limitations

There are limitations to this study that should be considered when interpreting the results. The first is the limited number of participants in the study, which reduces power and restricts the external validity of the study. To achieve the desired power of .80 as recommended by Cohen (1988) and to reduce the probability of making a Type II error, a total sample size of 87 was needed for this study. Given limited resources, the study was confined to one elementary school so that all instructional sessions could be provided by the researcher. Although there was a pool of 93 potential participants, only 73 kindergarteners returned consent for participation and one of these participants moved before the completion of the study. This reduction in power limits the ability to detect differences that may exist between the treatment and comparison groups and this is noteworthy given the purpose of this study, which was to determine if pseudoword instruction resulted in significantly different effects than real-word instruction.

The sample also restricts the findings of this study to kindergarteners attending one elementary school. Although these kindergarteners and the school itself are not remarkably different than kindergarteners or schools in other areas of the country, generalization is limited beyond this grade level and the geographical location of this school. A larger sample from a variety of schools and geographical locations would have increased the external validity of this study.

Finally, a limitation within the design of the study is that the control group did not receive any instruction from the researcher. It is possible that treatment and comparison participants were influenced by the fact that they were receiving daily attention from the researcher; thus, reactivity, or the Hawthorne Effect, may have influenced the performances of participants. It is also possible that the two groups of participants had overall better results because of the additional time spent receiving reading-related instruction. To address this limitation, the control group would have to receive the same amount of time spent on a reading activity unrelated to decoding. In the present study, this was not possible due to limited resources.

Implications for Practice

Notwithstanding the limitations of this study, the findings shed some light on decoding instruction for teachers. At the very least, it is plausible to conclude from the present findings that there are no negative effects on decoding skills when including both pseudowords and real words during daily small-group instruction that targets early decoding skills. In fact, participants who received instruction with pseudowords performed comparably to participants who received instruction without pseudowords, and both groups significantly outperformed the control group. This finding challenges the opinion of some educators and scholars in the field of reading instruction who caution against the use of pseudowords for instructional purposes (Adams, 2011). Based upon the present findings, teachers may incorporate pseudowords in addition to real-words during decoding instruction for the explicit purpose of providing students opportunities to isolate discrete decoding skills.

These findings also have implications for teacher preparation and professional development. Because many teachers have already formed an opinion about pseudowords that is not based on empirical evidence, it would be useful to clarify the role that pseudowords can have in effective decoding instruction. Providing teachers with a deeper understanding of the rationale for using pseudowords should help them better understand the processes involved in skillful decoding. For example, teachers should understand that pseudowords offer more opportunities for students to practice blending and segmenting particular phonemic and orthographic patterns found within the English language, and what they learn with pseudowords may later be applied in novel ways, as the theory of recombinative generalization suggests (Goldstein, 1983; Suchowierska, 2006). As such, pseudowords can be particularly helpful when teaching patterns that are less common in English by offering extension and repetition that will serve to strengthen the connections between the orthographic and phonological processors and consolidate the patterns in memory.

Clearly, more research on pseudowords is needed to make specific recommendations pertaining to the use of pseudowords during decoding instruction. This study could not verify that pseudowords added value to decoding instruction, but these results in combination with results of other studies that specifically examined pseudowords (Cardenas, 2009) or included pseudowords in a larger intervention (Lane, Pullen, Hudson, & Konold, 2009; Pullen, Lane, Lloyd, Nowak, & Ryals, 2005) imply that pseudowords can be beneficial to the development of decoding. If pseudowords are used along with real words for the specific purpose of developing discrete decoding skills with students who are beginning to decode, this practice will not interfere with decoding development and has the potential to bolster these skills during a critical period of development. Moreover, the use of pseudowords during decoding instruction may provide an advantage for students with emergent or weak decoding skills.

It should be noted that decoding instruction with or without pseudowords was only provided to participants in this study for a total of only 15 days, yet statistically significant improvements in decoding skill were observed. While it is possible that pseudowords may have had a different impact if instruction had been provided for a longer duration, the impact of this short, intensive intervention should not be overlooked. This study demonstrates the power of daily, small-group decoding instruction with manipulatives for students who have not yet mastered decoding skill.

Implications for Future Research

The results and limitations of this study, in conjunction with the previous limited research on pseudoword instruction, provide several implications for future research. In the only study found to examine the use of pseudowords for instruction, Cardenas (2009) found that students who received phonics instruction with pseudowords alone for a period of 28 school days made greater gains on a phonetic word-reading task than students who received phonics instruction with real words alone. The present study shows that 15 daily, small-group decoding instructional sessions incorporating pseudowords with real words were also beneficial for young developing decoders; however, they were no more beneficial than 15 daily, small-group decoding instructional sessions using real words alone. Taken together, these studies provide an impetus for future research to further explain the role of pseudowords during decoding instruction. Although the present study was designed to better control for systematic differences between groups, the limitations of this study should be addressed through additional research.

To begin, larger studies that isolate pseudoword instruction as the independent variable will be beneficial to address the limitations that impact the power and generalizability of this study. This study included 72 participants in kindergarten from one elementary school in north central Florida. Future replication of this study should seek to include more participants in order to increase power, specifically for detection of differences that may exist between the treatment and comparison conditions. The findings of this study indicated no statistical differences between means of the treatment and comparison groups on any measure, but any differences may have required greater power to be detected.

Also, future studies that include participants from different grade levels will increase generalizability to students in those grades. For instance, many first graders are developing decoding skills within the partial-alphabetic phase of word recognition, so research should examine the effects of pseudowords with this population of students. The same holds true for older students struggling with decoding skill.

First-graders are likely to have had more exposure to printed words than kindergarteners and, as a result, may be able to read more words by sight. It is possible that pseudowords would provide greater benefit for first-graders who are under these circumstances and not yet decoding given the rationale that decoding pseudowords forces isolation and use of decoding skill rather than reliance upon memory for words. Moreover, real words will often act as pseudowords when they are not yet part of a student's lexicon. For many kindergarteners, simple CVC words such as *sop, vat,* or *hog* are not likely to hold meaning. There is no way to know if any of the real words presented during the lessons in this study were pseudowords for these participants. For these reasons, future research should investigate pseudoword use with first-graders in early decoding development and also with older students who are struggling with decoding skills. Support for future research with lower performing students is also offered from the finding of this study that participants with low pre-test scores improved the most on one standardized decoding measure when they received instruction with pseudowords included.

In addition to the issues of power and generalizability, the design of this study has its limitations. Participants in the control group were included for comparison to determine if pseudowords were effective at all, and particularly because treatment and comparison groups receiving explicit decoding instruction would each be expected to make progress on decoding skills. However, due to limited resources, the control group did not receive any instruction from the researcher. Thus, reactivity, or the Hawthorne Effect, may have influenced the performances of participants in this study. In future studies, a stronger design will provide control participants the same amount of attention and instruction unrelated to decoding development in order to eliminate this limitation.

Beyond addressing the limitations of this study, future research may also address many new questions that arise from the findings of this study. Reading research has shown that instruction to develop discrete skills should be paired with opportunities to apply the skills during authentic reading opportunities (Lane, 1994). The instruction provided in this study was highly focused on skill development. Lessons did not provide opportunities to immediately apply decoding skill in connected text, and only limited opportunities to review learned skills were provided due to the time allotted for each instructional session. Therefore, additional studies should seek to include opportunities to apply learned skills to determine if the effects on decoding differ when students are given these opportunities.

Moreover, it will also be important to learn whether or not decoding instruction with pseudowords has an effect on later-developing reading skills. Many of the pseudowords taught during this study may be syllables or affixes found in real multisyllabic words. It would be interesting to explore whether or not learning to decode pseudowords had any effect on multisyllabic word reading. Also, given that the ultimate goal of all reading instruction is for the reader to comprehend text (Adams, 1990), longitudinal studies that examine the impact of early decoding instruction with pseudowords on later-developed reading skills including text level fluency and reading comprehension would be important.

Although the effects of this study were promising, the design delimits the evidence that this intervention will work in classrooms when implemented by school personnel. Future studies can address this delimitation by implementing teacher-led instruction with pseudowords. Furthermore, it will be useful to find out if decoding instruction with pseudowords can be implemented successfully by paraprofessionals in the classroom. Several studies of decoding instruction without pseudowords have suggested that paraprofessionals may be instrumental in this way (Ryder, Tunmer, and Greaney, 2008; Vadasy, Sanders, & Peyton, 2005; Vadasy, Sanders, & Tudor, 2007). In the present study, the instruction was provided in small groups, which may or not be manageable for some teachers. Thus, further research should aim to elucidate the role of paraprofessionals.

Decoding instruction was only provided to treatment and control participants in this study for a total of only 15 days. It is possible that pseudowords may have had a different impact if instruction had been provided for a longer duration. As previously mentioned, Cardenas (2009) found that students receiving instruction with pseudoword alone had more growth than students who received instruction with real words alone after only 28 days of instruction. Removing real words from instruction is not widely recommended because students benefit from exposure to words that they will experience in print. However, it is possible that providing only pseudowords for a limited period of time, as Cardenas did, is more ideal because it offers a concentrated period of skill development. The theoretical underpinnings of the present study suggest that pseudowords have the capacity to add to instruction with real words by providing more opportunities to practice with more letter combinations. Future research should examine whether or not an experimental design similar to the present study will result in a significant outcome for participants exposed to both pseudowords and real words when more days of instruction are provided.

Conclusions

Most educators agree that effective reading instruction is critical for the development of early literacy skills. Decoding instruction is particularly important because it fosters the development of foundational phonological and orthographic skills that are beneficial for all readers, but critical for struggling readers. This study was conducted to examine the effects of including pseudowords during small-group decoding intervention with kindergarten students in the partial-alphabetic phase of word recognition as described by Ehri (1991, 1998, 1995). The findings suggest that instruction that incorporates pseudowords in addition to real words can have a positive effect on the decoding outcome of kindergarteners during this phase of development. Overall, post-test decoding performances of the pseudoword-trained participants were comparable to post-test decoding performances of participants trained with only real words, and both groups performed significantly better than a no-treatment control group on various measures of decoding accuracy and automaticity.

Because prior research specifically examining pseudowords for instruction is limited to one study, the present study offers preliminary support. The findings from this study also reveal implications for practice and direction for future research. Clearly, more studies are needed to determine the true value of pseudowords for developing early decoding skills. Additional research should replicate the existing research and seek to address the limitations of these studies.

APPENDIX A
IRB APPROVAL DOCUMENATION

UF | Institutional Review Board
UNIVERSITY of FLORIDA

PO Box 112250
Gainesville, FL 32611-2250
352-392-0433 (Phone)
352-392-9234 (Fax)
irb2@ufl.edu

March 21, 2013

TO: Keri Madsen
PO Box 117050
Campus

FROM: Ira S. Fischler, PhD; Chair ISFdl
University of Florida
Institutional Review Board 02

SUBJECT: **Approval of Protocol #2013-U-0374**

TITLE: Pseudowords in Decoding Instruction

SPONSOR: None

I am pleased to advise you that the University of Florida Institutional Review Board has recommended approval of this protocol. Based on its review, the UFIRB determined that this research presents no more than minimal risk to participants. Your protocol was approved as an expedited study under category 7: *Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.* Given your protocol, it is essential that you obtain signed documentation of informed consent from the parent or legal guardian of each participant. When it is feasible, you should obtain signatures from both parents. Enclosed is the dated, IRB-approved informed consent to be used when recruiting participants for the research.

> It is essential that the parents/guardians of your minor participants sign a copy of your approved informed consent that bears the IRB approval stamp and expiration date.

If you wish to make any changes to this protocol, ***including the need to increase the number of participants authorized***, you must disclose your plans before you implement them so that the Board can assess their impact on your protocol. In addition, you must report to the Board any unexpected complications that affect your participants.

This approval is valid through March 20, 2014. If you have not completed the study prior to this date, please telephone our office (392-0433), and we will discuss the renewal process with you. **Additionally, should you complete the study on or before the expiration date, please submit the study closure report to our office. The form can be located at** http://ib.ufl.edu/irb02/Continuing_Review.html It is important that you keep your Department Chair informed about the status of this research protocol.

ISF:dl

APPENDIX B
REAL-WORD ACCURACY PROTOCOLS AND STIMULUS PLATES

Real-Word Accuracy Measure – Form A

Scoring: This measure consists of two probes. Administer both probes. For a word read incorrectly, write the student's response phonemically in the space provided and mark the word as incorrect. If the student self-corrects, write the letter ***S*** next to the response. If the student does not make an attempt to read a word in 5 seconds, say, ***"Tell me what you think that word is."*** If they still do not respond, mark the word as incorrect and say, ***"Try the next word."*** For each probe, discontinue the probe if the student reads no words correctly on a given plate.

Training Item: Tell the student, ***"I would like you to read some words."*** Show the training card and point to *cat*. ***"You will read a list like this from top to bottom."*** Sweep your finger down the list of practice words. ***"Read these words starting at the top."*** If the student is not able to read a word, or if they do not blend the sounds together, say ***"Put them together to say the whole word."*** Model blending the word if necessary

cat
men
trap

Directions: Tell the student, **"*Now, I am going to ask you to read some more words. Please start at the top of the list. Be sure to read every word carefully and do your best. You may begin."*** Brief positive feedback may be provided (i.e., *"Good work."*) to motivate the student. Note that this is not a timed task.

LRW Accuracy Probe

1	trot	
2	fin	
3	cap	
4	flag	
5	slop	

11	sop	
12	wed	
13	melt	
14	dust	
15	mad	

6	log	
7	pick	
8	rig	
9	plug	
10	nut	

16	sum	
17	jet	
18	lend	
19	tack	
20	drip	

1

Real-Word Accuracy Measure – Form A

NLRW Accuracy Probe

1	dune	
2	rule	
3	tube	
4	toad	
5	slime	

11	shape	
12	mile	
13	steal	
14	globe	
15	chose	

6	fade	
7	wife	
8	roam	
9	glide	
10	bead	

16	lake	
17	peek	
18	bite	
19	seem	
20	brain	

Assessment Administrator: ________________________

Student: _______________________________________

Date: _________________ Time: __________________

cat

men

trap

LRW Accuracy Training Items – Form A

trot

fin

cap

flag

slop

LRW Accuracy – Form A: Plate 1

log

pick

rig

plug

nut

LRW Accuracy – Form A: Plate 2

sop

wed

melt

dust

mad

LRW Accuracy – Form A: Plate 3

sum

jet

lend

tack

drip

LRW Accuracy – Form A: Plate 4

dune

rule

tube

toad

slime

NLRW Accuracy – Form A: Plate 1

fade

wife

roam

glide

bead

NLRW Accuracy – Form A: Plate 2

shape

mile

steal

globe

chose

NLRW Accuracy – Form A: Plate 3

lake

peek

bite

seem

brain

NLRW Accuracy – Form A: Plate 4

Real-Word Accuracy Measure – Form B

Scoring: This measure consists of two probes. Administer both probes. For a word read incorrectly, write the student's response phonemically in the space provided and mark the word as incorrect. If the student self-corrects, write the letter ***S*** next to the response. If the student does not make an attempt to read a word in 5 seconds, say, ***"Tell me what you think that word is."*** If they still do not respond, mark the word as incorrect and say, ***"Try the next word."*** For each probe, discontinue the probe if the student reads no words correctly on a given plate.

Training Item: Tell the student, ***"I would like you to read some words."*** Show the training card and point to *cat*. ***"You will read a list like this from top to bottom."*** Sweep your finger down the list of practice words. ***"Read these words starting at the top."*** If the student is not able to read a word, or if they do not blend the sounds together, say ***"Put them together to say the whole word."*** Model blending the word if necessary

cat
men
trap

Directions: Tell the student, ***"Now, I am going to ask you to read some more words. Please start at the top of the list. Be sure to read every word carefully and do your best. You may begin."*** Brief positive feedback may be provided (i.e., *"Good work."*) to motivate the student. Note that this is not a timed task.

LRW Accuracy

1	wed	
2	plug	
3	mad	
4	drip	
5	sop	

11	melt	
12	jet	
13	log	
14	slop	
15	dust	

6	pick	
7	flag	
8	cap	
9	trot	
10	tack	

16	nut	
17	sum	
18	fin	
19	rig	
20	lend	

1

Real-Word Accuracy Measure – Form B

NLRW Accuracy

1	tube	
2	globe	
3	lake	
4	fade	
5	toad	

11	chose	
12	bead	
13	seem	
14	bite	
15	glide	

6	dune	
7	roam	
8	wife	
9	steal	
10	peek	

16	mile	
17	brain	
18	slime	
19	rule	
20	shape	

Assessment Administrator: ________________________

Student: _______________________________________

Date: _________________ Time: __________________

2

cat

men

trap

LRW Accuracy Training Items – Form B

wed

plug

mad

drip

sop

LRW Accuracy – Form B: Plate 1

pick

flag

cap

trot

tack

LRW Accuracy – Form B: Plate 2

melt

jet

log

slop

dust

LRW Accuracy – Form B: Plate 3

nut

sum

fin

rig

lend

LRW Accuracy – Form B: Plate 4

tube

globe

lake

fade

toad

NLRW Accuracy – Form B: Plate 1

dune

roam

wife

steal

peek

NLRW Accuracy – Form B: Plate 2

chose

bead

seem

bite

glide

NLRW Accuracy – Form B: Plate 3

mile

brain

slime

rule

shape

NLRW Accuracy – Form B: Plate 4

APPENDIX C
PSEUDOWORD ACCURACY PROTOCOLS AND STIMILUS PLATES

Pseudoword Accuracy Measure – Form A

Scoring: This measure consists of two probes. Administer both probes. For a word read incorrectly, write the student's response phonemically in the space provided and mark the word as incorrect. If the student self-corrects, write the letter ***S*** next to the response. If the student does not make an attempt to read a word in 5 seconds, say, ***"Tell me what you think that word is."*** If they still do not respond, mark the the word as incorrect and say, ***"Try the next word."*** For each probe, discontinue the probe if the student reads no words correctly on a given plate.

Training Item: Tell the student, ***"I would like you to read some words that are not real. When you read these, it's ok if these words don't make sense."*** Show the training card and point to *mip*. ***"You will read a list like this from top to bottom."*** Sweep your finger down the list of practice words. ***"Read these words starting at the top."*** If the student is not able to read a word, or if they do not blend the sounds together, say ***"Put them together to say the whole word."*** Model blending the word if necessary.

mip
fet
glim

Directions: Note that this is not a timed task. Tell the student, ***"Now, I am going to ask you to read some more words. Please start at the top of the list. Be sure to read every word carefully and do your best. You may begin."*** Brief positive feedback may be provided (i.e., *"Good work."*) to motivate the student.

LPW Accuracy Probe

1	bap	
2	nump	
3	zet	
4	clat	
5	nin	

11	zock	
12	vug	
13	brip	
14	wum	
15	lop	

6	jat	
7	yend	
8	fot	
9	blim	
10	jast	

16	selt	
17	vust	
18	hig	
19	yed	
20	grop	

1

Pseudoword Accuracy Measure – Form A

NLPW Accuracy Probe

1	pate	
2	neep	
3	soat	
4	breen	
5	vaid	

11	keat	
12	goam	
13	nute	
14	tane	
15	stife	

6	rone	
7	flate	
8	fide	
9	beal	
10	vape	

16	yeek	
17	zine	
18	hain	
19	boke	
20	sneap	

Assessment Administrator: ________________________

Student: ____

Date: _________________ Time: __________________

mip

fet

glim

LPW Accuracy Training Items – Form A

bap

nump

zet

clat

nin

LPW Accuracy – Form A: Plate 1

jat

yend

fot

blim

jast

LPW Accuracy – Form A: Plate 2

zock

vug

brip

wum

lop

LPW Accuracy – Form A: Plate 3

selt

vust

hig

yed

grop

LPW Accuracy – Form A: Plate 4

pate

neep

soat

breen

vaid

NLPW Accuracy – Form A: Plate 1

rone

flate

fide

beal

vape

NLPW Accuracy – Form A: Plate 2

keat

goam

nute

tane

stife

NLPW Accuracy – Form A: Plate 3

yeek

zine

hain

boke

sneap

NLPW Accuracy – Form A: Plate 4

Pseudoword Accuracy Measure – Form B

Scoring: This measure consists of two probes. Administer both probes. For a word read incorrectly, write the student's response phonemically in the space provided and mark the word as incorrect. If the student self-corrects, write the letter ***S*** next to the response. If the student does not make an attempt to read a word in 5 seconds, say, ***"Tell me what you think that word is."*** If they still do not respond, mark the word as incorrect and say, ***"Try the next word."*** For each probe, discontinue the probe if the student reads no words correctly on a given plate.

Training Item: Tell the student, ***"I would like you to read some words that are not real. When you read these, it's ok if these words don't make sense."*** Show the training card and point to *mip*. ***"You will read a list like this from top to bottom."*** Sweep your finger down the list of practice words. ***"Read these words starting at the top."*** If the student is not able to read a word, or if they do not blend the sounds together, say ***"Put them together to say the whole word."*** Model blending the word if necessary.

mip
fet
glim

Directions: Note that this is not a timed task. Tell the student, ***"Now, I am going to ask you to read some more words. Please start at the top of the list. Be sure to read every word carefully and do your best. You may begin."*** Brief positive feedback may be provided (i.e., *"Good work."*) to motivate the student.

LPW Accuracy

1	lop	
2	zock	
3	hig	
4	grop	
5	zet	

11	yend	
12	nin	
13	blim	
14	jat	
15	yed	

6	wum	
7	nump	
8	fot	
9	brip	
10	selt	

16	vust	
17	clat	
18	bap	
19	vug	
20	jast	

Pseudoword Accuracy Measure – Form B

NLPW Accuracy

1	goam	
2	vape	
3	rone	
4	zine	
5	beal	

11	flate	
12	jute	
13	boke	
14	sneap	
15	keat	

6	tane	
7	stife	
8	soat	
9	vaid	
10	neep	

16	fide	
17	pate	
18	yeek	
19	hain	
20	breen	

Assessment Administrator: ________________________

Student: ____

Date: _________________ Time: __________________

2

mip

fet

glim

LPW Accuracy Training Items – Form B

lop

zock

hig

grop

zet

LPW Accuracy – Form B: Plate1

wum

nump

fot

brip

selt

LPW Accuracy – Form B: Plate 2

yend

nin

blim

jat

yed

LPW Accuracy – Form B: Plate 3

vust

clat

bap

vug

jast

LPW Accuracy – Form B: Plate 4

goam

vape

rone

zine

beal

NLPW Accuracy – Form B: Plate 1

tane

stife

soat

vaid

neep

NLPW Accuracy – Form B: Plate 2

flate

jute

boke

sneap

keat

NLPW Accuracy – Form B: Plate 3

fide

pate

yeek

hain

breen

NLPW Accuracy – Form B: Plate 4

APPENDIX D
REAL-WORD AUTOMATICITY PROTOCOLS AND STIMULUS PLATES

Real-Word Automaticity Measure – Form A

Scoring: This is a timed word reading task. The student will have 1 minute to read as many words as possible for each of two automaticity word plates. Mark any word read incorrectly with a ~~**line**~~ through it. If the student self-corrects an error, write an ***S*** next to the word. Give the student 3-5 seconds to say a word, and if they do not read the word, say, ***"Try the next word."*** **Circle** the last word read before the timer sounds.

Training Item: ***"I would like you to read some more words for me. Read from left to across the row in this direction."*** [point to *cat* and sweep your finger from left to right under the words]. ***"Let's practice that."*** [Point to *cat*] ***"Start here and read across the row."*** [If the student does not blend the sounds together to form a whole word, ask the student to say the whole word. Model blending the word together if necessary. Repeat for each example word.]

cat	**men**	**trap**

Directions: ***"Now, you will read some more words. Start at the top of the page and read across each row from left to right. Try to read every word and do your best. If you get stuck on a word, you can skip it and try the next word. You will only read for one minute."*** [Set timer to 1 minute. Place probe in front of student] ***"You may begin now."*** Brief positive feedback (i.e., *"Good work."*) may be provided if needed for motivation.

LRW Automaticity

rat	hog	jump	tick	got
kit	yum	dot	must	bat
win	gust	frog	lab	fast
bug	let	drug	swim	fig
flip	prop	bend	pet	hit
dump	plot	but	pack	grim
kick	tin	jug	hump	map
dad	fed	lack	slug	rap
dig	tend	sad	skip	drag
drop	tab	grip	cop	last

NLRW Automaticity

beak	hope	nail	cape	seat
feel	flute	goat	bean	shine
bike	pride	fine	plate	tune
dime	leak	prize	stale	slide
five	trail	smoke	home	dude
wipe	feed	rude	wait	robe
main	paid	blaze	keep	cone
goal	wave	choke	June	speed
nose	bake	hole	clean	heat
shake	greet	drive	sweep	float

Administrator: ________________ Student: ____________________________ Date: ____________

cat men trap

LRW Automaticity Training Items – Form A

rat	hog	jump	tick	got
kit	yum	dot	must	bat
win	gust	frog	lab	fast
bug	let	drug	swim	fig
flip	prop	bend	pet	hit
dump	plot	but	pack	grim
kick	tin	jug	hump	map
dad	fed	lack	slug	rap
dig	tend	sad	skip	drag
drop	tab	grip	cop	last

LRW Automaticity – Form A

beak	hope	nail	cape	seat
feel	flute	goat	bean	shine
bike	pride	fine	plate	tune
dime	leak	prize	stale	slide
five	trail	smoke	home	dude
wipe	feed	rude	wait	robe
main	paid	blaze	keep	cone
goal	wave	choke	June	speed
nose	bake	hole	clean	heat
shake	greet	drive	sweep	float

NLRW Automaticity – Form A

Real-Word Automaticity Measure – Form B

Scoring: This is a timed word reading task. The student will have 1 minute to read as many words as possible for each of two automaticity word plates. Mark any word read incorrectly with a ~~**line**~~ through it. If the student self-corrects an error, write an ***S*** next to the word. Give the student 3-5 seconds to say a word, and if they do not read the word, say, ***"Try the next word."*** **Circle** the last word read before the timer sounds.

Training Item: ***"I would like you to read some more words for me. Read from left to across the row in this direction."*** [point to *cat* and sweep your finger from left to right under the words]. ***"Let's practice that."*** [Point to *cat*] ***"Start here and read across the row."*** [If the student does not blend the sounds together to form a whole word, ask the student to say the whole word. Model blending the word together if necessary. Repeat for each example word.]

cat	**men**	**trap**

Directions: ***"Now, you will read some more words. Start at the top of the page and read across each row from left to right. Try to read every word and do your best. If you get stuck on a word, you can skip it and try the next word. You will only read for one minute."*** [Set timer to 1 minute. Place probe in front of student] ***"You may begin now."*** Brief positive feedback (i.e., *"Good work."*) may be provided if needed for motivation.

LRW Automaticity

hit	got	bend	bat	cop
last	flip	drop	map	let
frog	skip	dot	lab	must
tick	yum	bug	swim	lack
tin	jug	plot	dump	fed
kit	kick	gust	fig	rap
fast	tend	hog	grip	pack
rat	dig	but	jump	prop
sad	drag	hump	dad	win
pet	slug	grim	tab	drug

NLRW Automaticity

hole	dime	goat	seat	prize
tune	cape	float	bean	leak
greet	cone	nose	speed	bike
keep	plate	feel	stale	rude
wait	robe	shake	sweep	bake
paid	feed	trail	smoke	five
home	heat	shine	blaze	wipe
fine	nail	goal	flute	choke
wave	dude	main	pride	slide
hope	beak	june	drive	clean

Administrator: _______________ Student: __________________________ Date: ___________

cat men trap

LRW Automaticity Training Items – Form B

hit	got	bend	bat	cop
last	flip	drop	map	let
frog	skip	dot	lab	must
tick	yum	bug	swim	lack
tin	jug	plot	dump	fed
kit	kick	gust	fig	rap
fast	tend	hog	grip	pack
rat	dig	but	jump	prop
sad	drag	hump	dad	win
pet	slug	grim	tab	drug

LRW Automaticity – Form B

hole	dime	goat	seat	prize
tune	cape	float	bean	leak
greet	cone	nose	speed	bike
keep	plate	feel	stale	rude
wait	robe	shake	sweep	bake
paid	feed	trail	smoke	five
home	heat	shine	blaze	wipe
fine	nail	goal	flute	choke
wave	dude	main	pride	slide
hope	beak	june	drive	clean

NLRW Automaticity – Form B

APPENDIX E
PSEUDOWORD AUTOMATICITY PROTOCOLS AND STIMULUS PLATES

Pseudoword Automaticity Measure – Form A

Scoring: This is a timed word reading task. The student will have 1 minute to read as many words as possible for each of two automaticity word plates. Mark any word read incorrectly with a ~~**line**~~ through it. If the student self-corrects an error, write an ***S*** next to the word. Give the student 3-5 seconds to say a word, and if they do not read the word, say, ***"Try the next word."*** **Circle** the last word read before the timer sounds.

Training Item: ***"I would like you to read some more words for me. Read from left to across the row in this direction."*** [point to *mip* and sweep your finger from left to right under the words]. ***"Let's practice that."*** [Point to *mip*] ***"Start here and read across the row."*** [If the student does not blend the sounds together to form a whole word, ask the student to say the whole word. Model blending the word together if necessary. Repeat for each example word.]

mip	**fet**	**glim**

Directions: ***"Now, you will read some more words. Start at the top of the page and read across each row from left to right. Try to read every word and do your best. If you get stuck on a word, you can skip it and try the next word. You will only read for one minute."*** [Set timer to 1 minute. Place probe in front of student] ***"You may begin now."*** Brief positive feedback (i.e., *"Good work."*) may be provided if needed for motivation.

LPW Automaticity Probe

spag	yop	plim	lat	mig
bot	clug	mab	blop	ned
crat	glot	nop	pend	nust
frop	grug	smip	tum	blag
flot	lin	zig	jelt	dap
jit	zick	rog	lum	rast
plog	jad	yelt	shug	vap
hast	zump	vad	zot	hab
lut	sug	crip	zin	ped
nend	vack	zug	ret	glim

NLPW Automaticity Probe

fane	meap	gleat	nide	boak
heek	cobe	pake	rean	fute
drate	lote	pime	bape	greap
leam	fime	jeed	spail	veek
vope	baid	doan	rile	sneep
chake	fune	glope	leat	wike
mobe	shime	tain	hoat	breet
blait	rive	tude	fain	zoat
noke	flabe	zail	yate	zake
stike	toam	blime	keet	vate

Administrator: _______________ Student: __________________________ Date: ___________

mip fet glim

LPW Automaticity Training Items – Form A

spag	yop	plim	lat	mig
bot	clug	mab	blop	ned
crat	glot	nop	pend	nust
frop	grug	smip	tum	blag
flot	lin	zig	jelt	dap
jit	zick	rog	lum	rast
plog	jad	yelt	shug	vap
hast	zump	vad	zot	hab
lut	sug	crip	zin	ped
nend	vack	zug	ret	glim

LPW Automaticity – Form A

fane	meap	gleat	nide	boak
heek	cobe	pake	rean	fute
drate	lote	pime	bape	greap
leam	fime	jeed	spail	veek
vope	baid	doan	rile	sneep
chake	fune	glope	leat	wike
mobe	shime	tain	hoat	breet
blait	rive	tude	fain	zoat
noke	flabe	zail	yate	zake
stike	toam	blime	keet	vate

NLPW Automaticity – Form A

Pseudoword Automaticity Measure – Form B

Scoring: This is a timed word reading task. The student will have 1 minute to read as many words as possible for each of two automaticity word plates. Mark any word read incorrectly with a ~~line~~ through it. If the student self-corrects an error, write an ***S*** next to the word. Give the student 3-5 seconds to say a word, and if they do not read the word, say, ***"Try the next word."*** **Circle** the last word read before the timer sounds.

Training Item: ***"I would like you to read some more words for me. Read from left to across the row in this direction."*** [point to *mip* and sweep your finger from left to right under the words]. ***"Let's practice that."*** [Point to *mip*] ***"Start here and read across the row."*** [If the student does not blend the sounds together to form a whole word, ask the student to say the whole word. Model blending the word together if necessary. Repeat for each example word.]

mip	**fet**	**glim**

Directions: ***"Now, you will read some more words. Start at the top of the page and read across each row from left to right. Try to read every word and do your best. If you get stuck on a word, you can skip it and try the next word. You will only read for one minute."*** [Set timer to 1 minute. Place probe in front of student] ***"You may begin now."*** Brief positive feedback (i.e., *"Good work."*) may be provided if needed for motivation

LPW Automaticity

lat	yop	jelt	mab	sug
zig	rast	dap	zug	ped
smip	nop	jad	nend	zin
mig	crip	shug	frop	vap
clug	hast	blop	lum	nust
zick	crat	zot	glim	jit
ned	zump	yelt	bot	rog
glot	lut	vack	ret	blag
hab	flot	plim	pend	grug
lin	plog	vad	spag	tum

NLPW Automaticity

bape	stike	jeed	vate	toam
flabe	pake	vope	blime	meap
heek	rile	breet	leat	rive
chake	fime	cobe	fute	glope
shime	tude	greap	wike	baid
rean	boak	pime	yate	mobe
spail	hoat	keet	drate	tain
sneep	fane	veek	leam	lote
fune	noke	zail	gleat	blait
zake	zoat	nide	fain	doan

Administrator: _______________ Student: __________________________ Date: ___________

mip fet glim

LPW Automaticity Training Items – Form B

lat	yop	jelt	mab	sug
zig	rast	dap	zug	ped
smip	nop	jad	nend	zin
mig	crip	shug	frop	vap
clug	hast	blop	lum	nust
zick	crat	zot	glim	jit
ned	zump	yelt	bot	rog
glot	lut	vack	ret	blag
hab	flot	plim	pend	grug
lin	plog	vad	spag	tum

LPW Automaticity – Form B

bape	stike	jeed	vate	toam
flabe	pake	vope	blime	meap
heek	rile	breet	leat	rive
chake	fime	cobe	fute	glope
shime	tude	greap	wike	baid
rean	boak	pime	yate	mobe
spail	hoat	keet	drate	tain
sneep	fane	veek	leam	lote
fune	noke	zail	gleat	blait
zake	zoat	nide	fain	doan

NLPW Automaticity – Form B

APPENDIX F
WORDS FOR TREATMENT LESSONS

LESSON 1: CVC
-at, -ap, -ip

Word Work	Elkonin Boxes
vap	dap
map	sap
mat	gat
zat	sat
sit	vit
dit	bit

LESSON 2: CVC
-in, -ig, -ug

Word Work	Elkonin Boxes
fin	zin
min	bin
mig	lig
dig	big
dug	jug
sug	nug

LESSON 3: CVC
-ad, -ed, -et

Word Work	Elkonin Boxes
mad	cad
zad	bad
zed	led
bed	ped
bet	jet
ret	fet

LESSON 4: CVC
-um, -ut, -ot

Word Work	Elkonin Boxes
lum	yum
gum	tum
gut	nut
sut	dut
sot	not
dot	mot

LESSON 5: CVC
-og, -op, -ab

Word Work	Elkonin Boxes
dog	pog
not	jog
nop	dop
cop	mop
cab	zab
sab	tab

LESSON 6: CCVC & CVCC
-ot, -at, -ast

Word Work	Elkonin Boxes
spot	plot
flot	prot
flat	blat
smat	scat
past	fast
rast	dast

LESSON 7: CCVC & CVCC
-ag, -og, -elt

Word Work	Elkonin Boxes
drag	blag
smag	flag
smog	frog
snog	spog
melt	velt
zelt	felt

LESSON 8: CCVC & CVCC
-ip, -ug, -op

Word Work	Elkonin Boxes
flip	slip
frip	glip
slug	clug
flug	plug
stop	chop
glop	frop

LESSON 9: CCVC & CVCC
-end, -ump, -ust

Word Work	Elkonin Boxes
rend	zend
send	bend
fump	bump
jump	tump
must	nust
zust	just

LESSON 10: CCVC & CVCC
-im, -ick, -ack

Word Work	Elkonin Boxes
slim	swim
stim	glim
yick	kick
pick	bick
pack	dack
gack	rack

LESSON II: Non-Linear
i_e, a_e

Word Work	Elkonin Boxes
fine	bite
five	bike
rive	fime
rike	pime
rake	fane
bake	cake
bape	cape
fape	bame

LESSON 12: Non-Linear
o_e, u_e

Word Work	Elkonin Boxes
hope	hole
hote	cobe
note	dobe
noke	nose
tube	dude
fune	dune
June	gute
lune	fute

LESSON 13: Non-Linear
ee, ai

Word Work	Elkonin Boxes
peek	feel
feek	peel
feed	jeek
zeed	jeed
rain	bait
gain	wait
taid	zain
baid	fain

LESSON 14: Non-Linear
ea, oa

Word Work	Elkonin Boxes
heat	feap
leat	beat
bean	leam
fean	heap
goat	boak
goal	boam
doal	load
doak	toad

LESSON 15: Non-Linear
i_e, o_e, a_e, ee

Word Work	Elkonin Boxes
slide	glide
blide	blime
choke	chose
chome	glope
flake	shake
flape	flape
greet	green
smeet	sneep

APPENDIX G
WORDS FOR COMPARISON LESSONS

LESSON 1: CVC
-at, -ap, -ip

Word Work	Elkonin Boxes
sap	sap
map	map
mat	mat
sat	sat
sit	sit
fit	fit

LESSON 2: CVC
-in, -ig, -ug

Word Work	Elkonin Boxes
fin	fin
bin	bin
big	big
dig	dig
dug	dug
jug	jug

LESSON 3: CVC
-ad, -ed, -et

Word Work	Elkonin Boxes
mad	mad
bad	bad
bed	bed
led	led
let	let
jet	jet

LESSON 4: CVC
-um, -ut, -ot

Word Work	Elkonin Boxes
yum	yum
gum	gum
gut	gut
nut	nut
not	not
dot	dot

LESSON 5: CVC
-og, -op, -ab

Word Work	Elkonin Boxes
dog	dog
jog	jog
mop	mop
cop	cop
cab	cab
tab	tab

LESSON 6: CCVC & CVCC
-ot, -at, -ast

Word Work	Elkonin Boxes
spot	spot
plot	plot
flat	flat
scat	scat
past	past
fast	fast

LESSON 7: CCVC & CVCC
-ag, -og, -elt

Word Work	Elkonin Boxes
drag	drag
flag	flag
frog	frog
smog	smog
melt	melt
felt	felt

LESSON 8: CCVC & CVCC
-ip, -ug, -op

Word Work	Elkonin Boxes
flip	flip
slip	slip
slug	slug
plug	plug
stop	stop
chop	chop

LESSON 9: CCVC & CVCC
-end, -ump, -ust

Word Work	Elkonin Boxes
send	send
bend	bend
bump	bump
jump	jump
just	just
must	must

LESSON 10: CCVC & CVCC
-im, -ick, -ack

Word Work	Elkonin Boxes
slim	slim
swim	swim
kick	kick
pick	pick
pack	pack
rack	rack

LESSON II: Non-Linear
i_e, a_e

Word Work	Elkonin Boxes
fine	fine
five	five
bite	bite
bike	bike
bake	bake
rake	rake
cake	cake
cape	cape

LESSON 12: Non-Linear
o_e, u_e

Word Work	Elkonin Boxes
hope	hope
hole	hole
note	note
nose	nose
tube	tube
dude	dude
dune	dune
June	June

LESSON 13: Non-Linear
ee, ai

Word Work	Elkonin Boxes
feed	feed
feel	feel
peel	peel
peek	peek
rain	rain
gain	gain
bait	bait
wait	wait

LESSON 14: Non-Linear
ea, oa

Word Work	Elkonin Boxes
bean	bean
beat	beat
heat	heat
heap	heap
load	load
toad	toad
goat	goat
goal	goal

LESSON 15: Non-Linear
i_e, o_e, a_e, ee

Word Work	Elkonin Boxes
slide	slide
glide	glide
choke	choke
chose	chose
flake	flake
shake	shake
green	green
greet	greet

APPENDIX H
FIDELITY INSTRUMENT FOR TREATMENT CONDITION

Fidelity Checklist: Treatment Condition

Instructor: ______________________ School: ______________________
Observer: ______________________ Group: __________ Date: __________
Lesson start time: __________ End time: __________ Session Length: __________

Adherence

Step 1: Word Work with Manipulative Letters Start: _________ End: _________

The instructor guided students in reading and spelling real and pseudowords using manipulative letters.	Yes	No	Notes
Instructor guided students in encoding words.			
Instructor guided students in decoding words.			
Real words and psuedowords were taught during Step 1.			
Instructor presented only the words selected for Step 1.			

Step 2: Word Work with Elkonin Boxes Start: _________ End: _________

The instructor guided students in segmenting and spelling real and pseudowords using Elkonin boxes.	Yes	No	Notes
Instructor guided students in segmenting and counting sounds in words.			
Instructor guided students in spelling/writing words.			
Real words and psuedowords were taught during Step 2.			
Instructor presented only the words selected for Step 2.			

Step 3: Word Review with Index Cards (when appropriate)

The instructor provided students with opportunities to read word cards containing words selected for instruction.	Yes	No	N/A	Notes
Instructor presented words selected for instruction on word cards.				
Instructor allowed students to attempt to read words first.				
When necessary, instructor assisted students to blend sounds and then read whole words.				
Focus of this step was on decoding.				

1

Quality

Instructor demonstrated elements of high quality instruction.	Yes	No	Notes
Instructor was prepared and organized with lesson plan and materials readily available before and during lesson.			
Instructional pace allowed for complete presentation of selected words in approximately 15-20 minutes.			
Instructor modeled sounds accurately and demonstrated blendable sounds when possible.			
Elements of direct instruction (gradual release of responsibilitiy) were observed during lesson.			
Insturctor provided positive feedback.			
Instructor provided specific corrective feedback as needed (i.e., modeled blending and/or segmenting sounds and guided students to correct reading and/or spelling of word).			

Responsiveness

Instructor provided opportunites for all students to participate and respond during lesson.	Yes	No	Notes
Instructor took measures to include all students during lesson.			
Instructor encouraged all students to respond and become engaged in lesson.			
Instructor made clear the expectation that all students should participate in lesson.			
All students were engaged in lesson.			

Exposure

Instructor exposed students to all real and pseudoword stimuli selected for Steps 1 and 2 of lesson.	Yes	No	Notes
Instructor presented all words selected for Step 1 of lesson.			
Instructor presented all words selected for Step 2 of lesson.			

Additional Observation Notes:

APPENDIX I
FIDELITY INSTRUMENT FOR COMPARISON CONDITION

Fidelity Checklist: Comparison Condition

Instructor: ______________________ School: ______________________
Observer: ______________________ Group: __________ Date: __________
Lesson start time: __________ End time: __________ Session Length: __________

Adherence

Step 1: Word Work with Manipulative Letters Start: ________ End: ________

The instructor guided students in reading and spelling real words using manipulative letters.	Yes	No	Notes
Instructor guided students in encoding words.			
Instructor guided students in decoding words.			
Instructor presented only the words selected for Step 1.			

Step 2: Word Work with Elkonin Boxes Start: ________ End: ________

The instructor guided students in segmenting and spelling real using Elkonin boxes.	Yes	No	Notes
Instructor guided students in segmenting and counting sounds in words.			
Instructor guided students in spelling/writing words.			
Instructor presented only the words selected for Step 2.			

Step 3: Word Review with Index Cards (when appropriate)

The instructor provided students with opportunities to read word cards containing words selected for instruction.	Yes	No	N/A	Notes
Instructor presented words selected for instruction on word cards.				
Instructor allowed students to attempt to read words first.				
When necessary, instructor assisted students to blend sounds and then read whole words.				
Focus of this step was on decoding.				

Contamination

Students were exposed to real words only during lesson.	Yes	No	Notes
Instructor presented real words only for instruction during this lesson.			

1

Quality

Instructor demonstrated elements of high quality instruction.	Yes	No	Notes
Instructor was prepared and organized with lesson plan and materials readily available before and during lesson.			
Instructional pace allowed for complete presentation of selected words in approximately 15-20 minutes.			
Instructor modeled sounds accurately and demonstrated blendable sounds when possible.			
Elements of direct instruction (gradual release of responsibilitiy) were observed during lesson.			
Insturctor provided positive feedback.			
Instructor provided specific corrective feedback as needed (i.e., modeled blending and/or segmenting sounds and guided students to correct reading and/or spelling of word).			

Responsiveness

Instructor provided opportunites for all students to participate and respond during lesson.	Yes	No	Notes
Instructor took measures to include all students during lesson.			
Instructor encouraged all students to respond and become engaged in lesson.			
Instructor made clear the expectation that all students should participate in lesson.			
All students were engaged in lesson.			

Exposure

Instructor exposed students to all real word stimuli selected for Steps 1 and 2 of lesson.	Yes	No	Notes
Instructor presented all words selected for Step 1 of lesson.			
Instructor presented all words selected for Step 2 of lesson.			

Additional Observation Notes:

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BIOGRAPHICAL SKETCH

Keri Marie Madsen received a Bachelor of Science in Communication Sciences and Disorders in 1997 from East Carolina University and a Master of Science in Speech-Language Pathology in 2002 from the University of South Florida. While attending graduate school, Keri worked for one year as a speech-language pathologist in an elementary school in Hillsborough County, Florida. After graduating with her master's degree, Keri resumed her work as a school-based speech-language pathologist in Alachua County, Florida, for six years.

During her time in Alachua County, Keri served many students with reading difficulties. As a result, she became interested in literacy development and began pursuing an Education Specialist degree in Curriculum and Instruction at the University of Florida. Her studies focused on differentiated instruction, inclusion, and language and literacy development, assessment, and instruction. In 2004, Keri began teaching reading to elementary students struggling with literacy skills, and she later assumed the role of reading coach for elementary school teachers. In 2007, Keri received her specialist degree.

While completing her doctoral studies in Special Education at the University of Florida, Keri served as a graduate teaching assistant and lead instructor for several face-to-face and web-based language and literacy courses in the College of Education and supervised student teachers during their practicum and internship placements. Keri also assumed various roles on grant-funded research projects including a leadership role as Professional Development Coordinator on a large project funded by the Institute of Education Sciences. She has presented her work in the areas of literacy instruction, professional development, and teacher knowledge about reading at local, state, and national conferences.

In the future, Keri plans to pursue teaching and research in the areas of language and literacy development as well as in the professional preparation and development of teachers and/or speech-language pathologists. She hopes to pursue these goals during a career in higher education.