THE EFFECTS OF THREE INSTRUCTIONAL APPROACHES ON STUDENT WORD READING PERFORMANCE

DISSERTATION

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By
Melissa Ann Schmidgall, M.S.

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Dissertation Committee:
Professor Laurice Joseph, Adviser
Professor Antoinette Miranda
Professor Emily Rodgers

Approved by

Adviser
Graduate Program in Education
ABSTRACT

The current study examined the instructional effectiveness and efficiency of three word reading interventions on student’s cumulative number of words read accurately and cumulative learning rate. Specifically, alternating treatments designs were used to compare the effects of interspersal drill and practice training (presenting one known word prior to every third unknown word for a ratio of 67% unknown to 33% known), the phonic analysis method of word boxes (presenting only unknown words), and a traditional drill and practice procedure (presenting only unknown words) on word reading mastery. This study was also intended to extend previous research findings of the positive outcomes of the three interventions by examining the acquisition, maintenance, and generalization of words that were taught under the three instructional conditions. Social validity of the three instructional methods was also assessed.

Subjects selected for this study consisted of six first grade students from a suburban elementary school who were identified as deficient in word identification skills as measured by their performance on the Dynamic Indicators of Basic Early Literacy Skills (DIBELS). Subjects received twenty-five minute sessions of intervention five days per week for a total of twenty sessions.

Results showed positive effects for all three conditions in regards to enhancing the word reading performance of students in the study. Specifically, the results of the study
indicated that the word boxes approach was most effective and the traditional drill and practice approach was most efficient in terms of increasing word reading performance. Results of the study also suggested that none of the three instructional approaches was statistically more effective in terms of student’s ability to “maintain” and “generalize” newly acquired words. Students demonstrated a preference for the word boxes approach as compared to the traditional drill and interspersing methods. Social validity results indicated that all three instructional methods are a socially valid way to assess and teach word reading skills to students identified as having word identification difficulties. Implications of these findings are discussed as they pertain to educational practitioners and researchers.
Dedicated in loving memory of David R. Schmidgall whose ambition inspired me to reach my goals and to Mark & Linda Schuver, Jenny Schuver, and Sarah Schmidgall who have provided invaluable support
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VITA

1997…………………………………B.A. Psychology, Purdue University

2000 .................................................M.S. Education, Indiana University (Counseling)

1999-2001 ........................................Grief and Loss Counselor
Brooke’s Place for Grieving Young People

2001-2003 ........................................Mental Health Consultant/Supervisor
CDC Head Start

FIELDS OF STUDY

Major Field: Education

Areas of Interest: School Psychology, Reading Intervention, Resiliency, Play Therapy
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CHAPTER 1

INTRODUCTION

This chapter provides background information relevant to the current study, as well as the following: statement of the problem, purpose of the study, research questions, significance of the study, and definitions.

Background

Research has shown that a child who does not learn the reading basics early is unlikely to learn them at all (Moats, 1999). According to the National Reading Panel Progress Report (2000), national longitudinal research studies show that more than 17.5% of the nation’s children, about 10 million children, will encounter reading problems in the vital first three years of their schooling. Furthermore, children who have poor first grade instruction are seriously impacted by their ineffective early learning experience and have a tendency to perform poorly for the rest of their schooling (LaParo & Pianta, 2000). In fact, children who fall behind in the first grade have a one in eight chance of ever catching up to their current grade level without intervention (Juel, 1994). In response, The National Research Council on the Prevention of Reading Difficulties in Young Children (1998) emphasized that many reading problems in school-aged children could be prevented by reducing the number of children who begin formal schooling with low levels of early literacy skills.
An early foundation in literacy is an essential component for one’s overall success in life. The National Literacy Act defines literacy as “an individual’s ability to read, write, speak English, and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one’s knowledge and potential” (NIFL, 1991). The lack of a solid foundation in reading can have not only a potentially profound effect on a student’s overall academic success (Lennon & Slesinski, 1999; Stanovich, 1986), studies have shown that individuals who have poor literacy skills tend to dropout of school early, experience higher rates of unemployment, generally work in semi-skilled or unskilled jobs, and demonstrate lower occupational aspirations (Wenar & Kerig, 2000). Poor reading achievement has also been correlated with a number of social problems including delinquency, teen pregnancy, and homelessness (McGill-Franzen, 1987).

Further complicating the literacy issue is the fact that approximately one-third of children in the United States are at-risk for academic failure by the time they enter kindergarten due to socially and economically impoverished conditions (Lerner, Lowenthal, & Egan, 2003). In particular, African American students from low-income families are consistently reported as obtaining excessively low achievement in literacy and language (Chall, Jacobs, & Baldwin, 1990). The discrepancy in performance between African Americans from low-income families and their peers continues to widen as these students proceed through the grade levels (Bowman, 1994). Fortunately, research indicates that effective intervention programs have potential to overcome the negative hurdles that are associated with coming from a low-socioeconomic environment with minimal support in later grades (Wasik & Slavin, 1993).
Early intervention and prevention are key steps in addressing the needs of students identified as “at-risk”. Researchers in the area of reading argue that in order to prevent reading failure, efforts must “begin early” and “assess dynamically” (Good, Gruba, & Kaminski, 2002). According to Torgesen (1998), if educators are going to take a preventative approach to beginning “as early as possible” then it is crucial that efforts begin upon children’s entry into kindergarten. Therefore, given the outcomes of students who are identified as poor readers at the end of the first grade, it is sufficient to assume that time is of the essence. As a matter of fact, research suggests that there is a “window of opportunity” that begins to close as a child finishes the first grade (McCormick, 1999). Consequently, educators must address the issue of literacy during the preschool and early primary grades and not wait until it is simply too late.

**Word identification.** One of the crucial reading skills that should be addressed during the early years is word identification. Research concludes that a primary area of difficulty for students with significant reading deficits is word identification skills (Lundberg, 1995; Share & Stanovich, 1995; Stanovich, 1980, 1986; Wise & Olson, 1991). Word identification is the process in which a reader calls directly into “play” one or more strategies to help in “figuring out” a word (McCormick, 1999). The ability to identify words is a fundamental step in the reading process because successful reading acquisition requires that children develop efficient strategies for identifying unfamiliar words in text (Tunmer & Chapman, 2002).

During the early periods of learning to read, confronting many new words is typical and doing so is necessary for learning to advance (McCormick, 1999). As a result,
possessing knowledge of strategies to utilize when new words appear is essential for reading achievement (McCormick, 1999). McCormick reported that once a student has attained competency in the use of word identification strategies, they can read unfamiliar words independently without the assistance of a teacher. Furthermore, once a student uses these strategies, major advances are made in the number of words they can read (Juel, 1991). Therefore, the development of word identification strategies facilitates comprehension because students are able to read more (Daneman, 1991). It is for these principal reasons that word identification will be a primary focus of the current study.

**Phonic and sight word approaches.** In order to read fluently, readers must typically acquire both word identification strategies as well as sight word recognition strategies (McCormick, 1999). The strongest current theories of reading growth link together phonemic and sight word-reading skills by showing how good phonemic decoding skills are necessary in the formation of accurate memory for the spelling patterns that are the basis of sight word recognition (Ehri, 1998). In addition, although some students learn word identification strategies incidentally, many require formal instruction in order to develop efficient strategies for identifying unfamiliar words in text. There are several different approaches frequently used to enhance word identification strategies among students. Two of the most frequently implemented approaches are phonic and sight word approaches.

The National Reading Panel (2000) defined systematic phonics instruction as a planned, sequential introduction of a set of phonic elements, along with teaching and practice of those elements. The primary objective when instructing students in phonic
analysis strategies is to help them learn letter-sound relationships (McCormick, 1999). It is believed that in order to gain command of phonological recoding, students must have developed phonemic awareness (the recognition that spoken words consist of a sequence of sounds), learned letter-sound relationships, and had practice with blending (combining separate sounds into a word) (Ehri, 1991). McCormick stated that phonological recoding is the ability to look at the letters in a word and turn them into (or recode them into) their sounds – that is, the visual code (letters) is recoded into a phonological code (the sounds). Proponents of phonic approaches to reading believe that many students require formal instruction in order to grasp the understanding necessary to apply letter-sound associations (Mason, 1980), and this is believed to be especially so with poor readers (Barr & Dreeben, 1983; Juel, 1991). For these students, intentional, precise phonics instruction moves students into and through the alphabetic phase of word learning (Ehri, 1991; Gough & Hillinger, 1980). Likewise, intervention research has demonstrated that intensive and systematic instruction in phonics leads to improvements in basic reading skills such as decoding, word recognition, and spelling (e.g., Ball & Blachman, 1991; Torgesen, Wagner, & Rashotte, 1997).

Students at the earliest stages of word learning often must read words by sight because they do not yet have in place adequate concepts and skills for reading words through phonological recoding systems; that is, they have not yet internalized the prerequisites to word identification strategies (Ehri, 1991). In fact, it appears to be necessary to recognize some words by sight in order to learn word identification strategies (McCormick, 1999). McCormick (1999) reported that developing readers need
to acquire a sight vocabulary because this is requisite to a word identification strategy employed by readers until they gain more proficiency. Therefore, sight word reading, or what is sometimes referred to as whole word reading, is a staple of most functional reading curricula and can be effectively taught with systematic instruction (Browder & Lalli, 1991; Browder & Snell, 2000; Slaton, Schuster, Collins, & Camine, 1994). The following includes a discussion surrounding the use of the phonic instructional technique of word boxes as well as the sight word techniques of traditional drill and interspersal training.

**Word boxes.** Many children experience difficulties in making letter-sound correspondences when learning to read (Stahl, 1998). Juel (1991) described the primary difference between good and poor readers as the ability to use letter-sound correspondence to identify words. The word boxes phonic technique is one approach that may be used to assist children in bridging phonemic awareness to word recognition. The bridging of phonemic awareness to word recognition is an important step in learning to read that typically must occur before fluency can come about. Essentially, the word boxes technique assists children in grasping the phonological and orthographic features that are necessary for recognizing words.

Clay (1993) originally incorporated the phonic technique of letter boxes into the Reading Recovery Program as a modification of Elkonin’s (1973) sound boxes. Sound boxes were developed to teach children phoneme segmentation, whereas, letter boxes were adapted to teach not only phonemic awareness but also phonological recoding as well as spelling skills. Letter boxes were primarily implemented in the Reading Recovery
Program in an effort to assist children experiencing difficulty grasping the sequential order of sounds in spoken words and of letter sequences in written words (Joseph, 2002b). Word boxes (Joseph, 1998/1999) are a phonic analysis technique that have been modified from Clay’s (1993) letter boxes with a primary purpose of assisting children in mapping phonemes to alphabetic codes, as well as helping students to spell and recognize words.

Word boxes consist of connected boxes that are created by dividing a drawn rectangle into sections corresponding to the number of sounds heard in words. For example, a word that contains four distinct phonemes would be represented by a rectangle drawn with three vertical lines to create four connected boxes. Word boxes reportedly include three phases: segmenting sounds, matching letters to sounds, and writing letters (Joseph, 2002b). The first phase consists of a child simultaneously articulating a word while placing counters into respective divided sections of a rectangle. In the second phase, the counters are reportedly replaced with magnetic or tile letters and the child is asked to move the letters into the boxes as he/she slowly articulates a word. The last phase entails writing the letters in the respective divided sections of the rectangle as the word is being stated. According to Joseph (2002a), children will eventually place letters (either magnetic or tile) in respective sections as each sound in a word is articulated.

**Drill and practice.** Drill and practice have been used for many years as whole word techniques to develop fluency of basic skills (Salisbury, 1990). In fact, Chase and Symonds (1992) reported; “the most effective device that can be applied to learning is to
increase the amount of drill and practice” (p. 289). The use of drill tasks can assist in academic remediation for students who are deficient in prerequisite skills, are not capable of performing higher order tasks, and must first master the basic information in order to move to another level (Burns, 2004). Standard drill and practice procedures consist of new material being repeatedly presented in isolation and/or in context for the learner to practice until the response is automatic (Cooke & Guzukas, 1993). Haring and Eaton (1978) defined drill and practice procedures as two independent procedures with different functions. Drill refers to those procedures aimed at repeated repetition of responses to be learned, whereas, practice refers to those procedures that center on combining a number of learned responses to solve problems (Haring & Eaton, 1978).

Researchers have frequently analyzed different drill models as a means to increase the overall instructional effectiveness of repetition (MacQuarrie-Klender, Tucker, Burns, & Hartman, 2002). Skinner, Belfiore, and Watson (1995) recommended that in order to prevent and remedy academic skill deficits, school personnel should determine which interventions are most efficient by measuring students’ learning rates under various instructional conditions. Task variation, or what is sometimes referred to as interspersal training, is a method of drill and practice whereby the delivery of trials of previously learned behaviors are interspersed among trials of behaviors to be learned.

Interspersing techniques. Recently, researchers have started examining the notion of student choice behavior. Fundamental research and theory suggests that when given the choice of two behaviors, and all else is held constant, students are more likely to engage in the behavior that requires the least amount of effort (Billington & Skinner,
Choice behavior is a particularly important concept in the classroom because when students choose to engage in assigned tasks, they more than likely increase skill acquisition, fluency, generalization, and maintenance (Binder, 1996; Skinner, Fletcher, & Henington, 1996). However, when students choose to engage in off-task behaviors, skill growth is likely to suffer and they will be more likely to engage in disruptive behavior (Dunlap & Kern, 1996). Therefore, procedures intended to increase the probability of students choosing to engage in assigned academic tasks can improve the rate of learning and decrease inappropriate classroom behavior (Skinner, 2002).

One such group of procedures that has been used to facilitate learning is commonly referred to as interspersing or interspersal training (Cates et al., 2003). Interspersing procedures are whole word approaches that typically emphasize altering academic assignments (e.g., worksheets, traditional drill and practice procedures) by interspersing known or mastered tasks among tasks that students are in the process of learning (Cates et al., 2003). Neef, Iwata, and Page (1977) first examined the effects of interspersal of known items to teach letter recognition to students with developmental delays by teaching a list of 50% known and 50% unknown spelling and sight words to students diagnosed with a mental impairment. Results suggested that interspersing known words facilitated acquisition and retention of unknown words more effectively than the presentation of all unknown words. Many researchers are currently examining the effects of interspersing techniques in their intervention research, as this type of approach has demonstrated much promise.
The interspersing technique was examined in a recent study conducted by Cates et al. (2003). Cates and colleagues examined the extent to which considering instructional time and student learning rate affects academic treatment decisions. Five second-grade students with difficulties in spelling were exposed to three spelling interventions. These conditions included traditional drill and practice (TDP), interspersal training (IST), and high-p sequencing (HPS). High-p (HPS) is another format of task sequencing that is based on behavioral compliance studies that showed that sequencing multiple high probability demands (tasks that are likely to be engaged in) prior to a lower probability demand (tasks that are less likely to be engaged in relative to the high probability task) can increase the probability of a person engaging in lower probability demands (Cates et al., 2003).

Students were exposed to the three different conditions (TDP, IST, and HPS), each with a different set of words. Each condition began with a set of 6 randomly assigned target/unknown words. For the IST condition, 3 known words were added and interspersed following every third target word. The first word was a known word. During the HPS condition, students were exposed to the 6 target words and 18 known words. Three known words were presented prior to each target word. The TDP condition consisted of 6 target words only.

Experimental sessions were conducted on 12 consecutive school days. During each session, students were exposed to two of the three conditions (TDP, IST, and HPS). Conditions were randomly selected and presented in counterbalanced order across school days to control for sequence effects. During each condition, students completed each set
of spelling words two times. The experimenters used a stopwatch to measure the number of seconds to complete each condition.

The same presentation procedures were reportedly used across all three conditions. An experimenter read the word aloud, used the word in a sentence, and then read the word again. The experimenter then observed the student write the word on her or his paper. All correct responses were followed with verbal praise (“Good!” or “That’s Right!”). Incorrect responses were followed by an overcorrection procedure. The experimenter presented an index card with the word spelled correctly and instructed the student to write the word correctly three times.

Target words were considered mastered when the student’s initial response was correct across both trials during a given session. All newly mastered words were removed from the respective list and replaced with a new randomly chosen target word and included in the next day’s procedures. Words not mastered were included as target words in the next session.

Maintenance was measured the day following the 6th and 12th sessions. Students were presented with a maintenance list consisting of all words that he or she had mastered during the 6 treatment sessions. These words were presented one time in random order. The researchers administered verbal praise (e.g., “Good job”) following correct responses and overcorrection procedures (i.e., having the student copy the word three times) followed incorrect responses.

Using an alternating treatments design, student performance was measured and graphed in two ways, cumulative learning (a measurement that does not consider the
amount of instructional time) and student learning rate (a measurement that does consider instructional time). These two measurement procedures were then compared on their ability to detect differential effects of interventions on spelling mastery. Results suggested that the cumulative learning measurement did not facilitate data-based instructional decision making (i.e., did not show differentiation across conditions). However, the more sensitive measurement that accounted for instructional time (i.e., student learning rate) did. In particular, students as a group learned a statistically greater number of words under the traditional drill (TDP) condition when the amount of instructional time was considered. Overall, maintenance was high, ranging from 85% to 100%. All students, with the exception of one, were found to have higher numbers of mastered words per minute of instruction under the TDP condition as compared to the IST or HPS conditions, respectively.

The current study is an extension of the study conducted by Cates et al. (2003). Similarly to the Cates et al. study, the present study also focused on intervention effectiveness and efficiency. There are several reasons for selecting these two variables for the current study. One of the ways in which school psychologists can address the concerns surrounding low reading performance is by providing recommendations for instructional interventions to remediate academic skills deficits among those students struggling with reading. Because a teacher’s time is valuable, it is important to provide academic interventions that are both time-efficient as well as effective. In addition, although many reading interventions are examined for overall effectiveness, few are examined for both effectiveness and efficiency. Therefore, as the demands on teachers’
time increase, the need for more effective and more efficient reading interventions will also be required.

Two of the three instructional techniques implemented in the Cates et al. study (TDP and IST) were also employed in the present study. However, the third instructional technique of high-P sequencing (HPS) was not implemented in the current study. The primary reason for this decision is that Cates and colleagues found that the HPS condition, with high ratios of known items to unknown items, might reduce learning rates (Cates, et al., 2003). Therefore, in an effort to examine a different instructional technique from the whole word approaches of traditional drill and interspersal training, the phonic instructional approach of word boxes was added to the present study.

The current study also extended the Cates et al. (2003) study by focusing on word reading as opposed to spelling. The study also sought to extend the Cates study by including 6 participants, instead of 5, and by conducting experimental sessions over a period of 20 consecutive school days, instead of 12 consecutive school days, like in the Cates et al. study. The present study also included a generalization measure, as well as a social validity component, thereby enhancing the overall strength of the design of the study.

Statement of the Problem

One of the most persuasive findings from current reading research is that children who get off to a poor start in reading will more than likely have a difficult time catching up. Several recent studies, including Torgesen and Burgess (1998) and Francis, Shaywitz, Stuebing, Shaywitz, and Fletcher (1996), recognized the poor first grade reader as almost
invariably continuing to be a poor reader. Undoubtedly, once a child gets off to a slow start in reading, the consequences become exponentially immense over time.

Presently, there is a substantial amount of research to support the need for the early identification and remediation of children considered to be at-risk for reading failure. What is less researched are the effectiveness and efficiency of various interventions targeting students with word identification difficulties. Evaluating an academic intervention for both effectiveness and efficiency is important because although many interventions have been proven effective (i.e., capable of enhancing learning), not all interventions are equally efficient (i.e., result in equal amounts of learning in the same amount of instructional time) (Cates et al., 2003). In particular, there is a lack of research in the reading literature examining the effectiveness and efficiency of various interventions or instructional approaches in relation to skill acquisition, maintenance and generalization of skill acquisition, and social validity. Investigating each of these factors is significant as each may directly impact the quality of educational services that is provided to students learning to read.

**Purpose of the Study**

The current study was an extension of a research study conducted by Cates and colleagues (2003). The primary purpose of this study was to examine the instructional effectiveness and efficiency of three word reading interventions on student’s cumulative number of words read accurately and cumulative learning rate. Specifically, alternating treatments designs were used to compare the effects of interspersal drill and practice training (presenting one known word prior to every third target/unknown word for a ratio
of 67% unknown to 33% known), the phonic analysis method of word boxes (presenting only target/unknown words), and a traditional drill and practice procedure (presenting only target/unknown words) on word reading mastery. This study was also intended to extend previous research findings of the positive outcomes of the three interventions by examining the acquisition, maintenance, and generalization of words that were taught under the three instructional conditions. Social validity of the three instructional methods was also assessed.

**Research Questions**

For the purpose of this investigation, the following questions were posed:

1. Based on the number of cumulative words learned, which is a more effective method of teaching words to individual students with word identification difficulties, interspersal training of known items drill sequence (IST), word boxes (WB), or traditional drill and practice (TDP)?

2. Based on the number of cumulative words learned, which is a more effective method of teaching words to students with word identification difficulties as a group, interspersal training of known items drill sequence (IST), word boxes (WB), or traditional drill and practice (TDP)?

3. Which method, the IST, WB, or TDP, is most efficient and to what extent for learning new words (as measured by learning rate) among individual students?

4. Which method, the IST, WB, or TDP, is most efficient and to what extent for learning new words (as measured by learning rate) among students as a group?
5. What are the effects of the three instructional approaches on student’s ability to maintain recognition of mastered words?

6. What are the effects of the three instructional approaches on student’s ability to generalize mastered words to a different context subsequent to instruction?

7. Are the three instructional methods (IST, WB, and TDP) a socially valid way to assess and teach word reading skills to students identified as having word identification difficulties?

8. Which of the three methods (IST, WB, or TDP) do students identified as having word identification difficulties most prefer?

9. Is a student’s perception of their reading abilities and of themselves more positive with the interspersal training of known items drill sequence (IST), word boxes (WB), or traditional drill and practice (TDP) intervention?

**Significance of the Study**

This study will add to the growing body of research related to reading intervention. The study is particularly significant in that it employed a systematic applied method for evaluating the effectiveness of three assignment alternation procedures. Specifically, the study directly inspected the effects of interspersal training, word boxes, and traditional drill and practice on word reading performance with students possessing word identification difficulties. This type of approach is unique in that it examined both the effectiveness and efficiency of the three instructional conditions, thereby providing a more in-depth analysis of the overall effects of the three different approaches for students with word identification difficulties.
The significance of the study for the school setting is to provide research data regarding the effectiveness and efficiency of three different interventions on student word reading performance. The answers to the research questions will provide a significant contribution to the present body of knowledge as well as practical guidance to educators involved in reading development. More specifically, the research findings will aid classroom teachers in determining which interventions are most effective and efficient in terms of enhancing word reading performance. Lastly, this research will provide information to the school district about the potential helpfulness of these instructional methods with students who are in need of word reading intervention. The information may also provide evidence of an effective early intervention that may preclude the need for more intensive interventions at a later time.

Definition of Terms

*Alphabetic Principle:* An understanding that words are composed of letters that are paired with sounds, and the ability to use letter-sound relationships to pronounce words and to spell.

*Automaticity:* Quality of fluency; implies automatic level of response with various tasks, such as speed of retrieving the sound for a specific letter.

*Early Intervention:* The provision of essential services and instruction during the critical pre-kindergarten years.

*Emergent Literacy:* The child’s early entrance into the comprehensive world of words, language, books, poetry, and stories.
Instructional Effectiveness: The extent to which a specific intervention results in accurate responding. Instructional effectiveness is determined by counting the number of words learned under each specific condition and comparing those conditions to each other for all students as a group. The more words learned in a given condition, the greater the instructional effectiveness.

Instructional Efficiency: The rate of accurate responding comparative to time. Instructional efficiency is calculated by dividing the number of words learned under a specific condition by the amount of time engaged in that condition. The greater the number of words learned per minute of instruction, the greater the instructional efficiency.

Phoneme: The smallest unit of sound in a language.

Phonemic Awareness: The child’s ability to focus on and manipulate phonemes in words.

Phonological Awareness: The child’s ability to focus on and manipulate the sounds of language in spoken words.

Phonological Recoding: The ability to transform letters and letter patterns into phonemes and blend the phonemes into pronunciations.

Rate of Skill Acquisition: Refers to the number of words acquired per minute for a specific student and is determined by dividing the total number of words acquired for a given condition by the total amount of time engaged in that condition. Rate of skill acquisition differs from instructional efficiency in that rate of skill acquisition focuses on a single student rather than a group of students.
**Word Identification**: When a reader directly calls into play one or more strategies to help in “figuring out” a word.

**Word Recognition**: The instant recall of words in which the reader resorts to no obvious mechanisms to recognize the word.
CHAPTER 2

REVIEW OF LITERATURE

This chapter will provide an overview of emergent literacy and the need for early intervention for students identified as at-risk for reading failure. The next section will provide an explanation of the “big ideas” of early literacy and their role in the development of early reading skills. This section is followed by a discussion of word identification, word recognition, and phonological decoding and their importance in the reading process. The chapter will conclude with a discussion of the use of word box procedures, interspersing procedures, as well as traditional drill and practice procedures as specific instructional approaches to supplement classroom reading instruction for students identified as having poor word identification skills.

Emergent Literacy

An early foundation in literacy is critical in minimizing the reading problems so many young children face. A review of the literature suggests that in order for children to become successful readers, it is essential they be exposed to literacy rich environments during the early years to enable the appropriate acquisition of literacy skills needed to read successfully (Bodrova & Paynter, 2000; Cox, 1994; Hearn, 1993; Hiebert & Pearson, 2000; Johnson, 1999; Lonigan, Burgess, Anthony, & Barker, 1998; McCarthy,
1995; Neuman & Roskos, 1993; Slegers, 1996; Torgesen, 2001; Yaden, Rowe, & MacGillivray, 1999). This approach is often referred to as emergent literacy.

In 1966, New Zealand researcher Marie Clay introduced the term emergent literacy to describe the behaviors witnessed in young children when they used books and reading materials to imitate reading and writing activities, even though they could not actually read and write in the conventional sense (Ramsburg, 1998). Emergent literacy reportedly consists of the skills, knowledge, and attitudes that are recognized to be the developmental antecedents to the traditional approaches of learning to read and write (Sulzby & Teale, 1991; Whitehurst & Lonigan, 1998). Simply put, emergent literacy is what children learn about reading and writing prior to becoming independent readers and writers (Teale & Sulzby, 1986).

Teale and Sulzby (1989) identified four basic principles upon which emergent literacy is based: (a) learning to read and write begins very early in life in a literate society, (b) the functions of literacy are an integral part of literacy learning, (c) reading and writing develop concurrently and inter-relatedly, and (d) learning occurs through active engagement in which children construct their understanding of how language works. The focus of emergent literacy is on learning, rather than teaching, and the child as an active learner (Hiebert & Fisher, 1990). The role of the adult is to make possible and extend child-initiated learning (Vygotsky, 1978).

To predict and prevent reading difficulties in young children, it is essential to understand the early skills required to read and write. Good, Kaminski, Simmons, and Kameenui (2001) reported among the commonly recognized and empirically validated
foundational skills are skills referred to as “big ideas” in early literacy. Big ideas are skills and strategies considered to be prerequisite and critical to later success in a content area or domain (Good et al., 2001). In the field of beginning reading, Good and colleagues recognize foundational skills or “big ideas” as including: (a) phonological awareness or the capability to hear and manipulate the sound structure of language, (b) alphabetic principle including alphabetic knowledge or the mapping of print to speech and the phonological recoding of letter strings into corresponding sounds and blending stored sounds into words, and (c) accuracy and fluency with connected text or the recognition of words in connected text (National Research Council, 1998).

Phonological Awareness

The acquisition of phonological awareness skills is thought to play a primary role in a child’s ability to recognize and comprehend words (Torgesen, 2002). Increasingly, educators have come to realize the importance of phonological awareness as a building block to literacy (Blom-Hoffman, Dwyer, Clarke, & Power, 2002). In fact, a child's level of phonological awareness upon entering school is widely held to be one of the strongest determinants of the success that he or she will experience in learning to read, or conversely, the likelihood that he or she will fail (Adams, 1990; Stanovich, 1986).

Phonological awareness has been defined as the ability to think about, or be conscious of, the speech sounds in words (Blachman, Ball, Black, & Tangel, 1994). Spector (1992) referred to phonological awareness as the ability to perceive spoken words as a sequence of sounds. Alternatively, Wagner and Torgesen (1987) defined phonological awareness as the awareness of and access to the sounds of language.
Children possessing strong phonological awareness skills can detect, match, blend, segment, and manipulate speech sounds (Lane, Pullen, Eisele, & Jordan, 2002). Additionally, children who perform well on phonological awareness tasks typically become successful readers, whereas those who perform poorly on these tasks sometimes encounter difficulty in learning to read (Adams, 1990). Specifically, the children who are successful are able to decentre from the meanings of words, attend to the constituent sounds and, as a result, understand that an alphabetic orthography is the written correspondent of spoken language (Mattingly, 1991).

Research has demonstrated that phonological awareness has a distinctive relationship with reading skills and literacy acquisition. In a longitudinal study, Juel (1988) concluded that a child’s phonological awareness abilities in the first grade were directly related to later reading abilities. In particular, it was shown that a child who had unresolved difficulties with phonological awareness skills in the first grade was found by the fourth grade to have reading skills that ranked in the bottom quartile of the class. Torgesen and Mathes (2000) reported three ways in which phonological awareness is central in acquiring word-reading skills: “1. Phonological awareness helps children understand the alphabetic principle…. 2. Phonological awareness helps children notice the regular ways that letters represent words…. 3. Phonological awareness makes it possible to generate possibilities for words in context that are only partially sounded out” (p. 4). However, the acquisition of phonological awareness is not guaranteed simply through maturation; in reality, about a third of students require varying degrees of assistance to promote its development (Adams, 1990). Moreover, it is important to
acknowledge that phonological awareness has been found to be necessary but not sufficient for reading acquisition (Stahl & Murray, 1993).

The Development of Phonological Awareness

The achievement of literacy occurs along a developmental continuum with origins in the preschool years. Consequently, phonological awareness is a developmental skill that has its most substantial period of growth between 4 and 7 years of age (Shankweiler & Lieberman, 1972). This awareness usually begins to develop around age 3 and improves steadily as children mature, particularly for children who are provided rich early language experiences at home and in preschool programs (Snow, Burns, & Griffin, 1998).

During early literacy development, children progress through several distinct categories of phonological skills. The earliest and most simple tasks involve rhyming, identifying words that rhyme, and thinking of rhyming words (Johnson, 1999). Intermediary tasks involve the blending of phonemes (for example, /o/ and /n/ = on) and syllable splitting (separating the first phoneme of a word from the ending sound: /c/ /at/). The most challenging tasks include the complete segmentation of phonemes and manipulation of them to form new words (Hall & Moats, 1999).

Four levels of phonological awareness development are discussed by Lane, Pullen, Eisele, and Jordan (2002). The first level is the word level, or the awareness that speech flow is a collection of individual words, which is typically achieved at a fairly young age. The authors stated that when a child speaks a single word that she has only
heard in combination with other words, she is demonstrating the word level of phonological awareness.

The second reported level is the syllable level or the ability to distinguish syllables. This level of phonological awareness is reportedly beneficial for initial teaching in detection, segmentation, blending, and manipulation of phonological components of language (Lane et al., 2002). Adams (1990) suggested that the ability to detect, segment, and count syllables is more critical to reading acquisition than the ability to manipulate and transpose syllables.

The third level of phonological awareness development, reported by Lane and colleagues, is the onset and rime level or the intrasyllabic level. The onset is the portion of the syllable that precedes the vowel (e.g., the /s/ in sat, or the /tr/ in truck). The rime is the rest of the observed syllable (e.g., the /og/ in frog, the /ack/ in sack). However, because a syllable must contain a vowel, all syllables must have a rime, but not all syllables have an onset (e.g., out, and). Adams (1990) noted that the onset-rime level of phonological awareness is an intermediate level of analysis between the syllable and the phoneme. Instruction at the onset-rime level is a key step for many children because tasks that require onset and rime analysis require the segmentation of syllables, and are therefore more sophisticated than syllable-level tasks (Lane et al., 2002). The authors concluded that onset-rime tasks could potentially be considered an intermediate step in the development of phonological awareness.

The final level of phonological awareness is the phoneme level. The phoneme level is reportedly the most sophisticated level of phonological awareness, most
commonly referred to as phonemic awareness. Phonemic awareness is a component of phonological awareness and refers to the ability to focus on and manipulate phonemes, the smallest units of a spoken language, in spoken words (Ehri et al., 2001). Ehri and colleagues reported the following as tasks used to assess children’s phonemic awareness: phoneme isolation, phoneme identity, phoneme categorization, phoneme blending, phoneme segmentation, and phoneme deletion. Finally, Treiman (1992) argued that phonemic analysis requires the child to detect, segment, and manipulate individual phonemes, and is therefore a much more sophisticated task and; consequently, a much more challenging task than either syllabic or intrasyllabic analysis.

The development of phonological awareness skills is not achieved in a discrete, precise fashion. According to Yopp (1992), phonological awareness skills do not develop in a lockstep process. In other words, a child does not require mastery of one skill before transitioning to the next. Instead, skills develop along a continuum and children can develop different levels of phonological awareness across this continuum (Jenkins & Bowen, 1994). Regardless of the order in which a child acquires these skills, the development of phonological awareness is thought to be a fundamental component for reading readiness (Jenkins & Bowen, 1994).

**Phonological Awareness Research**

The area of phonological awareness has gained substantial attention in educational research during the past 15 years (Lane et al., 2002). Accordingly, a great deal of research has provided support for the causal role of phonological awareness in learning to read (Stanovich, 2000). The major appeal to this relatively new area of
reading research is the repeated positive results in studies of phonological awareness interventions (Lane et al., 2002). Unfortunately, it is extremely difficult to summarize the continuously growing body of research dedicated to phonological awareness because of the multitude of individual differences in children and relationships that have been explored (Stanovich, 2000). Therefore, considering that the achievement of literacy has origins in the preschool years, several key phonological awareness studies specifically involving the preschool population will be discussed.

In a study conducted by Byrne and Fielding-Barnsley (1991), the effects of phonological awareness training in 126 four-year old preschool children were examined. The study primarily focused on the recognition of phoneme identity across words. Pretest measures were obtained through standardized and nonstandardized tests. Verbal facility as well as book and print conversion measures were collected using standardized tests. Nonstandardized tests were reportedly used to obtain measures of knowledge of the 26 letters and their sound representations, rhyme recognition, and phoneme identity. The experimental group consisted of 64 preschoolers who were trained for 12 weeks on 9 phonemes. The control group consisted of 62 preschoolers who were not trained on phonological awareness. Posttest data were collected for phoneme identity, letter knowledge, and reading. The researchers found that the experimental group made greater gains in phonological awareness when the pretest and posttest measures were compared. The gains reportedly included enhanced phoneme identification (for trained and untrained sounds) and word recognition.
A longitudinal study was conducted by Wood and Terrell (1998) in order to assess whether the development of phonological awareness occurs naturally, or whether it is a direct result of reading instruction. The study included 30 preliterate preschool children. A nonstandardized phonological awareness test battery was used to obtain pretest and posttest data. The battery reportedly assessed sentence segmentation, syllable/onset and rime/phoneme segmentation, syllable/onset and rime/phoneme blending, rhyme detection, alliteration, phoneme deletion, and sound-letter knowledge. The researchers concluded that preschool children have the ability to develop phonological awareness before beginning to read. Furthermore, preliterate rhyme detection was determined to be the best predictor of initial reading development.

More recently, a study conducted by Maslanka and Joseph (2002) examined the differential effects of sound boxes and sound sort phonological awareness instructional techniques on preschoolers’ phonological awareness performance. The researchers randomly selected 20 preschool children to participate in either the sound box or sound sort instructional group. All groups reportedly received pretests and posttest measures of rhyme, segmentation, isolation, blending, and detecting the same and different beginning and ending sounds. A MANCOVA revealed that there were no significant differences between the groups on all posttest measures while controlling for initial performances on pretest measures. The univariate analyses revealed that there were significant differences between the groups on an isolation measure and a segmentation measure. Children in the sound box group significantly outperformed children in the sound sort group on isolating medial sounds and segmenting phonemes. Maslanka and Joseph reported that the findings
might possibly suggest preschool children can obtain some of the phonological skills that are typically achieved in kindergarten and the first grade.

Lundberg, Frost, and Peterson (1988) also conducted a study to evaluate the effectiveness of phonological awareness in preschool children. The sample included 253 Danish preschool children whom received instruction on phonological awareness within their classes over an eight-month period. The training primarily focused on rhyming, segmentation, phoneme identification in initial position of words, and prosody. One hundred fifty-five preschool children served as the control group and were only given the pretest and posttest measures. The pretest and posttest measures were used to obtain nonstandardized measures of the children’s pre-reading ability and phonological awareness skills. The researchers determined that the phonological awareness training positively affected metalinguistic skills. Statistically reliable effects were observed on rhyming, manipulation, and segmentation measures. Additionally, the data from the study supported the notion that phonological awareness can be developed in preschool children before the development of reading ability. The authors also discovered their training not only resulted in significant gains in the children’s phonological awareness, but also produced significant positive effects on the facilitation of reading and spelling up to a second grade level.

Alphabetic Principle

Achievement of the alphabetic principle is the second prerequisite skill for reading identified by Good and colleagues (2001). The alphabetic principle includes both an understanding that words are composed of letters that are paired with sounds (e.g.,
knowing what sound the letter “p” makes), and the ability to use letter-sound relationships to pronounce words and to spell (Simmons & Kameenui, 1998; Vandervelden & Siegel, 1997). The alphabetic principle is also considered to consist of the intentional and conventional relations between alphabetic letters and the phonemes they represent (Foorman et al., 2003). Simmons and Kameenui reported that established skills in the alphabetic principle are vital to accurate and fluent word identification. Similarly, Juel (1991) described the primary difference between good and poor readers as being the ability to use letter-sound correspondence to identify words. Moreover, children who acquire and apply the alphabetic principle early in their reading careers reportedly garner long-term benefits (Stanovich, 1986).

The alphabetic principle is composed of two primary parts, alphabetic understanding and phonological recoding (Good, Kaminski, Simmons, & Kameenui, 2001). Alphabetic understanding entails the knowledge that words are composed of letters that represent sounds. That is, children with alphabetic understanding comprehend that each phoneme within the English language is characterized orthographically by a particular letter or combination of letters. The second component of the alphabetic principle is phonological recoding. Vandervelden and Siegel (1997) defined phonological recoding as the process of using systematic relationships between letters and phonemes (letter-sound correspondence) to retrieve the pronunciation of an unknown printed string or to spell words. Simply stated, phonological recoding entails recognizing the letter-sound correspondences and blending them to generate a word (e.g., the sounds /d/ /o/ /g/ can be recoded to read as the word “dog”).
Phonics Instruction

As with phonological awareness, explicit instruction in the alphabetic principle reportedly assists in the process of learning to read (Adams, 1990; Good, Simmons, & Smith, 1998; National Reading Panel, 2000; National Research Council, 1998). Intervention research has demonstrated that intensive and systematic instruction in phonological awareness and phonics leads to improvements in basic reading skills such as decoding, word recognition, and spelling (e.g., Ball & Blachman, 1991; Torgesen, Wagner, & Rashotte, 1997). The National Reading Panel (2000) defined systematic phonics instruction as a planned, sequential introduction of a set of phonic elements along with teaching and practice of those elements. In their analysis of thirty-eight studies examining the effects of different types of reading instruction, systematic phonics proved to be more effective than any other type of reading instruction on six student outcomes: (a) decoding regularly spelled real words, (b) reading nonsense words, (c) word identification (regular or non-words), (d) spelling, (e) comprehension, and (f) oral reading of connected text.

The meta-analysis conducted by The National Reading Panel revealed that systematic phonics instruction produces significant benefits for students in kindergarten through 6th grade and for children having difficulty learning to read. The National Reading Panel also discovered that phonics instruction taught during the early years proved to be much more effective than phonics instruction presented after the first grade on all six-outcome measures. Additionally, the panel concluded that systematic phonics instruction is potentially more effective than non-phonics instruction in serving to prevent
reading difficulties among at-risk children and helping to remediate reading difficulties in disabled readers. However, the panel stated that there is a need to be cautious in giving a blanket endorsement to all kinds of phonics instruction and that systematic phonics instruction should only be one component of a total reading program. Therefore, phonics instruction should be incorporated with other reading instruction in phonemic awareness, fluency, and comprehension strategies to create an inclusive reading program (National Reading Panel, 2000).

The Alphabetic Principle and Spelling

For many children, one of the earliest literacy-related experiences is learning the alphabet (Treiman & Tincoff, 1997). Worden and Boettcher (1990) reported that children characteristically master the names of letters before they learn the sounds that the letters represent. Additionally, children’s knowledge of letter names influences their early attempts to spell (Treiman & Tincoff, 1997). Read (1986) discovered children who began to write as preschoolers sometimes used a letter to represent the phoneme that corresponded to the letter’s name. For example, children often employed a to symbolize the phoneme /e/, writing face as “fas” and day as “da.” In addition, children had more difficulty representing vowel phonemes such as /e/ that were not the name of the letter. Treiman and Tincoff concluded that the errors are noteworthy because they show how children sometimes deviate from the basic principle that each phoneme should be spelled with its own grapheme.

A study conducted by Treiman and Tincoff (1997) investigated how children’s early-acquired knowledge of letter names affects their spelling. Specifically, the
researchers questioned whether kindergartners and first graders sometimes spell a sequence of phonemes such as /bi/ (the name of the letter b) or /zi/ (the name of the letter z) with the corresponding consonant letter rather than spelling the sentence alphabetically, with a consonant letter followed by a vowel letter. Treiman and Tincoff reported that the children made a number of letter-name spelling errors, especially when the consonant and vowel formed a complete syllable. The results reportedly demonstrated how children’s knowledge of letter names might cause them to deviate from the alphabetic principle.

Accuracy and Fluency with Connected Text

Accuracy and fluency with connected text is the third significant factor of beginning reading instruction, and is synonymous with “facile and seemingly effortless recognition of words in connected text” (Good, Simmons, & Kameenui, 2001, p. 261). Despite the varying views regarding the alphabetic principle and learning to read, children who have not mastered the alphabetic principle will more than likely experience difficulties reading connected text (Good, Simmons, & Smith, 1998). Forty-four percent of American fourth grade students cannot read connected text fluently, even when they read grade-level material aloud under supportive testing conditions (Pinnell et al., 1995). Consequently, it is thought that if children do not succeed in making the transition to fluent reading, they will encounter significant problems in constructing meaning from text (Stahl & Kuhn, 2002). Fortunately, researchers and practitioners have begun to center increased attention on fluency and its role in reading success (Osborn & Lehr, 2003).
Even with the heightened interest in reading fluency, there remains no single agreed-upon definition (Osborn & Lehr, 2003). Durkin (1993) defined reading fluency as the ability to quickly decode and to automatically recognize words. Meyer and Felton (1999) defined fluency as the ability to read text “rapidly, smoothly, effortlessly, and automatically with little conscious attention to the mechanics of reading, such as decoding” (p. 284). The definition reported by The National Reading Panel (2000); however, takes into account the components of rapid and automatic word recognition and of prosody. According to the panel, fluency is “the ability to read text quickly, accurately, and with proper expression” (p. 5). The panel also suggested that fluency extends beyond indicators of accurate word recognition and that it is a direct determinant of higher order skills such as reading comprehension.

Fluency in beginning reading is imperative because research studies indicate that successful readers; (1) rely primarily on the letters in the word rather than context or pictures to identify familiar and unfamiliar words, (2) process virtually every letter, (3) use letter-sound correspondences to identify words, (4) have a reliable strategy for decoding words, and (5) read text a sufficient number of times for words to become automatic (Hasbrouck, 1998). Additionally, in oral reading, fluency is thought to be a better gauge of proficiency with cognitive processes than either accuracy or speed alone (Good, Simmons, & Kameenui, 2001). However, in order to fully understand the concept of fluency, it is important to be aware of how fluency typically develops.
The Development of Reading Fluency

For the majority of readers, fluency develops gradually over a period of time and through extensive reading practice (Biemiller, 1977-1978). The bulk of this fluency has developed by the third grade, although some research indicates that children continue to develop certain aspects of fluent reading beyond this point (Stahl & Kuhn, 2002). Therefore, due to the fact that beginning readers must apply a great deal of energy into recognizing and pronouncing words, their oral reading is rarely fluent (Osborn & Lehr, 2003). In terms of instruction, reading fluency is often developed through the repeated opportunity to practice reading quickly and accurately aloud (Schneider & Shiffrin, 1977). Berliner (1981) argued in order to develop fluency, children need teacher-directed lessons in which children spend the maximum amount of time engaged in reading connected text.

Assisted practice in reading appears to be an important component in developing fluency for all children. Shany and Biemiller (1995) found that reading practice improves the reading speed, accuracy, and comprehension of children at all ability levels. Advances in these areas were reportedly similar in both the silent readers who were tape-assisted, and those children who read aloud to the teacher. Despite the fact that different methods of reading practice produced differences in the volume of reading, the two groups of children read equal amounts of time. This possibly suggests that the time on task is the key factor rather than the volume of reading, and that assisted practice plays a key role for children who are struggling readers. Similarly, The National Reading Panel (2000) found that repeated oral reading procedures that included assisted practice had a
significant effect not only on word recognition and fluency, but also on comprehension across a variety of grade levels.

Comprehension and Reading Fluency

The ability to read fluently is positively related to the ability to comprehend (Marston, 1989). Hypothetically speaking, when basic reading skills are slow and inaccurate, they necessitate a great deal of exertion and concentration, limiting the amount of attention the reader has available to focus on the meaning of the text (Ehri & McCormick, 1998). However, while children who comprehend well are better at decoding, those who decode well do not necessarily comprehend well (Perfetti, 1984). Therefore, reading fluency has been found to be an essential, but not sufficient condition for reading comprehension (Snow et al., 1998). As a result, implementing interventions designed to enhance reading fluency may not be guaranteed to improve comprehension. Nonetheless, numerous studies have shown that the development of fluent reading is beneficial to the goal of improving reading comprehension (e.g., Fuchs, Fuchs, & Maxell, 1988; Kuhn & Stahl, 2000; Levy, Abello, & Lysynchuk, 1997; Tan & Nicholson, 1997; The National Reading Panel, 2000).

Two significant research studies linking fluency to comprehension were conducted by Levy (1997) and by Fuchs, Fuchs, and Maxwell (1988). First, in a study by Levy and colleagues (1997), the reading comprehension performance of fourth grade poor readers, as measured by their ability to both retell stories and to answer a list of questions, improved after training the children to read words from the passage in isolation before actually reading the passage. The training reportedly led to improvements in rate
and accuracy that consequently allowed for better comprehension of the passage. A critical component during the training phase of this study was that the children were required to attain a reading rate of one second per word or less. When this standard was not established, improvements in comprehension were not reported. The researchers believed that proper timing of the availability of words is what allowed the higher-level language comprehension processes to occur (Levy et al., 1997).

Fuchs, Fuchs, and Maxwell (1988) demonstrated a very compelling relationship between reading rate and accuracy and the ability to understand connected text. The researchers assessed the silent reading comprehension skills of 70 middle school students with reading disabilities. The students were administered two 400-word passages to read silently and were then asked to read and identify correct answers to questions about the passages. In addition, three other measures of reading comprehension were also administered, including oral question and answering, passage retell via retelling, and procedures in which words in the passages were deleted and the students were required to fill in the blanks. Lastly, a measure of each participant’s reading rate and accuracy was obtained by calculating the average number of words read correctly per minute for both passages. Results suggested that the relationship between rate and accuracy calculations with the initial silent reading comprehension measure was stronger than the relationship between alternative comprehension measures and the original.

Word Identification

Word identification skills, or those strategies a reader employs when he or she does not recognize a word at sight, have been found to be highly related to reading
performance (McCormick, 1999). In fact, successful reading acquisition is thought to necessitate that children develop efficient strategies for identifying unfamiliar words in text (Tunmer & Chapman, 2002). The ability to identify words has also been cited as playing a central role in reading for meaning (e.g., Adams, 1990; Juel, Griffith, & Gough, 1986; Mason, Herman, & Au, 1991; Olson, Forsberg, Wise, & Rack, 1994; Pefetti, 1984, 1985; Perfetti & Hogaboam, 1975; Snow et al., 1998; Stanovich, 1980, 1986, 2000; Stanovich, Cunningham, & Feeman, 1984; Vellutino, Scanlon, & Tanzman, 1994). Once a student has attained competency in the use of word identification strategies, they can typically read unfamiliar words independently without the assistance of a teacher (McCormick, 1999). Furthermore, once a student uses these strategies, major advances are made in the number of words they can read (Juel, 1991). Therefore, the development of word identification strategies facilitates comprehension because students are simply able to read more (Daneman, 1991).

There are two basic strategies that beginning readers commonly implement to identify unfamiliar words in text, text-based strategies and word-based strategies (Tunmer & Chapman, 2002). Tunmer and Chapman described text-based strategies as including the use of picture cues, semantic cues (which indicate whether the attempted response satisfies the semantic constraints of the sentence, e.g., “The ball at the sandwich”), syntactic cues (which indicate whether the attempted response satisfies the grammatical constraints of the sentence, e.g., “The boy slept the door”), preceding passage content, and prior knowledge activated by the developing meaning of the text. Word-based strategies reportedly include the use of correspondences between single
letters or digraphs and single phonemes, correspondences between groups of graphemes (e.g., tion) and groups of phonemes (e.g., /shun/), orthographic analogies (i.e., reading an unknown word like that by an analogy to a known word like hat), and polyphonic letter patterns (e.g., ear as in bear and hear, where children generate alternative pronunciations of the word until one is produced that matches a word in their listening vocabulary).

In general, text-based strategies are stressed in whole language approaches to reading instruction, whereas word-based strategies are stressed in code-emphasis approaches (Liberman & Liberman, 1992). Tunmer and Chapman (2002) stated that the emphasis in whole language programs on the use of text-based strategies for identifying unfamiliar words stems from the theory that skilled reading is a process in which minimal word-level information is used to confirm language predictions. On the basis of this assumption, whole language proponents conclude that the development of reading ability is mostly a matter of learning to rely more and more on the syntactic and semantic redundancies of language to create hypotheses about the text yet to be encountered (Tunmer & Chapman, 2002). Tunmer and Chapman stated that children in whole language programs are advised to use context as the major strategy for identifying words in text. However, the authors reported that children in whole language programs are also trained to use letter-sound cues, but only very minimally and mainly to verify language predictions.

The contrary view to that advocated by supporters of whole language, is that when beginning readers encounter an unfamiliar word, they should first rely on word-based strategies and then possibly use context, but only to validate hypotheses about what
unfamiliar words might be, based on information given by partial decoding attempts (Tunmer & Chapman, 2002). According to this view, children learning to read must learn to take advantage of the systematic mappings between subcomponents of written and spoken words to progress beyond an initial stage of reading in which words are recognized by partial visual cues (Byrne, 1992). Tunmer and Chapman cited that in using word-based strategies the beginning reader is able to identify unfamiliar words which in turn, results in the formation of sublexical connections between orthographic and phonological representations in lexical memory, thereby providing the basis for rapid and efficient access to the mental lexicon.

In a recent study, Tunmer and Chapman (2002) examined beginning readers’ reported word identification strategies for identifying unfamiliar words in text in relation to reading achievement, reading-related skills, and academic self-perceptions. Results suggested that children who reported using word-based strategies showed superior reading and reading-related performance, and reported more positive self-efficacy beliefs in reading and more positive academic self-concepts than children who reported using text-based strategies.

In an additional study, Hammill, Mather, Allen, and Roberts (2002) investigated the relative importance of semantic, grammatical, phonological, and rapid naming abilities in predicting word identification in a sample of 200 children enrolled in the first through sixth grade. Composite measures of these abilities were found to correlate significantly with word identification. Factor analysis indicated that the spoken language composites and the word identification composite loaded on one factor, whereas the
perceptual speed composites loaded on a second factor. Multiple regression analyses showed that among younger children in the early stages of learning to read and children whose word identification skills were below average, the phonology and rapid naming composites accounted for the most variance in predicting word identification skills. Among older children and children who were proficient in word identification, the semantics composite accounted for the most variance. The most important analysis of this study evaluated the practical value of using the composites to predict poor word identification skills in children. The authors reported that in order to be considered practically useful, all predictive outcome values had to be .75 or greater. None of the composites studied, including an application of the double-deficit hypothesis, met this criterion. The results from this study reportedly question the accuracy and utility of using any of the abilities studied to predict which students are at risk for or have poor word identification skills (Hammill, et al., 2002).

Despite the type of strategy used to identify unfamiliar words, all children must develop reliable word identification skills in order for successful reading achievement to take place. The most important reason for this is the finding that skill in word identification accelerates reading acquisition (Stanovich, 1991). In addition to accelerating reading acquisition, efficient word identification strategies have also been found to be necessary for the development of rapid word recognition ability (Tunmer & Chapman, 2002).
Word Recognition

Word recognition refers to the instant recall of words in which the reader resorts to no apparent mechanisms to recognize the word (McCormick, 1999). McCormick reported that when a reader is able to recognize a word, and can say the word with no hesitation, it is said that he or she has developed automaticity. In other words, the brain has quickly and automatically processed the word to read it. High levels of automaticity in word recognition free up cognitive resources for distribution to comprehension and text integration processes, both critical for making progress in learning to read (Perfetti, 1985). Word recognition is closely linked with word identification in that it appears to be necessary to recognize some words by sight in order to learn word identification strategies or strategies that a reader calls into play to help “figure out” a word (McCormick, 1999).

The recognition of words is an essential basis for a good start in reading for several reasons. First, a number of studies have demonstrated that better readers show a greater propensity to recognize words automatically (Guttentag & Haith, 1978; Pace & Golinkoff, 1976; West & Stanovich, 1979). Second, McCormick (1999) noted that there is a cyclical effect that takes place when sight word recognition promotes additional word recognition. Third, the lack of skill at recognizing words is a reasonable predictor of difficulties in developing comprehension ability (Stanovich, 2000). Fourth, the processing of sentences and paragraphs cannot occur unless the reader can recognize individual words reliably and efficiently (Pressley, 1998). Fifth, McCormick reported that sight word recognition has been found to increase independent reading ability. Finally,
the ability to automatically recognize words is important because it frees capacity for higher-level integrative and semantic processing (Stanovich, 2000).

In a recent review of word recognition research, Chard, Simmons, and Kameenui (1998) identified four prerequisite conditions to strong word recognition. The first two conditions are that children recognize the existence of words in print and in speech and understand that speech maps into print. The majority of children are able to develop both of these prerequisite conditions through being read to and observing others reading (Chard & Osborn, 1999).

The third prerequisite condition for word recognition is phonological awareness. As previously discussed, phonological awareness has been defined as the ability to think about, or be conscious of, the speech sounds in words (Blachman, Ball, Black, & Tangel, 1994). A child possessing phonological awareness is cognizant of the internal phonological structure of words (Liberman, Shankweiler, & Liberman, 1991). Despite the importance of this condition, it remains debatable whether phonological awareness is prerequisite to word recognition, or whether it is more interactive and, therefore, improved by word recognition (Chard, Simmons, & Kameenui, 1998). The following two studies investigated the role phonological skills plays in recognizing words.

A study conducted by Ellis (1990) revealed that a reciprocal development between phonological skills and word recognition exists. Ellis found that for the eight preliterate subjects, phonological awareness, letter recognition, and visual short-term memory predicted word recognition. For the forty literate subjects, word recognition was found to be a stronger predictor of phonological awareness and phonological memory.
than vice versa. Ellis concluded that the acquisition of reading skills underpins the developmental changes in strategies and skills required for short-term memory tasks. However, in their review of the study, Dufva, Niemi, and Voeten (2001) noted that the results must be interpreted with caution due to the use of structural equation modeling (LISREL) in an explorative fashion and the small sample size in which latent variables could not be used. Dufva and colleagues additionally reported that other studies have not supported a similar reciprocal development between reading and phonological skills (e.g., Gathercole & Baddeley, 1993; Wagner, Torgesen, & Rashotte, 1994).

Wagner, Torgesen, and Rashotte (1994) followed children from preschool to second grade in an effort to find out the role of various phonological skills in word recognition. Of the five latent phonological factors (phonological synthesis and analysis, phonological memory, isolated and serial naming), only preschool phonological analysis had an effect on first grade word recognition. Similarly, for second grade word recognition, only first grade phonological synthesis had an effect. Consequently, neither preschool nor first grade phonological memory predicted word recognition. However, the study conducted by Wagner and colleagues has been criticized for testing only the direct, but not the indirect, effects of the five phonological processing skills on word recognition (Dufva, Niemi, & Voeten, 2001).

The fourth prerequisite condition identified by Chard, Simmons, and Kameenui (1998) is alphabetic understanding. Alphabetic understanding relates to both an understanding that words are composed of letters that are paired with sounds (e.g., knowing what sound the letter “p” makes), and the ability to use letter-sound
relationships to pronounce words and to spell (Simmons & Kameenui, 1998; Vandervelden & Siegel, 1997). This prerequisite is important because in order for students to analyze and to reliably and accurately read words, they must comprehend that written words are constructed of individual letters and apply their letter-sound knowledge to these letters (Chard & Osborn, 1999). Liberman and Liberman (1990) reported that preliterate children are not very aware that words are formed by letters of the alphabet, but those who have alphabetic understanding perform inevitably superior to those who have less.

In a series of experiments studying the relation between phonological awareness, letter-sound correspondence, and word recognition, Byrne and Fielding-Barnsley (1989) discovered that young children can read by analogy (i.e., begin to process new words by recognizing the same word parts found in familiar words) if they know (a) that phonemes are separate segments in words, (b) that the same phonemes can occur in different words, and (c) letter-sound correspondences. Chard, Simmons, and Kameenui (1995) stated that because these researchers identified reading by analogy as an indication of alphabetic understanding, their findings suggested that neither phonological awareness nor letter-sound correspondence was sufficient for acquisition of the alphabetic principle (i.e., phonological awareness, knowledge of the segmental structure of words, and letter-sound correspondence). In spite of the reasons surrounding the significance of developing word recognition skills, it is also important to keep in mind that the process of reading entails much more than simply recognizing words (Pressley, 1998).
Phonological Recoding in Relation to Word Recognition

The prerequisites for word recognition may be sufficient for some children to make the connection with minimal assistance between the written word and its meaning (Ehri & Wilce, cited in Juel, 1991). However, Chard, Simmons, and Kameenui (1998) argued that for many children more explicit instruction in phonological recoding is necessary. As previously mentioned, the alphabetic principle is composed of two primary parts, alphabetic understanding and phonological recoding (Good, Kaminski, Simmons, & Kameenui, 2001). Torgesen (1985) described word recognition as a process involving the following steps:

The phonological constituents of words must be obtained from their graphic representations, stored in sequence, and then blended together while the child searches memory for a real word that roughly matches the string of phonemes produced by the blending operations. (p. 354)

Facility with phonological recoding is thought to play a key role in the processes of automatic word recognition and fluent reading (Chard, Simmons, & Kameenui, 1998). As previously mentioned, phonological recoding is the ability to transform letters and letter patterns into phonemes and blend the phonemes into pronunciations, a process that is frequently called decoding or sounding out (Ehri, 1991). Specifically, McCormick (1999) stated that to “phonologically recode” a word implies looking at the letters in the word and turning them into (or recoding them into) their sounds – that is, the visual code (the letters) is recoded into a phonological code (the sounds). Stanovich (1991) cited 16 independent studies on word recognition that offered substantial evidence that
phonological recoding plays a very important role in word recognition. Similarly, convincing evidence suggests that phonological recoding is supported by the frequency of opportunities to read words (Stanovich, 1991). Therefore, it is the interaction of phonological recoding skill and recurrent opportunities to read words that seems to lead to word identification skills, thus leading to strong word recognition (Chard & Osborn, 1999).

Upon reviewing the word recognition and word identification literature, it becomes apparent that there are several different manners in which these essential reading skills can develop. The primary point is that the achievement of word identification and word recognition strategies plays a critical role in the development of fluent reading skills. What follows is a discussion of several instructional approaches that may be employed to enhance student word reading performance.

Word Boxes

Many children experience difficulties in making letter-sound correspondences when learning to read (Stahl, 1998). Juel (1991) described the primary difference between good and poor readers as the ability to use letter-sound correspondence to identify words. The word boxes phonic technique is one approach that may be used to assist children in bridging phonemic awareness to word recognition. The bridging of phonemic awareness to word recognition is an important step in learning to read that typically must occur before fluency can come about. Essentially, the word boxes technique assists children in grasping the phonological and orthographic features that are necessary for recognizing words.
Clay (1993) originally incorporated the phonic technique of letter boxes into the Reading Recovery Program as a modification of Elkonin’s (1973) sound boxes. Sound boxes were developed to teach children phoneme segmentation, whereas, letter boxes were adapted to teach not only phonemic awareness but also phonological recoding as well as spelling skills. Letter boxes were primarily implemented in the Reading Recovery Program in an effort to assist children experiencing difficulty grasping the sequential order of sounds in spoken words and of letter sequences in written words (Joseph, 2002b). Word boxes (Joseph, 1998/1999) are a phonic analysis technique that have been modified from Clay’s (1993) letter boxes with a primary purpose of assisting children in mapping phonemes to alphabetic codes as well as helping students to spell and recognize words.

Word boxes consist of connected boxes that are created by dividing a drawn rectangle into sections corresponding to the number of sounds heard in words. For example, a word that contains four distinct phonemes would be represented by a rectangle drawn with three vertical lines to create four connected boxes. Word boxes reportedly include three phases: segmenting sounds, matching letters to sounds, and writing letters (Joseph, 2002b). The first phase consists of a child simultaneously articulating a word while placing counters into respective divided sections of a rectangle. In the second phase, the counters are reportedly replaced with magnetic or tile letters and the child is asked to move the letters into the boxes as he/she slowly articulates a word. The last phase entails writing the letters in the respective divided sections of the rectangle.
as the word is being stated. According to Joseph (2002a), children will eventually place letters (either magnetic or tile) in respective sections as each sound in a word is articulated.

Despite the fact that word boxes have not received considerable empirical examination, Joseph (2000) reported that they have been implemented as part of comprehensive phonemic awareness training programs in experimentally controlled investigations (e.g., Ball & Blachman, 1991; Hohn & Ehri, 1983). Additionally, word boxes have been proven beneficial in assisting children with learning disabilities. Joseph (1998/1999) demonstrated the effectiveness of using word boxes with a sample of six children with learning disabilities. Through the use of multiple baseline designs, the researcher was able to show that second grade and third grade children with learning disabilities improved their performance on making letter-sound correspondences while reading and spelling words as a function of using the word boxes.

Joseph (2000) found that a sample of first grade students who received word boxes instruction performed better on word identification and spelling than a control group of first graders who received instruction on detecting phonetic rules through the use of teacher-directed lessons and worksheet exercises. In contrast to children who received a more traditional phonic approach, children who received word boxes instruction were reportedly also able to transfer word identification and spelling skills to words that were not directly taught but were similar to those presented during instruction. Nonetheless, controlled comparative research is relatively new; therefore, Joseph (2002a)
recommended utilizing flexibility in selecting from a variety of empirically based phonic approaches that aid in the study of phonological and orthographic components of words.

Drill and Practice

Drill and practice have been used for many years as techniques to develop fluency of basic skills (Salisbury, 1990). In fact, Chase and Symonds (1992) reported; “the most effective device that can be applied to learning is to increase the amount of drill and practice” (p. 289). The use of drill tasks can assist in academic remediation for students who are deficient in prerequisite skills, are not capable of performing higher order tasks, and must first master the basic information in order to move to another level (Burns, 2004). Standard drill and practice procedures consist of new material being repeatedly presented in isolation and/or in context for the learner to practice until the response is automatic (Cooke & Guzaukas, 1993). Haring and Eaton (1978) defined drill and practice procedures as two independent procedures with different functions. Drill refers to those procedures aimed at repeated repetition of responses to be learned, whereas, practice refers to those procedures that center on combining a number of learned responses to solve problems (Haring & Eaton, 1978).

Researchers have frequently analyzed different drill models as a means to increase the overall instructional effectiveness of repetition (MacQuarrie-Klender, Tucker, Burns, & Hartman, 2002). Skinner, Belfiore, and Watson (1995) recommended that in order to prevent and remedy academic skill deficits, school personnel should determine which interventions are most efficient by measuring students’ learning rates
under various instructional conditions. Task variation, or what is sometimes referred to as interspersal training, is a method of drill and practice whereby the delivery of trials of previously learned behaviors are interspersed among trials of behaviors to be learned.

**Interspersing Techniques**

Recently, researchers have started examining the notion of student choice behavior. Fundamental research and theory suggests that when given the choice of two behaviors, and all else is held constant, students are more likely to engage in the behavior that requires the least amount of effort (Billington & Skinner, 2002). Choice behavior is a particularly important concept in the classroom because when students choose to engage in assigned tasks, they more than likely increase skill acquisition, fluency, generalization, and maintenance (Binder, 1996; Skinner, Fletcher, & Henington, 1996). However, when students choose to engage in off-task behaviors, skill growth is likely to suffer and they will be more likely to engage in disruptive behavior (Dunlap & Kern, 1996). Therefore, procedures intended to increase the probability of students choosing to engage in assigned academic tasks can improve the rate of learning and decrease inappropriate classroom behavior (Skinner, 2002).

One such group of procedures that has been used to facilitate learning is commonly referred to as interspersing or interspersal training (Cates et al., 2003). Interspersing procedures typically emphasize altering academic assignments (e.g., worksheets, traditional drill and practice procedures) by interspersing known or mastered tasks among tasks that students are in the process of learning (Cates et al., 2003). Neef,
Iwata, and Page (1977) first examined the effects of interspersal of known items to teach letter recognition to students with developmental delays by teaching a list of 50% known and 50% unknown spelling and sight words to students diagnosed with a mental impairment. Results suggested that interspersing known words facilitated acquisition and retention of unknown words more effectively than the presentation of all unknown words. Many researchers are currently examining the effects of interspersing techniques in their intervention research, as this type of approach has demonstrated much promise.

Interspersal training is an approach that is commonly found in the mathematics performance research literature. Robinson and Skinner (2002) conducted a study using standardized mathematics subtests with different task demands. Thirty, seventh grade students considered to be at-risk were administered Forms A and B of the Mental Computation and Multiplication subtests of the *KeyMath-Revised*. Results showed that the interspersal procedure enhanced academic performance on the Mental Computation subtest, but not the Multiplication subtest. The results suggested that the efficacy of the interspersal procedure is affected differentially by task demands. The researchers concluded that the results supported Neef, Iwata, and Page’s (1977, 1980) hypothesis that the interspersal procedure may increase rates of reinforcement, which enhances students’ attention to tasks and their performance on tasks that require high levels of sustained attention (Robinson & Skinner, 2002).

In an additional study related to the area of mathematics, Skinner, Hurst, Teeple, and Meadows (2002) implemented an alternating treatments design in order to compare on-task levels in four students diagnosed as emotionally disturbed while working on
control and experimental independent seat-work mathematics assignments. The control and experimental assignments were similar except experimental assignments contained additional briefer mathematics problems interspersed following every third problem. Skinner and colleagues reported greater on-task levels while working on experimental assignments in three of the four students.

Interspersing techniques are also frequently used as approaches to enhance reading and spelling performance. In a study conducted by MacQuarrie-Klender, Tucker, Burns, and Hartman (2002), two commonly used models; Drill Sandwich and Incremental Rehearsal flash card techniques, were compared to each other and to a traditional flash card method by individually teaching words from the Esperanto International Language to 25 third – and 26 seventh – grade students who were screened for receptive vocabulary. In particular, the traditional flashcard instructional technique was used as a control condition by presenting each index card with a word individually and asking the child to recall orally the pronunciation and English translation. Words continued to be presented until all had been mastered, as demonstrated by stating the pronunciation and translation three times.

The Drill Sandwich involved presenting nine unknown words to the students in sets of three. The first three unknown words were included with six words that the child already knew in the following sequence: first known, second known, third known, first unknown (Esperanto), fourth known, fifth known, second unknown (Esperanto), sixth known, and third unknown (Esperanto). Each set of three unknown words was practiced three times, with the six known words interspersed as stated above. After completing
three repetitions, three of the previous known words were taken out of the set, and the three previous unknown words were treated as the first three known words when teaching the second set of three unknown words. The same sequence occurred after rehearsing the second set of words three times.

The Incremental Rehearsal technique also involved introducing new words as mentioned above. However, unlike the other two conditions, the unknown words were introduced and rehearsed one at a time. The student was presented the unknown word and asked to recall the pronunciation and English translation. After completing the instructional sequence, the previously unknown word was then treated as the first known word, and the previous ninth known word was removed in order to rehearse the second unknown word, which kept the number of total words in the set at 10.

Retention of the pronunciation and English translation was tested after 1, 2, 3, 7, and 30 days. The researchers reported a significant main effect \( p < .001 \) between the three conditions at each interval. The Incremental Rehearsal model consistently led to significantly more words retained than the traditional or Drill Sandwich approaches. MacQuarrie-Klender and colleagues concluded that the findings indicate that Incremental Rehearsal may be more effective for retention as compared to the traditional or Drill Sandwich approaches.

Cooke and Guzaukas (1993) conducted three experiments in order to compare the effects of interspersal drill and practice using 30% new items/70% review items with 100% new items in three separate experiments. The first experiment compared the effects of the two ratios on spelling acquisition and maintenance with four adolescent males.
diagnosed as having severe behavior or emotional handicaps. The second experiment compared the effects of the two ratios on multiplication fact fluency of three students with learning disabilities. The third experiment compared the two ratios on fluency gains in passage reading with three elementary boys, one with learning disabilities and two identified as educable mentally handicapped. Results of the first experiment indicate that students were as accurate on end-of-session tests when all spelling words were new as when only 30% of the words were new, suggesting that the 100% condition was more efficient for these students. In contrast, higher fluency was reached on multiplication facts under the 30/70% condition in the second experiment. The researchers reported that the results of the third experiment indicated no consistent advantage for either condition in generalization to passage reading; however, more words were learned per session and movement through the content was more rapid when all training words were new.

In a recent study, Cates and colleagues (2003) examined the extent to which considering instructional time and student learning rate affects academic treatment decisions. Five second-grade students with difficulties in spelling were exposed to three spelling interventions. These conditions included traditional drill and practice (TDP), interspersal training (IST), and high-p sequencing (HPS). High-p (HPS) is another format of task sequencing that is based on behavioral compliance studies that showed that sequencing multiple high probability demands (tasks that are likely to be engaged in) prior to a lower probability demand (tasks that are less likely to be engaged in relative to the high probability task) can increase the probability of a person engaging in lower probability demands (Cates et al., 2003).
Students were exposed to the three different conditions (TDP, IST, and HPS), each with a different set of words. Each condition began with a set of 6 randomly assigned target/unknown words. For the IST condition, 3 known words were added and interspersed following every third target word. The first word was a known word. During the HPS condition, students were exposed to the 6 target words and 18 known words. Three known words were presented prior to each target word. The TDP condition consisted of 6 target words only.

Experimental sessions were conducted on 12 consecutive school days. During each session, students were exposed to two of the three conditions (TDP, IST, and HPS). Conditions were randomly selected and presented in counterbalanced order across school days to control for sequence effects. During each condition, students completed each set of spelling words two times. The experimenters used a stopwatch to measure the number of seconds to complete each condition.

The same presentation procedures were reportedly used across all three conditions. An experimenter read the word aloud, used the word in a sentence, and then read the word again. The experimenter then observed the student write the word on her or his paper. All correct responses were followed with verbal praise (“Good!” or “That’s Right!”). Incorrect responses were followed by an overcorrection procedure. The experimenter presented an index card with the word spelled correctly and instructed the student to write the word correctly three times.

Target words were considered mastered when the student’s initial response was correct across both trials during a given session. All newly mastered words were removed
from the respective list and replaced with a new randomly chosen target word and included in the next day’s procedures. Words not mastered were included as target words in the next session.

Maintenance was measured the day following the 6th and 12th sessions. Students were presented with a maintenance list consisting of all words that he or she had mastered during the 6 treatment sessions. These words were presented one time in random order. The researchers administered verbal praise (e.g., “Good job”) following correct responses and overcorrection procedures (i.e., having the student copy the word three times) followed incorrect responses.

Using an alternating treatments design, student performance was measured and graphed in two ways, cumulative learning (a measurement that does not consider the amount of instructional time) and student learning rate (a measurement that does consider instructional time). These two measurement procedures were then compared on their ability to detect differential effects of interventions on spelling mastery. Results suggested that the cumulative learning measurement did not facilitate data-based instructional decision making (i.e., did not show differentiation across conditions). However, the more sensitive measurement that accounted for instructional time (i.e., student learning rate) did. In particular, students as a group learned a statistically greater number of words under the traditional drill (TDP) condition when the amount of instructional time was considered. Overall, maintenance was high, ranging from 85% to 100%. All students, with the exception of one, were found to have higher numbers of mastered words per minute of instruction under the TDP condition as compared to the IST or HPS conditions, respectively.
Research regarding interspersing has demonstrated that interspersal of known tasks can improve academic performance (e.g., Browder & Shear, 1996; Cooke & Guzaukas, 1993; Horner & Day, 1991; Neef et al., 1977, Neef et al., 1980). However, these studies have not examined the extent to which this effect is moderated by task preference. It may be possible that students prefer easy tasks and that interspersing easy tasks simply reduces the aversiveness of the task by increasing contact with preferred tasks. Therefore, the extent to which the task is easy or difficult may not be relevant. Nonetheless, these studies have generally concluded that the inclusion of known items leads to more effective learning.

Drill Ratios

Despite the overwhelming support for drill tasks, finding an appropriate level of challenge or an optimal ratio of known to unknown items for drill tasks has been a topic of much discussion (Burns, 2004). Several authors have concluded that a drill and practice ratio of no greater than 30% new items to 70% review items is optimal across students and curriculum content (i.e., Coulter & Coulter, 1989; Tucker, 1989a). Others have suggested a ratio of 50% unknown and 50% known (Neef, Iwata, & Page, 1980) as well as ratios considered to be more challenging such as less than 50% known (Robinson & Skinner, 2002).

A current empirical meta-analysis of drill ratios conducted by Burns (2004) examined the following groupings: <50% known, 50% to 69% known, 70% to 85% known, and 90% known. The 90% known group was found to have the highest median effect size coefficient and the second-highest (behind the 70% to 85% group) mean effect.
size. Additionally, the most challenging (<50% known) ratio resulted in a small to
moderate effect. Much stronger effects were also noted for tasks involving acquisition of
new skills compared to proficiency tasks.

Gickling and Havertape (1981) suggested three levels of instruction that signify
the degree of instructional match or mismatch between the student’s skills and the
learning demands of the instructional task. If an assignment is entirely too challenging, or
at a frustrational level for a student, a ratio would approach 0% known items to 100%
unknown ratio items. An assignment that is much too easy or at an independent level
would approach a ratio of 100% known to 0% unknown items. Students’ daily
performances are based on a continuum between these two extremes (Gickling &
Havertape, 1981). According to Gickling and Havertape, an instructional ratio level in
reading consists of 93-97% known items with a 3-7% margin in challenge (unknown
items), at which comprehension should be approximately 75% or higher. However, under
conditions of drill and practice, an increased margin of challenge should be used with an
instructional ratio of 70-85% known items to 15-30% unknown (Gickling & Thompson,
1985).

Gickling and Armstrong (1978) compared the students’ on-task, task completion,
and task comprehension at three levels: frustrational (<70% of material known),
instructional (between 70% - 80% of the material is known), and independent (>90% of
the material is known). The results provided strong evidence that students’ on-task, task
completion, and task comprehension performance is greatest when the ratio of known
material is at an instructional level of 70% - 80%.
Cooke, Guzaukas, Pressley, and Kerr (1993) extended the research on instructional ratios and learning rates by investigating the differential effects between a 30% acquisition-70% maintenance drill ratio and a traditional 100% acquisition. The researchers investigated the relative effects of the two conditions on acquisition of spelling words with four adolescents with emotional/behavioral disorders. The order of word presentation was based on suggestions made by Coulter and Coulter (1989). This presentation was K-K-K-U-K-K-U-K-K-U where “K” is known and “U” is unknown. Data were collected for (a) the percentage of words spelled correctly on single daily probes, (b) number of words learned per session minute, (c) percentage correct on a maintenance probe every fifth session and (d) participants preference for conditions. Results indicated that accuracy levels were similar between the two conditions across daily probes. When analyzed in terms of instructional efficiency, the 100% condition allowed for more words to be learned per minute across all students. The results of the five-day probes suggested that the maintenance of the mastered words was also similar. Moreover, when asked which condition they preferred, all four students favored the 30/70% condition.

Cooke and Guzaukas (1993) reported that although there has been some empirical support for interspersing new and known items, no studies have established any particular ratio as optimal. One possible reason for why research on instructional ratios is so inconclusive might deal with the way in which interspersing is carried out. For example, while some research has been conducted with complex patterns of interspersing maintenance items among acquisition items (i.e., Coulter & Coulter, 1989), other
research has utilized interspersing by simply alternating between maintenance and acquisition items (i.e., Neef et al., 1977, 1980). Therefore, although numerous methods of interspersing and task variation within academic learning sessions have been proposed, the extent to which these methods are time efficient and effective for increasing learning rates continues to be debated. Clearly, research on instructional ratios has provided mixed results and suggests a need for additional research analyzing various optimal ratios of known to unknown items for drill tasks.

Summary

In summary, it appears evident that early identification and intervention for students at risk of reading failure is a primary component in preventing reading difficulties. As word identification has been shown to play a key role in learning to read, instructional approaches that emphasize the explicit instruction of this concept have been shown to have high value. The following study will attempt to determine the effectiveness and efficiency of three different instructional methods (word boxes, interspersing of known items, and traditional drill and practice) on student word reading performance.
CHAPTER 3

METHODOLOGY

This chapter describes the methods of the study. The following sections are discussed: subject selection, setting, role of the researcher, materials, and definition and measurement of the dependent variables. Procedures including initial assessment, experimental conditions, random sampling, experimental design, experimental procedures, maintenance assessment, generality, social validity, interscorer agreement, and treatment integrity will also be discussed.

Subject Selection

Participants were six general education first grade students from a suburban elementary school in Central Ohio. The school district in the study consists of one elementary school, one middle school, and one high school. Enrollment is as follows: elementary – 1,416 students, middle school – 584 students, high school – 592 students. Socioeconomic status of the families within the district generally ranges from middle to upper middle class. Less than 1% of students in the district are identified as economically disadvantaged. Reported racial background of students in the district is as follows: African-American – 4.6%, Asian – 5.9%, Hispanic – 1.6%, Caucasian – 85.4%, Mixed racial background – 2.4%.
The makeup of the students chosen for the research study is representative of district averages. All six students participating in the study were of Caucasian decent. The study included two females and four males, all of which were from middle to upper middle class environments. Four of the students were six years of age and two of the students were seven years of age, during the period of the study.

Students were recruited by first obtaining approval to conduct the study from school administrators and the university’s Institutional Review Board. Students were selected through normal educational practices of identification. Several times a year, the reading specialist and school psychologist screen first grade students in an effort to determine which students are in need of supplemental instruction. Therefore, six students were selected for the present study due to their poor performance on the most recent administration of the Dynamic Indicators of Basic Early Literacy Skills (Good & Kaminski, 2002). The Dynamic Indicators of Basic Early Literacy Skills (DIBELS) are a set of standardized, individually administered measures of early literacy development. They are designed to be short (one minute) fluency measures used to regularly monitor the development of pre-reading and early reading skills.

In order to determine which students were most in need of intervention (at or below the 20th percentile on PSF and/or NWF measures), results were collected from the Winter administration of the Phonemic Segmentation Fluency (PSF) and Nonsense Word Fluency (NWF) measures of the Dynamic Indicators of Basic Early Literacy Skills (DIBELS). The Winter assessment took place in mid-February and the study began in late February. Therefore, there was an approximate lapse of two to three weeks between
assessment and intervention. A score falling below the 20th percentile on PSF and/or a NWF qualified a student for the intervention (Good, Wallin, Simmons, Kameenui, & Kaminski, 2002). The students’ gender, ethnicity, nor language impacted participation selection; it was simply based on PSF and NWF scores. Six target students were identified for the study based on their PSF and NWF scores.

Each of the six students participating in the study received an overall DIBELS instructional recommendation of ‘Intensive Support’ after the Winter administration. In order to receive this recommendation, students demonstrated performance on the Winter administration of the DIBELS measures of Phoneme Segmentation Fluency, Nonsense Word Fluency, and Oral Reading Fluency that fell within the range of “Deficit”. Particular attention was given in selecting students who fell within the “Deficit” range on the Nonsense Word Fluency and the Phoneme Segmentation Fluency measures.

The DIBELS Nonsense Word Fluency (NWF) measure is a standardized, individually administered, test of the alphabetic principle that includes letter-sound correspondence and the ability to blend letters into words in which letters represent their most common sounds (Kaminski & Good, 1996). During the NWF assessment, the student is presented an 8.5" x 11" sheet of paper with randomly ordered VC and CVC nonsense words (e.g., jid, vob, el) and asked to produce verbally the individual letter sound of each letter or verbally produce, or read, the whole nonsense word. For example, if the stimulus word is "nog" the student could say /n/ /o/ /g/ or say the word /nog/ to obtain a total of three letter-sounds correct. The student is allowed one minute to produce as many letter-sounds as he/she can, and the final score is the number of letter-sounds
produced correctly in one minute. Because the measure is fluency based, students receive a higher score if they are phonologically recoding the word and receive a lower score if they are providing letter sounds in isolation.

Phoneme Segmentation Fluency (PSF) is the DIBELS measure designed to assess phonological awareness in kindergarteners and first graders. PSF is a standardized, individually administered test of phonological awareness, which has been found to be a good predictor of future reading achievement (Kaminski & Good, 1996). The task requires the student to segment the individual sounds in orally presented words. For example, if the word was “hat” the student would say the sounds /h/ /a/ /t/ and would receive credit for each phoneme correctly produced. Students have one minute to produce as many phonemes as they can, and the number of correct phonemes per minute is computed (Good et al., 1998). Students are identified as at-risk for reading failure by comparing their PSF score with performance criterions developed for each measure (Coyne, Kameenui, & Simmons, 2001). Good and Kaminski (2002) have found that if students perform at 35 or more phonemes per minute by the end of kindergarten, they are at less risk for reading difficulty than lower performing students. Students performing below the established criterion are at-risk for reading failure and are in need of immediate preventive programs (Good & Kaminski, 2002; Torgesen, 1998).

Once the six students were identified, parents of the students participated in a phone conference with the experimenter. This conversation consisted of an explanation of the purpose of the study, issues of confidentiality, and the reporting of results. Each parent received, through the mail, an informational sheet explaining the nature of the
study (See Appendix A) as well as a consent form (See Appendix B) for permitting their child to participate in the study. Written parent permission for participation in the study was obtained through this form via a return envelope provided to the parent. In an effort to eliminate the possibility of extraneous variable effects, the specific instructional approaches used in the study were not discussed in detail. All parents or guardians were provided specifics of the instructional approaches used as well as an account of their child’s performance upon completion of the study. The results were also shared with the reading specialist, school psychologist, and child’s classroom teacher.

Setting

The instructional interventions were conducted in an office at the above elementary school. The intervention took place at a circular table that comfortably seated the student and the experimenter. Additional furniture in the room included two desks, an additional table, bookshelves, and a filing cabinet. Lighting in the room was adequate for instructional approaches used.

Role of the Researcher

The researcher was a female, doctoral candidate in the School Psychology program at The Ohio State University. This researcher possesses sufficient training in education as evidenced by four years of practicum and work related experiences. In this study, the researcher administered, scored, and interpreted results of all assessments during the screener, treatment, and maintenance phases of the study.
Materials

Materials used in this study included paper and pencils, a stopwatch, a dry erase board with a drawn rectangle divided into boxes according to the number of sounds in a word, small magnetic letters, and 3-inch x 5-inch index cards with words printed on them.

Definition and Measurement of the Dependent Variables

The primary dependent variables used in the study included a measure of instructional effectiveness and a measure of instructional efficiency. For purposes of the current study, instructional effectiveness was defined as the extent to which a specific intervention resulted in accurate responding. Instructional efficiency, on the other hand, was defined as the rate of accurate responding relative to time. Accurate responding meant that when a student was presented with a word, in order to be considered correct, the word had to be read as a whole. For instance, the word “feel” would need to be read as a correct whole word, not as “f”, “fee”, or “fell”, etc. The cumulative number of target/unknown words mastered across conditions served as a measure of instructional effectiveness.

Learning rate, a measure of instructional efficiency, was based on the number of words mastered per minute of instruction. Words were considered mastered when a correct response was provided for both trials. For each session, learning rates were calculated by taking the number of words mastered during that session divided by the amount of instructional time (in minutes) spent under each respective condition during that session. For each condition, the number of words mastered per minute was added
across sessions to obtain a measure of cumulative learning rates across sessions that could be compared to the instructional effectiveness data. For instance, if 3 words were acquired during the first session and 4 during the second session, a cumulative learning rate of 7 was recorded for the two sessions. The number of words students read correctly was recorded for each maintenance assessment. Maintenance rate was calculated in a similar manner; the number of mastered words maintained was divided by the cumulative amount of instructional time (in minutes) spent in each respective condition (IST, TDP, and WB).

Procedures

Initial assessment. The current study included both “known” and “target” or “unknown” words. Prior to beginning the study, students were assessed with a screener in order to obtain a list of “known” and “unknown” words for each student. The researcher randomly selected one hundred words consisting of an equal number of CVC, CVCV, CVVC, and CVCC consonant (C) and vowel (V) patterns from various instructional reading texts. The researcher then created the presentation order of words for the screener by writing each of the one hundred words on index cards and then shuffling the cards for random ordering. Each student was presented with the same initial 100 randomly selected words printed on flashcards. Words were presented to each student in the same order. All correct responses were followed by verbal praise from the experimenter (e.g., “Good job!” or “Nice work!”). All incorrect responses were ignored. Words recognized incorrectly were considered “unknown” and were used in all three
experimental conditions. Words recognized correctly were considered “known” and were used in the interspersing of known items experimental condition.

**Experimental conditions.** The individual treatment sessions lasted approximately twenty-five minutes each and took place five days a week over a period of approximately five weeks (20 sessions per student). During each session, the students were exposed to three different conditions, each with a different set of words. These conditions included interspersal training (IST), traditional drill and practice (TDP), and word boxes (WB).

**Random selection.** In order to control for word difficulty, initial lists were constructed for each student by randomly assigning six target/unknown words from the screener to each condition. Words were randomly selected from each of the four consonant-vowel patterns (CVC, CVCV, CVVC, and CVCC) for the first session as well as each additional treatment session by rotating through the order of patterns. For instance, the first set of six words would consist of CVC, CVCV, CVVC, CVCC, CVC, and CVCV patterns. The second set of six words would consist of CVVC, CVCC, CVC, CVCV, CVVC, and CVCC patterns. Therefore, the same word did not appear in more than one condition throughout the treatment sessions. The rotation of consonant-vowel patterns was done to ensure that each child was equally exposed to all vowel patterns, so that one pattern was not more represented across the sessions. In addition, three known words were added and interspersed following every third target word in the IST condition. The first word was a known word. Therefore, nine words were used for the IST condition as opposed to the six used for the WB and TDP conditions. Known words for the IST condition were also replaced with new known words for each treatment
session. Once the initial lists were established for each condition, the remaining target words were randomly assigned to each list after students had mastered a target word in that list. Therefore, each list always contained six target words, but these words changed as students mastered words.

Experimental design. In order to assess change over a period of time, a single-subject research design was employed in the current study. This type of design was specifically implemented in an effort to collect intensive data on the six student’s word reading performance. The single-subject research design has been described as any research involving one subject, or one group, that is treated as a single entity (Hittleman & Simon, 1997). Specifically, this type of design is most commonly used to study the changes in behavior an individual exhibits after exposure to an intervention or treatment of some sort (Fraenkel & Wallen, 2003).

By implementing the same interventions for each student in the current study, the effect of an intervention was more clearly established. Additionally, performance was repeatedly measured in order to determine if a particular intervention was more effective in helping the student, or students, with word reading. Research has indicated that single-subject research designs are gaining recognition due to their emphasis on the individual student, rather than group assessments typically used to measure student success (Gresham, 1998; Myrick, 1990). Barlow and Hersen (1984) reported that one of the advantages of single-case research designs is that they are the best research designs for isolating the cause for behavior change and for determining which treatment procedures result in the most effective and efficient behavior change. Several researchers believe
group research designs are misleading and that single-case research reveals more accurate findings concerning change in individuals, which are often obscured by group results (Gresham, 1998; Lundervold & Belwood, 2000; Myrick, 1997). It is through single-case studies that educational practitioners can measure the effectiveness of interventions with students.

Single-subject researchers primarily use line graphs to present their data and to illustrate the effects of a particular intervention or treatment (Borg & Gall, 1983; Fraenkel & Wallen, 2003; Gay, 1987). The use of traditional statistical tests in single-subject research still remains somewhat of an issue of debate (Gay, 1987; Janosky, 1992; Weiner & Eisen, 1985). Therefore, the examination of graphed data will be the primary means of data analysis in the present study and statistical data analysis procedures will be conducted as a supplemental source of information.

Alternating treatments designs (ATD) were implemented to compare the effects of each condition on student learning. Alternating treatments designs require the rapid alteration of two or more conditions. This design was chosen for the current study because it is appropriate for comparing the effects of two or more interventions over brief periods of time (Barlow & Hersen, 1984). With the ATD, an equal number of observation days typically occur for each of the interventions being compared (Barlow & Hayes, 1979). In addition, this design requires that all irrelevant variables be controlled or counterbalanced, and that the planned experimental procedures be carefully analyzed to ensure that all conditions will be identical, with the exception of the independent variables being investigated (Holcombe & Wolery, 1994). Usually, the independent
variables are presented in random order, ensuring that rapid alternation occurs and that
during the comparison phase the independent variables are in effect an equal number of
sessions (Holcombe & Wolery, 1994). Finally, one intervention is judged to be superior
to another when a consistent difference occurs in the level and/or trend of the respective
data patterns (Tawney & Gast, 1984).

**Experimental procedures.** Experimental sessions were conducted on twenty
consecutive school days. During each session, students were exposed to all three
conditions (IST, TDP, and WB). Conditions were randomly selected and presented in
counterbalanced order across school days to control for sequence effects. For instance,
the order for the first session was IST, WB, TDP, and WB, TDP, IST, for the second, etc.
During each condition, students completed the set of words two times. The experimenter
used a stopwatch to measure the number of seconds taken to complete each condition.
Appendix C provides an intervention script for each of the three conditions and Appendix
D provides the session protocol form used for each intervention session.

**Traditional drill and practice.** In the traditional drill and practice (TDP) condition,
six unknown words were presented on index cards to the students in a drill type format.
The researcher first went through the index cards pronouncing each word aloud one time
and asking the student to repeat the word before moving to the next word. Correct
responses were followed with verbal praise (e.g., “Good job!” or “Nice work!”). The
student was then administered two trials of the words by himself as the examiner held up
the index cards one by one. Correct responses were followed with verbal praise (e.g.,
“Good job!” or “Nice work!”), and the experimenter then delivered the next word. The
examiner shuffled the index cards after the instructional phase as well as after the first trial for random ordering. Words were considered mastered when the student correctly responded on both trials.

**Interspersal training.** For the interspersal training (IST) condition, six unknown and three known words were presented on index cards to the students in a drill type format. The examiner first went through the index cards pronouncing each of the unknown words aloud one time and asking the student to repeat the word before moving to the next word. Correct responses were followed with verbal praise (e.g., “Good job!” or “Nice work!”). The student was then administered two trials of the words (both known and unknown) by himself as the examiner held up the index cards one by one. Correct responses were followed with verbal praise (e.g., “Good job!” or “Nice work!”), and the experimenter then delivered the next word. The examiner shuffled the index cards after the instructional phase as well as after the first trial for random ordering. However, known words remained in the first, fifth, and ninth presentation spots. Words were considered mastered when the student correctly responded on both trials.

**Word boxes.** The word boxes (WB) condition consisted of slightly different presentation procedures due to the fact that it is a phonic analysis method. Students were positioned across a table from the researcher. The examiner drew a box divided by vertical lines on a dry erase board. The box was divided into as many sections as there were sounds in the words presented. Below the divided boxes, the examiner placed a magnetic letter for each letter in the word presented. The letters were placed in order below the sections of the divided box. For example, if the word was “bat,” under the first
box a letter “b” was placed, under the second box a letter “a” was placed, and under the third box the letter “t” was placed. The examiner modeled the process for the student by articulating the word slowly while placing the letters in the corresponding sections of the box. The examiner then ran her finger underneath the boxes while pronouncing the word as a whole. The examiner then moved the letters back below the corresponding boxes and asked the student to repeat the process himself. Correct responses were followed with verbal praise (e.g., “Good job!” or “Nice work!”), and the experimenter then placed the letters under the boxes for the next word. The examiner presented the six words in this fashion and the student was asked to repeat the process after each word. Next, the examiner administered two trials of the same words on index cards. Correct responses were followed with verbal praise (e.g., “Good job!” or “Nice work!”), and the experimenter then delivered the next word. The examiner shuffled the index cards after the instructional phase as well as after the first trial for random ordering. Words were considered mastered when the student correctly responded on both trials.

In each of the three conditions, target/unknown words were considered mastered when the student’s initial response was correct across both trials during a given session. All newly mastered words were removed from the respective list and replaced with a new randomly chosen target word and included in the next day’s procedures. Similarly, three known words from the screener were randomly rotated in place of the previous three known words each session for the IST condition. Words not mastered were included as target words in the next session.
Maintenance assessment. Maintenance was measured the day following the 10th and 20th sessions. Students were presented with index cards consisting of all words that he or she had “mastered” during the treatment sessions. These words were presented one time in random order. Verbal praise (e.g., “Nice Work”) was administered contingent upon response accuracy.

Generality. In an effort to determine whether the students were able to generalize the words recognized correctly in the maintenance phases to a different context, sentences containing the mastered words were created. For each student, the experimenter randomly selected 54 of the mastered words (18 words from each condition) and created a brief sentence for each of the words. The 54 words were randomly selected by shuffling index cards containing all mastered words for each condition from the maintenance sessions. Sentences were typed in large font and presented four per page. Students were asked to read each sentence in order to determine whether or not the mastered word was correctly recognized. Target words were considered to be “generalized” when a student was able to correctly recognize the word within the sentence. A correct response only required the student to identify the target word. Therefore, the additional words in the sentence did not need to be identified in order to qualify for a correct generalization. Generalization data was collected over a period of two 25-minute sessions per student.

Social validity. In order to assess social validity, researchers frequently use techniques such as interviews, questionnaires, or rating scales. In addition to the subject, additional individuals within the educational community such as parents, teachers, other
staff members, and students may also be considered when examining social validity. The current study included interviews with the students (See Appendix F) as well as teacher questionnaires (See Appendix G) in an effort to assess the social validity of the three instructional methods. The interviews were conducted following the final maintenance session for students. Teacher questionnaires were also administered following the final maintenance session.

**Interscorer agreement.** Reliability of correct and incorrect response measurement was checked by having a second independent researcher trained in the three conditions (TDP, IST, and WB) score 30% of the responses across all participants. Interscorer agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements, and multiplying by 100%. A similar procedure was used to determine the reliability for maintenance assessments.

**Treatment integrity.** Treatment integrity data was collected on each of the researcher’s implementations of the three conditions across six randomly selected sessions (30% of the sessions). A treatment integrity checklist (See Appendix E) was utilized to assist in the process. These data were collected in order to determine if the researcher was implementing the procedures correctly.
CHAPTER 4

RESULTS

This chapter presents the results of the study for each of the research questions. The chapter begins with a discussion of interobserver agreement and treatment integrity. Research Questions One and Three were examined using visual inspection of graphed data. Research Questions Two and Four were examined using graphs and statistical data analysis procedures. Research Questions Five and Six were examined using data gathered from the maintenance and generalization phases of the study. Research Questions Seven, Eight, and Nine were examined using data and information collected from teacher questionnaires and student interviews. Due to the fact that single-subject researchers primarily use line graphs to present their data and to illustrate the effects of a particular intervention or treatment (Borg & Gall, 1983; Fraenkel & Wallen, 2003; Gay, 1987), the examination of graphed data was the major means of data analysis in the present study. Statistical data analysis procedures were conducted as a supplemental source of information.
**Interobserver Agreement**

As previously indicated, an independent observer scored 30% of the responses across all participants. Observer agreement on the scoring of the responses was calculated by using the following formula:

\[
\frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}} \times 100
\]

Interobserver agreement between the examiner and independent observer was 98% for daily intervention sessions and 100% for the maintenance sessions. These data suggest a relatively high degree of agreement between the examiner and the independent observer.

**Treatment Integrity**

Treatment integrity data was collected on each of the researcher’s implementations of the three conditions across six randomly selected sessions (30% of the sessions). A treatment integrity checklist (See Appendix E) was utilized to assist in the process. These data were collected in order to determine if the researcher was implementing the procedures correctly. Treatment integrity was 100% across all six sessions. The results suggest that the procedures were implemented with high reliability and accuracy.
Research Question Number One

Based on the number of cumulative words learned, which is a more effective method of teaching words to individual students with word identification difficulties, interspersal training of known items drill sequence (IST), word boxes (WB), or traditional drill and practice (TDP)?

Table 4.1 includes the final cumulative number of words learned for all six students across the traditional drill and practice (Drill), interspersing, and word boxes procedures. Table 4.1 also provides a total number of words learned across all students for the three instructional approaches. The data suggest that the students as a group learned a total of 1,123 words with some variability in the number of words learned across the three conditions. Specifically, it appears as though students learned a greater number of words in the word boxes condition as compared to the traditional drill and interspersing conditions. The data also suggest a minimal amount of variability between the traditional drill and interspersing conditions in terms of the cumulative number of words learned.
Figures 4.1 through 4.6 provide the cumulative number of words learned across all sessions for Tyler, Evan, Sarah, Jenny, David, and Noah respectively. The figures were constructed in order to allow for a visual representation of the data on a student-by-student basis. The data from these figures show consistent patterns of word acquisition across the three conditions. Figure 4.1 represents the cumulative number of words learned for Tyler. Tyler was able to participate in all 20 treatment sessions. The data indicate an increasing trend with little variability within conditions. Additionally, upon examining Figure 4.1, it appears as though the word boxes (WB) condition may have been slightly superior in terms of increasing rates of word acquisition. These data also suggest that Tyler may have learned approximately the same number of words across the interspersing (IST) and traditional drill and practice (TDP) conditions.
Figure 4.1
*Cumulative Number of Words Learned Across Three Conditions by Tyler*

Figure 4.2 shows the cumulative number of words learned across all sessions by Evan. Evan was able to participate in all 20 treatment sessions. Similar to the data depicted for Tyler in Figure 4.1, Evan also showed an increasing trend in word acquisition across all three treatment conditions. Evan’s data showed a slight degree of variability between conditions and very little variability within any specific condition. In particular, Evan may have demonstrated a slight increase in the number of words learned in the traditional drill and practice (TDP) procedure as compared to the interspersing (IST) or word boxes (WB) procedures. Furthermore, it appears as though Evan may have learned more words in the interspersing condition as compared to the word boxes condition.
Figure 4.2
*Cumulative Number of Words Learned Across Three Conditions by Evan*

Figure 4.3 represents the cumulative number of words learned under the three treatment conditions across all sessions by Sarah. Sarah was also able to participate in all 20 treatment sessions. The data show a similar pattern to the previous two figures. There is a stable increasing trend for all three conditions with very little variability within conditions. However, it appears as though Sarah may have demonstrated a noticeable increase in the number of words learned in the interspersing (IST) procedure as opposed to the traditional drill and practice (TDP) and word boxes (WB) procedures. Additionally, there appears to be a minimal degree of variability between the traditional drill and word boxes procedures, suggesting a similar number of words learned for both conditions by Sarah.
Figure 4.4 represents the cumulative number of words learned under the three conditions across all sessions by Jenny. Jenny was able to participate in all 20 treatment sessions despite several absences. These data also indicate consistent increasing trends for all three conditions. Again, very little variability can be seen within any specific condition. Upon examining Figure 4.4, it appears as though the word boxes (WB) condition may have been superior for Jenny in terms of increasing rates of word acquisition as compared to the traditional drill (TDP) and interspersal (IST) conditions.
Figure 4.4
*Cumulative Number of Words Learned Across Three Conditions by Jenny*

Figure 4.5 depicts the cumulative number of words learned for all three conditions across all 20 treatment sessions by David. David was able to participate in all 20 intervention sessions. He showed an increasing trend across all three conditions with little variability within any specific condition. It does appear, however, that David may have shown a marked increase in the number of words learned in the word boxes (WB) condition as compared to the traditional drill and practice (TDP) and interspersal (IST) approaches. In addition, it seems as though David was able to acquire more words in the traditional drill condition as opposed to the interspersing condition.
Figure 4.5
Cumulative Number of Words Learned Across Three Conditions by David

Figure 4.6 represents the cumulative number of words learned under the three treatment conditions across all sessions by Noah. Similarly to the other students, Noah was also able to participate in all 20 treatment sessions. The treatment data indicate an increasing trend with some variability between conditions and very little variability within conditions. Specifically, the data suggest a noticeable increase in the number of words learned in the word boxes (WB) approach as compared to the traditional drill and practice (TDP) or the interspersal (IST) conditions. Also, there appears to be only a minimal amount of variability between the traditional drill and interspersing procedures, suggesting a similar number of words learned for the two conditions.
The data from the above graphical displays show consistent patterns of word acquisition across the three conditions. These treatment data indicate an increasing trend with little variability within conditions. However, there is a noticeable degree of variability between conditions. Specifically, the figures suggest that four of the six students demonstrated more effective word learning under the word boxes procedure, one demonstrated more effective learning under the traditional drill and practice procedure, and one demonstrated more effective learning under the interspersing procedure. Therefore, the results might possibly suggest that the word boxes condition is a more effective method of teaching words to individual students with word identification difficulties.
Research Question Number Two

Based on the number of cumulative words learned, which is a more effective method of teaching words to students with word identification difficulties as a group, interspersal training of known items drill sequence (IST), word boxes (WB), or traditional drill and practice (TDP)?

The data were collapsed into group data in order to test which treatment condition was more effective in terms of the number of cumulative words learned among students as a group. Figure 4.7 shows the data collapsed across individuals for the three procedures.

![Figure 4.7: Cumulative Number of Words Learned by All Students Across All Conditions](image-url)

*Figure 4.7: Cumulative Number of Words Learned by All Students Across All Conditions*
Upon analyzing the data, the graphical display suggests a minimal degree of variability within the conditions and a small degree of variability across conditions. Specifically, the data suggest an increase in the number of words learned in the word boxes (WB) approach as compared to the traditional drill and practice (TDP) or the interspersal (IST) conditions. That is, students tended to learn more words under the word boxes condition over the course of the current study. Also, there appears to be only a minimal amount of variability between the traditional drill and interspersing procedures, suggesting a similar number of words learned for the two conditions among students as a group.

A Repeated Measures Analysis of Variance (ANOVA) was also conducted in order to assess whether or not a statistical difference existed between the three conditions. This type of ANOVA was selected due to having one independent variable as well as one group of subjects that were measured repeatedly under three conditions. All assumptions of the Repeated Measures Analysis of Variance, including sphericity, were satisfied. The ANOVA revealed a statistically significant difference between the three procedures, $F(1,119) = 50.63, p < .001$. The F-statistic is a statistic for a test concerning the differences among means. The F-statistic value of 50.63 was found by dividing the mean square within group total by the mean square between group total. The p-value of a statistical hypothesis test is the probability of getting a value of the test statistic as extreme as or more extreme than that observed by chance alone, if the null hypothesis is true. Low p-values, such as the one found for this study, are indications of strong evidence against the null hypothesis. Therefore, in the current study, there is strong
evidence against the hypothesis that there is no statistical difference between the three conditions in terms of instructional effectiveness (the number of words learned).

In the current study, power was considered to be strong (1.00) suggesting that the probability of being able to detect the treatment effect is approximately 100%. An obtained value of .80 is typically considered to be a reasonable and realistic value of power for research in the behavioral sciences (Cohen, 1965). Additionally, Cohen defined “small,” “medium,” and “large” effect sizes as being \( f = .10, .25, \) and .40 respectively (Cohen, 1988). The estimated effect size found in the present study was considered to be medium (.30), indicating that approximately 30% of the variance can be attributed to treatment effects or the effects of the three instructional approaches on instructional effectiveness. Three paired t-tests were conducted for post-hoc analysis in order to follow up this effect. The post-hoc analysis revealed that the word boxes (WB) condition (\( M = 34.23, SD = 20.89 \)) had statistically greater cumulative learning scores than both the traditional drill (TDP) (\( M = 30.13, SD = 18.90 \)) and interspersing (IST) (\( M = 30.93, SD = 20.70 \)) conditions. There was no statistically significant difference found between the TDP and IST conditions. Table 4.2 provides the ANOVA summary table for the Repeated Measures Analysis of Variance that was conducted on the collapsed group data including observed power and effect size estimates (i.e., partial eta-squared).
Based on the above graphical displays of cumulative words learned and the results of the Repeated Measures Analysis of Variance, it appears as though the word boxes (WB) condition resulted in a greater degree of instructional effectiveness. Therefore, it seems as though there may be a considerable benefit for students to be instructed under the word boxes condition as opposed to the traditional drill or interspersal conditions in relation to instructional effectiveness.

**Research Question Number Three**

Which method, the IST, WB, or TDP, is most efficient and to what extent for learning new words (as measured by learning rate) among individual students?

Table 4.3 provides a summary of the cumulative number of words learned, total time engaged in each of the three conditions, and the rate (i.e., number of words learned per minute of instruction) of word acquisition under all three conditions by each participant, and total across all participants. It should be noted that the data presented in Table 4.3 are not mean learning rates, but overall learning rates. Overall learning rates are
not calculated on a session-by-session basis but on a total condition basis resulting in a less sensitive and much broader measure of learning. Unlike overall learning rates, mean learning rates are calculated on a session-by-session basis and are much more sensitive to changes in student learning rates. The mean learning rates and respective standard deviations are provided under Research Question Four.

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<td>363</td>
<td>374.95</td>
<td>.97</td>
</tr>
</tbody>
</table>

\(a\) = number of minutes  
\(b\) = number of words learned/time

Table 4.3
Total Number of Words Learned, Number of Minutes Spent in Each Condition, Learning Rates by Student and Group Totals by Condition

A further analysis of the data can be seen in Figures 4.8, 4.9, 4.10, 4.11, 4.12, and 4.13 which are provided to allow for a visual analysis of the data on a student-by-student basis for Tyler, Evan, Sarah, Jenny, David, and Noah, respectively. In figure 4.8, Tyler’s learning rate is highest under the traditional drill and practice (TDP) condition followed by the interspersing (IST) condition. All three conditions appear to have stable increasing
trends. However, the word boxes (WB) condition shows a slower increasing trend and lower levels of progress. These data differ from what was discovered when simply analyzing the number of cumulative words learned in Figure 4.1. The previous data suggested only a slight difference in performance across the three conditions, with the most words learned in the word boxes condition. Here, when time is factored into the analysis, there appears to be a considerable advantage in using traditional drill or interspersing over word boxes to increase word acquisition rates with Tyler.

Figure 4.8
*Cumulative Learning Rates Across All Sessions and Conditions by Tyler*
Evan’s word reading acquisition data are presented in Figure 4.9. These data indicate that all learning conditions resulted in word acquisition. Although an increasing trend is visible among all three conditions, traditional drill (TDP) resulted in a greater number of words learned per minute than the interspersing (IST) and word boxes (WB) procedures, respectively. The increasing trend for the word boxes condition is not as steep, suggesting slower rates of word acquisition. These findings support earlier results that suggested the traditional drill might result in increased word acquisition for Evan. Here, when time is factored into the analysis, the result is much clearer.

Figure 4.9
*Cumulative Learning Rates Across All Sessions and Conditions by Evan*
Figure 4.10 displays the cumulative learning rate data for Sarah. These data demonstrate increasing trends for all three conditions. The data also suggest that the traditional drill and practice (TDP) procedure may be more efficient in terms of increasing word acquisition as compared to the interspersing or word boxes procedures. However, there appears to be only a small degree of variability between the traditional drill and practice (TDP) and interspersing (IST) conditions for Sarah. Therefore, there is an indication that the traditional drill and interspersing procedures may result in superior learning rates for Sarah when compared to the word boxes (WB) procedure. These data differ from those presented in Figure 4.3. The data in Figure 4.3 indicate that there may be an advantage for the interspersing condition to increase rates of acquisition. However, when time is factored into the analysis, it appears that rates of word acquisition under the interspersing procedure are slightly lower than the traditional drill and practice procedure.
Figure 4.10
Cumulative Learning Rates Across All Sessions and Conditions by Sarah

Figure 4.11 shows the cumulative learning rate for Jenny. These data show an increasing trend for all three conditions. These data also suggest that all conditions resulted in the acquisition of words. However, the increasing trends for the interspersing and word boxes are not as steep, suggesting slower rates of word acquisition. There is an indication that the traditional drill and practice (TDP) procedure may result in superior learning rates for Jenny when compared to the interspersing (IST) or word boxes (WB) procedures. These data differ from those presented in Figure 4.4. The data in Figure 4.4 suggest that there may be an advantage for the word boxes condition to increase rates of acquisition. However, when time is factored into the analysis, it appears that rates of word acquisition under the word boxes condition are noticeably lower than the traditional drill and practice procedure.
The cumulative rate of word acquisition for David is presented in Figure 4.12. These data show an increasing trend across all three conditions suggesting that all conditions resulted in the acquisition of words. The data also suggest that traditional drill (TDP) may result in more efficient learning for David. These data differ from those presented in Figure 4.5. The data in Figure 4.5 indicate that there may be an advantage for the word boxes (WB) condition to increase rates of acquisition. However, when time is factored into the analysis, it appears that rates of word acquisition under the word boxes procedure are lower than the traditional drill and interspersing procedures.
Figure 4.12
Cumulative Learning Rates Across All Sessions and Conditions by David

Figure 4.13 displays the cumulative learning rate data for Noah. These data show increasing trends for all three conditions. The data also suggest that the traditional drill procedure may be more efficient in terms of increasing word acquisition with Noah. These data differ from those presented in Figure 4.6. Similarly to David, the data in Figure 4.6 suggest that there may be an advantage for the word boxes condition to increase rates of acquisition. However, when time is factored into the analysis, it appears that rates of word acquisition are lower when words are presented under the word boxes procedure.
The above graphical displays suggest that all six students demonstrated more efficient learning rates under the traditional drill and practice (TDP) procedure as opposed to the interspersing (IST) and the word boxes (WB) procedures. Additionally, none of the students demonstrated the greatest efficiency for the acquisition of words under the word boxes procedure. Therefore, the results might possibly suggest that the traditional drill and practice procedure is most efficient for learning new words among individual students identified as having word identification difficulties.

**Research Question Number Four**

Which method, the IST, WB, or TDP, is most efficient and to what extent for learning new words (as measured by learning rate) among students as a group?
Data were collapsed in order to examine this research question. Figure 4.14 shows the cumulative learning rates collapsed across all six participants across all three procedures.

Figure 4.14
*Cumulative Learning Rates Across All Students Across All Three Conditions*

Upon analyzing the data, the graphical display suggests a minimal degree of variability within the conditions and a considerable degree of variability across conditions. Specifically, the data suggest that when time is factored into the measurement of student learning, the traditional drill and practice (TDP) procedure resulted in noticeably superior rates of word acquisition followed by the interspersing (IST) and
word boxes (WB) conditions respectively. That is, students tended to learn more words per minute under the traditional drill condition over the course of the current study. Table 4.4 provides the means and standard deviations of the learning rates (words learned per minute) for each individual and for the group as a whole.

<table>
<thead>
<tr>
<th></th>
<th>Drill</th>
<th>Interspersing</th>
<th>Word Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Tyler</td>
<td>1.45</td>
<td>.72</td>
<td>1.00</td>
</tr>
<tr>
<td>Evan</td>
<td>.94</td>
<td>.52</td>
<td>.63</td>
</tr>
<tr>
<td>Sarah</td>
<td>1.58</td>
<td>.58</td>
<td>1.30</td>
</tr>
<tr>
<td>Jenny</td>
<td>1.61</td>
<td>.63</td>
<td>1.03</td>
</tr>
<tr>
<td>David</td>
<td>1.15</td>
<td>.73</td>
<td>.84</td>
</tr>
<tr>
<td>Noah</td>
<td>1.03</td>
<td>.25</td>
<td>.74</td>
</tr>
<tr>
<td>Group</td>
<td>1.29</td>
<td>.64</td>
<td>.92</td>
</tr>
</tbody>
</table>

Table 4.4
*Means and Standard Deviations of Learning Rates (Words Learned Per Minute of Instruction) by Participant and Group Means by Condition*

Table 4.5 provides the Repeated Measures Analysis of Variance (ANOVA) summary table. Similarly to the instructional effectiveness research question, this type of ANOVA was selected due to having one independent variable as well as one group of subjects that were measured repeatedly under three conditions. All assumptions of the Repeated Measures Analysis of Variance, including sphericity, were satisfied. The results of the ANOVA indicated a statistically significant difference between the three conditions $F(1, 119) = 294.52, p < .001$. The partial eta-squared estimate of effect size
was considered large (.71) and the power was considered strong (1.00). Three paired t-tests were conducted for post-hoc analysis in order to follow up this effect. This procedure revealed that the traditional drill and practice (TDP) (M = 13.00, SD = 7.89) condition had statistically greater learning rates than both the interspersing (IST) (M = 9.40, SD = 6.13) and word boxes (WB) (M = 5.25, SD = 3.19) conditions, respectively. Additionally, the IST condition was found to have statistically greater learning rates than the WB condition.

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Effect Size</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>3608.87</td>
<td>294.52*</td>
<td>.001</td>
<td>.71</td>
<td>1.00</td>
</tr>
<tr>
<td>Error</td>
<td>119</td>
<td>12.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Denotes Statistical Significance at p<.001

Table 4.5
Repeated Measures ANOVA Summary Table for Cumulative Learning Rate by the Students as a Group

Based on the above graphical displays and the results of the Repeated Measures Analysis of Variance, it appears as though the traditional drill and practice (TDP) condition resulted in a greater degree of instructional efficiency. Therefore, it seems as though there may be a considerable benefit for students to be instructed under the traditional drill condition as opposed to the interspersal or word boxes conditions in relation to instructional efficiency.
Research Question Number Five

What are the effects of the three instructional approaches on student’s ability to maintain recognition of mastered words?

Data were collapsed across the two maintenance sessions in order to examine this research question. Table 4.6 represents the means and standard deviations (SD) for the number of words maintained under each of the three conditions. These data indicate a small difference between group means. Specifically, the interspersing condition was found to have the lowest mean (M = 82.67) and the word boxes condition was found to have the highest mean (M = 86.33) for percentage maintenance data. These data might possibly suggest that the word boxes condition was better in facilitating the maintenance of words learned by the six students as a group.

<table>
<thead>
<tr>
<th>Drill</th>
<th>Interspersing</th>
<th>Word Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>84.50</td>
<td>7.92</td>
<td>82.67</td>
</tr>
</tbody>
</table>

Table 4.6
Means and Standard Deviations for Percentage Maintenance Data Across the Three Conditions

Table 4.7 represents the number of words maintained (WM), percentage of learned words maintained (%WM), and rate of mastered words maintained (MR) for each student and totals across all participants for all variables. Overall, maintenance was
considered moderate to high, ranging from 72% to 97%. It is important to note that these
data are proportions based on overall collapsing of maintenance sessions and are not
means.

<table>
<thead>
<tr>
<th></th>
<th>Drill</th>
<th>Interspersing</th>
<th>Word Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WM</td>
<td>%WM</td>
<td>MR&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tyler</td>
<td>57</td>
<td>83%</td>
<td>1.28</td>
</tr>
<tr>
<td>Evan</td>
<td>36</td>
<td>80%</td>
<td>.82</td>
</tr>
<tr>
<td>Sarah</td>
<td>72</td>
<td>97%</td>
<td>1.61</td>
</tr>
<tr>
<td>Jenny</td>
<td>67</td>
<td>91%</td>
<td>1.51</td>
</tr>
<tr>
<td>David</td>
<td>42</td>
<td>80%</td>
<td>.97</td>
</tr>
<tr>
<td>Noah</td>
<td>38</td>
<td>76%</td>
<td>.84</td>
</tr>
<tr>
<td>Group</td>
<td>312</td>
<td>85%</td>
<td>1.17</td>
</tr>
</tbody>
</table>

<sup>a</sup> = number of mastered words maintained/time

Table 4.7
Number of Words Maintained (WM), Percentage of Learned Words Maintained (%WM), and Rate of Mastered Words Maintained (MR) for Each Student and Condition Totals

A Repeated Measures Analysis of Variance (ANOVA) was conducted in order to
determine if any statistically significant differences existed between the three conditions.
Results of the ANOVA indicated no statistically significant differences between the three
conditions $F(1,5) = 2.43, p > .05$. The partial eta-squared effect size was considered to be
“medium” (.33) and the power was considered low (.25). Due to the finding of a power
value less than .80, we will want to be cautious when interpreting the results. The results
might possibly suggest that none of the three conditions was better in facilitating the
maintenance of words learned by the six students as a group. Table 4.8 provides the ANOVA summary table for the Repeated Measures Analysis of Variance that was conducted on the collapsed group data, including observed power and effect size estimates (i.e., partial eta-squared).

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Effect Size</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1</td>
<td>90.75</td>
<td>2.43</td>
<td>.180</td>
<td>.33</td>
<td>.25</td>
</tr>
<tr>
<td>Error</td>
<td>5</td>
<td>37.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.8
Repeated Measures ANOVA Summary Table for Maintenance Data by the Students as a Group

Research Question Number Six

What are the effects of the three instructional approaches on student’s ability to generalize mastered words to a different context subsequent to instruction?

Data were collected from the generalization student sessions in order to examine this research question. In particular, 54 “mastered” words (18 words from each condition) were randomly selected for each child from the words that he or she had correctly identified from the maintenance sessions. After the words were randomly selected for each child, 54 short sentences were created for each of the target generalization words. Sentences were typed in large font and presented four per page. Target words were considered to be “generalized” when a student was able to correctly recognize the word
within the sentence. A correct response only required the student to identify the target word. Therefore, the additional words in the sentence did not need to be identified in order to qualify for a correct generalization. Generalization data was collected over a period of two 25-minute sessions per student.

Table 4.9 represents the number of words correctly generalized (WG) of the 54 randomly selected words, percentage of words generalized (PWG) for each student across all three conditions, and group total for all of the variables across each condition. Overall, generalization was considered moderate to high, ranging from 72% to 100%.

<table>
<thead>
<tr>
<th>Drill</th>
<th>Interspersing</th>
<th>Word Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WG</td>
<td>%WG</td>
</tr>
<tr>
<td>Tyler</td>
<td>15</td>
<td>83%</td>
</tr>
<tr>
<td>Evan</td>
<td>16</td>
<td>89%</td>
</tr>
<tr>
<td>Sarah</td>
<td>18</td>
<td>100%</td>
</tr>
<tr>
<td>Jenny</td>
<td>18</td>
<td>100%</td>
</tr>
<tr>
<td>David</td>
<td>15</td>
<td>83%</td>
</tr>
<tr>
<td>Noah</td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>Group</td>
<td>96</td>
<td>89%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Words Generalized (WG) and Percentage of Words Generalized (%WG) for Each Student, and Condition Totals</td>
</tr>
</tbody>
</table>

Table 4.10 represents the means and standard deviations for the number of words generalized under each of the three conditions. Similarly to the maintenance data, the generalization data also suggest a small difference between group means. In particular, the interspersing condition was found to have the lowest mean (M = 85.00) and the word
boxes condition was found to have the highest mean (M = 90.50) for percentage
generalization data. These data might possibly suggest that the word boxes condition was
better in facilitating the generalization of words learned by the six students as a group.

<table>
<thead>
<tr>
<th>Drill</th>
<th>Interspersing</th>
<th>Word Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>88.83</td>
<td>9.33</td>
<td>85.00</td>
</tr>
<tr>
<td>90.50</td>
<td>6.78</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.10
*Means and Standard Deviations for Percentage Generalization Data Across the Three Conditions*

A one-way Analysis of Variance (ANOVA) was conducted in order to determine
if any statistically significant differences existed between the three conditions in terms of
the percentage of learned words generalized. Results of the ANOVA indicated no
statistically significant differences between the three conditions $F(2,15) = .76, p > .05$.
The partial eta-squared effect size was considered to be “small” (.09) and the power was
considered low (.155). Due to the finding of a power value less than .80, we will want to
be cautious when interpreting the results. The results might possibly suggest that none of
the three conditions was better in facilitating the generalization of words learned by the
six students as a group. Table 4.11 provides the ANOVA summary table of the collapsed
group data, including observed power and effect size estimates (i.e., partial eta-squared).
Table 4.11
ANOVA Summary Table for Generalization Data by the Students as a Group

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Effect Size</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>2</td>
<td>1.56</td>
<td>.76</td>
<td>.484</td>
<td>.09</td>
<td>.155</td>
</tr>
<tr>
<td>Error</td>
<td>15</td>
<td>2.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Question Number Seven

Are the three instructional methods (IST, WB, and TDP) a socially valid way to assess and teach word reading skills to students identified as having word identification difficulties?

The six students in this study participated in a social validity interview following the completion of the final intervention session (See Appendix F). The interview consisted of seven short response questions. All questions were verbally read to the students. Questions such as, “Did you like working together,” “Which of the three activities do you think helped you read the most,” and “Do you think that the three activities that we did together seem to be helpful for teaching students to learn new words” were asked in order to assess the social validity of the three instructional approaches.

Results indicated that all six students enjoyed working together on the reading intervention activities. The results also suggested that four students, or 67% of the sample, reported that the word boxes approach was the activity that helped them with reading the most. Two students, or 33% of the sample, reported that the traditional drill
and practice approach helped them with reading the most. None of the students reported the interspersing approach as being the most helpful in terms of reading. In addition, all six students reported feeling as though the three activities would be helpful for teaching students new words.

The five classroom teachers participated in filling out a social validity questionnaire following the completion of the final intervention session (See Appendix G). The questionnaire consisted of seven short response questions. Responses to questions such as, “Did you notice any difference in the student’s word reading performance while he or she was participating in the study,” “Do you feel as though the three instructional methods appear to be valid approaches, or appropriate approaches, for teaching words to students with word identification difficulties,” and “Which methods would you consider using in the classroom as part of your instruction to teach word reading” were examined in an effort to assess the social validity of the three instructional approaches.

Results indicated that all five teachers felt as though they were able to see some type of improvement in the student’s word reading performance while participating in the study. All five teachers also reported feeling as though the three instructional techniques appear to be valid approaches for teaching words to students with word identification difficulties. However, the majority of teachers seemed to be in favor of the word boxes (60% of the teachers) and interspersing of known items (40% of the teachers) as methods to implement in the classroom. Therefore, upon examining the student and teacher responses, it appears as though all three methods could be considered a socially valid way
to assess and teach word reading skills to students identified as having word identification difficulties.

**Research Question Number Eight**

Which of the three methods (IST, WB, or TDP) do students identified as having word identification difficulties most prefer?

Students’ responses to “Which of the three activities that we did together did you like the best” and “Which of the three activities that we did together did you like the least” were analyzed in order to assess the fourth research question. A visual display of the data regarding student preference is presented in Figure 4.15. Figure 4.15 shows that three students, or 50% of the sample, reported that they prefer the word boxes (WB) condition to the interspersal training of known items drill sequence (IST) or the traditional drill and practice (TDP) conditions. Two students, or 33% of the sample, reported that they prefer the TDP condition and one student, or 17% of the sample, reported that they prefer the IST condition.

In terms of which activity was liked the least, three of the six students, or 50% of the sample, least preferred the IST condition. Two students, or 33% of the sample, least preferred the TDP condition. One student, or 17% of the sample, least preferred the word boxes condition. Therefore, results suggest that the word boxes (WB) condition was the most preferred and the interspersal training of known items (IST) was the least preferred by students identified as having word identification difficulties.
Research Question Number Nine

Is a student’s perception of their reading abilities and of themselves more positive with the interspersal training of known items drill sequence (IST), word boxes (WB), or traditional drill and practice (TDP) intervention?

In an effort to assess the ninth research question, students were asked questions from the social validity interview (See Appendix F) such as; “Did working together help you with learning new words,” “Did working together help you with your reading,” and “Which of the three activities do you think helped you read the most.” All six students reported that working together helped them with learning new words. Similarly, all six students reported that working together also helped them with their reading. Four
students, or 67% of the sample, reported that the word boxes approach was the activity that helped them with reading the most. Conversely, one student (17% of the sample) reported that the traditional drill and practice approach helped them with reading the most and one student (17% of the sample) reported the interspersing approach as being the most helpful in terms of reading. Therefore, the results might possibly suggest that student’s perception of their reading abilities and of themselves is more positive with the word boxes approach as compared to the interspersing of known items or the traditional drill and practice approaches, respectively.
CHAPTER 5

DISCUSSION

This chapter presents the results of the study, which examined the effectiveness and efficiency of three instructional techniques on word reading performance. The obtained results are discussed in terms of the research questions posed by the study. Comparisons to previous research studies, implications for practice, limitations, and directions for future research are also discussed.

The purpose of this study was to extend the work of Cates et al. (2003) by continuing to investigate the effectiveness and efficiency of three instructional techniques. However, unlike the Cates et al. study, which focused on spelling, the current study examined the instructional effectiveness and efficiency of three word reading interventions on student’s cumulative number of words read accurately and cumulative learning rate. Specifically, alternating treatments designs were used to compare the effects of interspersal drill and practice training (presenting one known word prior to every third target/unknown word for a ratio of 67% unknown to 33% known), the phonic analysis method of word boxes (presenting only target words), and a traditional drill and practice procedure (presenting only target words) on word reading mastery. This study was also intended to extend previous research findings of the positive outcomes of the
three interventions by examining the acquisition, maintenance, and generalization of words that were taught under the three instructional conditions. Social validity of the three instructional methods was also assessed.

**Instructional Effectiveness**

Results showed positive effects for all three conditions in regards to enhancing the word reading performance of students in the study. However, the findings revealed a considerable difference between the three conditions in terms of instructional effectiveness and efficiency. Upon examining the instructional effectiveness data, results revealed that students, as a total group, learned the most words in the word boxes condition. However, it should be noted that when figures were analyzed on an individual basis, Evan and Sarah did not learn the greatest number of words in the word boxes condition. Nonetheless, when examined as a group, the word boxes instructional approach was found to be statistically superior as compared to the traditional drill and interspersing conditions in terms of instructional effectiveness, or the extent to which a specific intervention results in accurate responding.

Several potential explanations exist for the reason students performed considerably better in the word boxes condition in terms of the number of words learned. One reason could possibly be that the word boxes approach provided a learning strategy for identifying unknown words. Specifically, the word boxes approach entails direct instruction in isolating beginning, middle, and ending sounds as each sound is slowly articulated while magnetic letters are placed in connected boxes. Phonic approaches, such as word boxes, have been frequently cited in the literature as providing a learning
strategy for students (i.e., Adams, 1990; Adams & Henry, 1997; Gough & Hillinger, 1980; Juel, 1991; McCormick, 1999). Therefore, by incorporating the teaching of phonemic awareness skills into the approach, the word boxes condition might have increased the likelihood of students identifying more words simply because they were provided with a strategy.

An additional reason for the superior performance in the word boxes condition might be associated with the amount of time spent in the condition as compared to the traditional drill or interspersing conditions. In particular, the amount of time spent in the word boxes condition was significantly greater than the traditional drill or interspersing conditions. This difference in the amount of time spent in the word boxes condition allowed students to have a greater amount of exposure to the condition throughout the treatment sessions, thereby potentially increasing the likelihood that a greater number of words would be correctly identified. An overall combination of these factors might explain the reason for the higher performance by students in the word boxes condition with regards to instructional effectiveness. Nevertheless, analysis of the effectiveness data suggests that educators wishing to maximize word reading performance may wish to consider choosing the word boxes procedure as an instructional technique.

**Instructional Efficiency**

When the three instructional conditions were investigated from an efficiency standpoint, there was a distinct advantage to using the traditional drill procedure over the interspersing and word boxes procedures. In fact, all six students were found to have higher learning rates in the traditional drill and practice condition as compared to the
interspersing or word boxes conditions. Results revealed that the traditional drill and practice approach was the most beneficial in terms of instructional efficiency, or the rate of accurate responding comparative to time, followed by the interspersing of known items and word boxes approaches. The traditional drill approach was also found to be statistically superior as compared to the interspersing and word boxes approaches, respectively.

Instructional efficiency was calculated by dividing the number of words learned under a specific condition by the amount of time engaged in that condition. Specifically, the greater the number of words learned per minute of instruction, the greater the instructional efficiency. By examining the amount of time needed to make such gains, it was evident that the word boxes procedure might not be the best treatment to consider when looking for a time efficient intervention. Although students learned more words in the word boxes procedure, more time was required to learn the words in this condition.

Despite the results of the current study regarding efficiency, the finding that the word boxes approach was the most effective in terms of the number of words learned and in terms of the number of words maintained and generalized, as well as one of the most preferred approaches by teachers and students, might possibly suggest that this instructional method may be more beneficial over the course of time. In other words, this type of approach may be more beneficial in terms of retention, or the retaining of learned information. The traditional drill procedure could be considered to be the more efficient intervention in the short term, or when the goal is acquisition.
In an empirical meta-analysis of research on drill ratios, Burns (2004) found that drill tasks are more effective in the acquisition stage of learning than in the proficiency stage. Acquisition is the initial stage of learning that occurs between the period that the desired response first appears and some level of accuracy of that performance is attained (Haring & Eaton, 1978). The goal of the proficiency stage is to increase accuracy and fluency (Rivera & Smith, 1997). Therefore, the word boxes procedure could possibly be considered to be a more efficient intervention in the long term, or when the goal is retention and increasing accuracy and fluency. However, both of these claims need to be empirically examined in order to draw a clearer conclusion. Nonetheless, when selecting an intervention procedure, professionals may wish to consider both long-term and short-term goals with regards to instructional effectiveness and instructional efficiency.

**Maintenance**

Professionals should also consider short-term and long-term effects when examining the usefulness of various interventions. Maintenance is a critical component in determining the overall effectiveness of an intervention. Cooper, Heron, and Heward (1987) defined maintenance as “the extent to which the learner continues to perform the target behavior after a portion or all of the intervention has been terminated” (p. 558). Most importantly, it is imperative that instructional methods facilitate skill maintenance. In the current study, maintenance was measured the day following the 10th and 20th sessions. Students were presented with index cards consisting of all words that he or she had “mastered” during the treatment sessions.
Overall, maintenance rates were considered to be moderate to high. As previously mentioned, results revealed that maintenance was slightly higher (in terms of the number of words maintained by students as a group) in the word boxes condition. The traditional drill and interspersing conditions resulted in an equal percentage of words maintained across the two maintenance sessions, suggesting a minimal amount of variability. All students with the exception of Evan and Sarah had higher numbers of mastered words under the word boxes condition than in the traditional drill or interspersing conditions, respectively. Therefore, the maintenance of mastered words may be closely related to intervention effectiveness, as those conditions that resulted in higher rates of word learning also resulted in higher maintenance rates. However, it should be noted that a statistical difference was not found in the number of words maintained across the three conditions. This finding suggests that none of the three conditions was statistically superior in facilitating the maintenance of words learned by the six students as a group. In spite of this, these data indicate that methods of assessing student learning may influence not only the understanding of the functional relationship between instructional conditions and mastery, but also maintenance.

Generalization

In an effort to determine whether the students were able to generalize the words recognized correctly in the maintenance phases to a different context, sentences containing the mastered words were created. Baer, Wolf, and Risley (1968) defined generality of behavior change as a behavior change that, “proves durable over time, if it appears in a wide variety to possible environments, or if it spreads to a wide variety of
related behaviors” (p. 96). Simply put, generalization takes place if a student demonstrates a relative behavior under non-trained conditions. Overall, generality measures assist researchers in examining the effectiveness of interventions and in making interventions more beneficial for students. The assessment of the student’s ability to generalize mastered words to a different context subsequent to instruction in the current study could be considered a distinct advantage, as many studies examining interventions do not include a generalization measure.

Similarly to the maintenance data, generalization rates were also considered to be moderate to high. As previously mentioned, the findings from the current study suggest that generalization rates were slightly higher in the word boxes instructional condition as compared to the traditional drill and interspersing conditions. This finding mimics the results found in the maintenance data in that the word boxes condition was also found to be the most beneficial. However, it should be noted that a statistical difference was not found in the number of learned words generalized across the three conditions. This finding suggests that none of the three conditions was statistically superior in facilitating the generalization of words learned by the six students as a group.

A possible explanation for students generalizing a greater number of words in the word boxes condition may be that the word boxes instructional technique provided students with a strategy for identifying unknown words, therefore, when students encountered words in context (sentences), they had a strategy to implement. In addition, the generalization of mastered words may be closely related to intervention effectiveness and maintenance, as those conditions that resulted in higher rates of word learning and
maintenance also resulted in higher generalization rates. These results might also possibly suggest that a word reading intervention can be less efficient but more effective in terms of the number of words learned, number of words maintained, and number of words generalized, over a period of time. Therefore, it may be that the word boxes procedure lends itself more readily to the retaining of words over the course of time.

Social Validity

The current study included interviews with the students (See Appendix F) as well as teacher questionnaires (See Appendix G) in an effort to assess the social validity of the three instructional methods. Social validity measures evaluate the overall importance of an intervention to the subjects involved. Social validity of intervention involves addressing: (a) the needs and wants of society, (b) the social appropriateness of intervention procedures, and (c) the acceptability and satisfaction of those who are recipients of the given intervention procedures (Wolf, 1978). Simply stated, in researching effective interventions, researchers need to examine the procedures, skills or behaviors, and results in regards to the subject’s benefits (Wolf, 1978).

Social validity results indicated that all six students enjoyed working together on the reading intervention activities. The results also suggested that the majority of students reported that the word boxes approach was the activity that helped them with reading the most. In addition, all six students reported feeling as though the three activities would be helpful for teaching students to recognize new words. Results also revealed that all five teachers felt as though they were able to see some type of improvement in the student’s word reading performance while participating in the study. All five teachers also reported
feeling as though the three instructional techniques appear to be valid approaches for teaching students with word identification difficulties. However, the majority of teachers seemed to be in favor of the word boxes and interspersing of known items as methods to implement in the classroom. Therefore, upon examining the student and teacher responses, it appears as though all three methods could be considered a socially valid way to assess and teach word reading skills to students identified as having word identification difficulties.

Student Preference

In regards to student choice for conditions in the current study, the word boxes approach was selected by three students, or half of the sample. This approach was followed by two students selecting the traditional drill and practice, and one student selecting the interspersal of known items approach. Student preference was an important concept to evaluate because researchers in the area of choice behavior have found that making assignments briefer or easier and allowing students to choose assignments increases the probability of students choosing to engage in assigned academic work (i.e., Cooke, Guzaukas, Pressley, & Kerr, 1993; Dyer, Dunlap, & Winterling, 1990; Horner & Day, 1991; Kern, Childs, Dunlap, Clarke, & Falk, 1994). Of particular importance is the fact that a large percentage of the researchers examining the interspersal procedure believe that when students are working independently on assignments that require them to complete many discrete tasks, the completion of each task may serve as a reinforcing event (Logan & Skinner, 1998; Skinner, Robinson, Johns, Logan, & Belfiore, 1996).
The current study based student choice on which condition was most liked or enjoyed, as opposed to looking at ease of the tasks. Therefore, given that the students are in the first grade, they were more than likely basing their opinions on the degree of enjoyment, or the amount of fun, associated with the instructional techniques. Interestingly, a significant amount of research in the area of student-choice behavior has found that students tend to prefer assignments that result in more rapid task completion. The finding in the current study regarding choice behavior is inconsistent with this research in that the intervention that was least rapid was found to be the most preferred. These results may suggest that students can be presented with difficult tasks that include challenging information as long as the task or activity is presented in an appealing way.

The current finding that students least prefer the interspersal of known items procedure differs from several previous studies. Specifically, earlier studies conducted by Neef et al. (1980) and Dunlap (1984) as well as others, have found that students demonstrate a preference for the interspersal conditions. However, the results of the current study might possibly relate to the finding that the interspersal technique was neither the most effective nor the most efficient instructional method; thereby, students might have sensed that they were not performing as well with this task and therefore did not prefer the interspersing task over the word boxes or traditional drill tasks.

Comparison to Previous Research Studies

Several comparisons between the current study and previous research studies are of significance. In their study comparing traditional drill, interspersal of known items, and high-p sequencing (another format for task sequencing) on spelling performance,
Cates and colleagues (2003) found no superior benefits to either of the three interventions in terms of effectiveness, or the number of words learned. However, when the amount of instructional time was considered, Cates et al. found the traditional drill and practice procedure to be the most efficient intervention approach. The finding in the present study that the traditional drill procedure was most efficient is consistent with the Cates study. However, clear conclusions cannot be drawn regarding comparisons between the effectiveness and efficiency results due to the use of different instructional techniques.

Cates and colleagues (2003) found the maintenance of mastered words to be closely related to intervention efficiency, as those conditions that resulted in higher mastery rates also resulted in higher maintenance rates. Therefore, Cates et al. argued that their research findings demonstrate how basing decisions on effectiveness data may be poor educational practice that fails to maximize student learning rates. These findings vary from the current study in that maintenance of mastered words was found to be closely related to intervention effectiveness, as opposed to intervention efficiency. In the present study, effectiveness was found to be an important variable not only in terms of maintaining words, but also in terms of generalizing words to a different context subsequent to instruction. Furthermore, the present study included a social validity assessment, which found word boxes (the most effective method in the study) to be one of the most preferred approaches by teachers and students. This finding reinforces the importance of instructional effectiveness in the current study and possibly suggests that an instructional method that is effective may be more beneficial over the course of time.
Several significant differences exist between the current study and the Cates et al. (2003) study that might potentially explain the discrepancy in overall findings. First, the current study looked at word reading performance whereas the Cates study assessed spelling performance. Second, the present study included the phonic analysis method of word boxes whereas the Cates study included only traditional drill and task variation procedures. Third, experimental sessions were conducted over a period of 20 consecutive school days in the current study and 12 consecutive school days in the Cates et al. study. The larger number of experimental sessions might have enabled a clearer pattern to emerge regarding data in the present study. Fourth, unlike the Cates et al. study, the current study included a generalization measure that in turn reinforced the findings regarding the importance of intervention effectiveness and retention. Finally, regardless of the differences between the two studies, definite conclusions cannot be drawn regarding comparisons due to a number of distinct disparities. However, the finding that both studies reported the traditional drill and practice procedure as being the most efficient intervention technique is of notable importance.

Despite previous positive research findings (i.e., Browder & Shear, 1996; Cates & Skinner, 2000; MacQuarrie-Klender and colleagues, 2002; McCurdy, Skinner, Grantham, Watson, & Hindman, 2001; Neef, Iwata, & Page, 1977; Robinson & Skinner, 2002; Skinner, Fletcher, Wildmon, & Belfiore, 1996), the present study failed to make a consistent case for the use of interspersal training. This suggests that in the interspersing condition, where a single known word was presented every third word, adding known words did not significantly impact student learning. There are several possible reasons for
the difference in findings. A ratio of 33% known to 67% unknown items was selected for the current study due to the finding that several authors have concluded that a ratio of 30% new items to 70% review items is optimal across students and curriculum content (i.e., Coulter & Coulter, 1989; Tucker, 1989a). Several previous research studies have presented a larger number of new items to be mastered within the learning set. For example, Neef et al. (1980) used a 50% ratio with 10 new items interspersed within 10 review items. In the varied-with-maintenance task condition, Dunlap (1984) used a total of ten items but 50% were new items. These previous research findings suggest that the results of the interspersal condition in the current study may have been quite different had a different ratio of known to unknown items been implemented.

Implications for Practice

The findings from the current study have several notable implications for educational practitioners and researchers. The results indicate that all three instructional techniques had a positive impact on word reading performance for students identified as having word identification difficulties. Therefore, it is recommended that all three instructional approaches, or a combination of the approaches, be incorporated within a comprehensive literacy program in the classroom. In fact, it may be good practice to implement two approaches that differ in the way that word boxes differs from that of traditional drill or interspersing (i.e., phonic and sight word approaches). In considering this type of approach, teachers would potentially be able to meet a broader range of individual student needs.
The general findings related to instructional effectiveness and efficiency are especially important when recommending word reading instructional techniques to teachers. As the demands on teachers’ time increase, the need for more effective and efficient interventions will also be needed. The present study demonstrated how basing decisions solely on efficiency data may be poor educational practice that fails to maximize student learning. In particular, the intervention that was found to be most efficient was not found to have better rates in terms of maintenance or generalization. These findings suggest that educators may wish to consider specific priorities in relation to their instructional needs, as well as individual student needs, when selecting an intervention. Specifically, when selecting a reading intervention for retention purposes, it may be good practice to consider both the effectiveness and efficiency of an intervention versus relying solely on efficiency.

There are several noteworthy implications for school practitioners related to the use of an alternating treatments design. Due to its applied benefits, Barlow and Hersen (1984) predicted that the alternating treatments design would become one of the most commonly used single-subject research designs. The present study emphasizes many of the advantages related to this type of design. In particular, the alternating treatments design permitted the researcher to determine quickly and empirically whether the three instructional conditions improved the student’s word reading performance. School professionals working to prevent and remediate student problems should consider using this design to scientifically evaluate the effects of their intervention on individual student word reading performance.
Limitations

There are several limitations associated with the current study. First, the students were selected for the intervention, therefore, random sampling was not a part of the research study. Due to the lack of random sampling, the study cannot be generalized beyond the sample population. In addition, the method of selecting students (i.e., must be having difficulty with word identification as reported by the DIBELS assessment) also impacts the generality of findings to other populations. It may be reasonable; however, to generalize to other first grade populations that are similar to the population being studied. A second limitation is that a sample size of six students greatly reduces the external validity of the study. It is unclear as to the extent to which other individuals would display similar learning rates under the various conditions. Third, the only academic area investigated in this study was word reading. Therefore, the extent to which the findings would generalize across curricula is unclear. Fourth, one concern when presenting several alternating treatments is that exposure to one treatment may impact the student’s performance in other conditions (Barlow & Hersen, 1984). McCurdy and colleagues (2001) reported that alternating treatments designs lend themselves to multiple treatment interface (e.g., carryover effects, practice effects, fatigue, primacy effects, recency effects, and contrast effects). These effects could be reduced in future research studies by employing long intervals between conditions. A final limitation of the study was the population from which the sample was taken. The elementary school contained very little racial diversity, consisting of an overwhelmingly majority of middle and upper-class Caucasian families. This limited sampling was representative of the district in which this
study took place, however, it may not have been equivocal to the population of the United States. For better generalization, one may want to choose a more diverse population in which to conduct a similar study.

**Directions for Future Research**

Due to the fact that the only academic area investigated in the current study was word reading, the extent to which the findings would generalize across curricula is unclear. Therefore, future research may wish to examine the extent to which findings generalize across academic subject areas. The current study examined two sight word approaches and one phonic approach in terms of instructional effectiveness and efficiency. In a certain respect, the current study highlighted the need for intervention comparison between phonic and whole word approaches. Researchers should consider investigating these two approaches in future research studies. Currently, there is very little data examining the relationship between intervention effectiveness and efficiency and to what degree these two components may be a trade off of one another. In particular, it is feasible to have an intervention that is highly effective, yet requires a great deal of time and/or effort to implement. Similarly, it is feasible to have an intervention that is less effective and requires very little time/effort to implement.

Researchers should also consider comparing the effects of the three instructional procedures used in the present study (TDP, IST, and WB) with other procedures that increase rates of word reading, as this type of investigation may help in clarifying the variable(s) responsible for the effectiveness and efficiency of these procedures. In particular, researchers may wish to consider using the incremental rehearsal instructional
technique in place of the interspersal technique used in the current study, as incremental rehearsal has been found to enhance generalization and more accurate recall (Roberts, Turco, & Shapiro, 1991) as well as retention and time on-task (Burns & Dean, 2002).

Tucker (1989b) introduced a model termed incremental rehearsal, in which unknown items are interspersed among known items to teach a drill task. Unlike the interspersal training procedure used for the current study, incremental rehearsal introduces one new item at a time. Furthermore, incremental rehearsal uses a high repetition of words, a gradual introduction of unknown items, high rate of success due to the high number of known material, and enough spacing to move unknown from short-term to long-term memory (MacQuarrie et al., 2002). According to MacQuarrie and colleagues, several repetitions of new words are achieved by presenting the new word, pronouncing it, and defining and using the new word in a sentence. After the initial instruction, the new word is rehearsed nine times using a set pattern (See MacQuarrie et al., 2002). After completing the first word, a second unknown word is introduced by treating the previous unknown word as the first known, removing the previous ninth known word, and starting the sequence over again. However, the ratio of unknown to known words remains with Tucker’s model of 10% unknown and 90% known. Finally, future research should continue to examine matching intervention to student needs, as this is an ongoing area of concern.

Summary

Results showed positive effects for all three conditions in regards to enhancing the word reading performance of students in the study. Specifically, the results of the study
indicated that the word boxes approach was most effective and the traditional drill and practice approach was most efficient in terms of increasing word reading performance. Results of the study also suggested that none of the three instructional approaches was statistically more effective in terms of student’s ability to “maintain” and “generalize” newly acquired words. Students demonstrated a preference for the word boxes approach as compared to the traditional drill and interspersing methods. Additionally, social validity results indicated that all three instructional methods are a socially valid way to assess and teach word reading skills to students identified as having word identification difficulties.
APPENDIX A

LETTER REQUESTING PARENTAL/GUARDIAN PERMISSION
Dear Parent(s)/Guardian(s),

Your child has the opportunity to participate in a reading intervention study lead by Dr. Laurice Joseph, a professor at The Ohio State University, and Melissa Schmidgall, a doctoral student in the School Psychology program at The Ohio State University. The study is designed to enhance your child’s learning rate in the area of word recognition. Specifically, your child is invited to participate in three word reading intervention activities: drill and practice of unknown words, interspersal training (presenting one word that your child knows prior to every third target or “unknown” word), and a phonic analysis or “sounding out” approach with unknown words.

If you decide to allow your child to participate, Melissa will meet with your child on an individual basis five days a week for a period of approximately five weeks. The intervention activities are designed to be brief and will only require your child to miss approximately twenty-five minutes of class time each day. The primary goal of the study is to determine which of the three interventions is most effective in helping children to increase their word reading learning rate.

The study will take place in the XXXXX XXXX XXX School District. All identifying information will be kept confidential. Students will be given a code number so that names will not be used on any documents. Participation in this study is completely voluntary, and you have the right to remove your child from participating at any time without prejudice. A summary of the results for your child will be provided to you upon completion of the intervention sessions.

We hope that you will find this experience valuable for your child. A letter of consent has been included and will need to be signed and returned by Friday, February 18th if you are interested in participating. If you have any questions please feel free to contact Melissa Schmidgall at XXX-XXXX or Dr. Laurice Joseph at XXX-XXXX. Thank you for your consideration.

Sincerely,

Laurice Joseph, Ph.D.
Melissa Schmidgall, M.S.
APPENDIX B

CONSENT FOR PARTICIPATION IN SOCIAL AND BEHAVIORAL RESEARCH
CONSENT FOR PARTICIPATION IN RESEARCH

I consent to my child's participation in the study entitled: The Effects of Three Instructional Approaches on Student Word Reading Performance.

Dr. Laurice Joseph, Principal Investigator, or her authorized representative Melissa Schmidgall have provided information regarding the purpose of the study, the procedures to be followed, and the expected duration of my child’s participation. Possible benefits of the study have been described, as have alternative procedures, if such procedures are applicable and available.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Furthermore, I understand that my child is free to withdraw consent at any time and to discontinue participation in the study without prejudice.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: _______________________________

Signed: ____________________________________

(Participant)

Signed: _______________________________

(Principal Investigator or his/her authorized representative)

Signed: _______________________________

(Person authorized to consent for participant, if required)

Witness: _______________________________

________________________________________
APPENDIX C

INTERVENTION SCRIPTS
Intervention Scripts

Traditional Drill & Practice (TDP):
Examiner starts stopwatch.
“I am going to read some words so listen carefully as I read each word because I’m going to ask you to read it after me” Examiner reads aloud each of the six target words and asks the student to repeat the word by saying, “Now you read it”, before moving on to the next.
If correct, “Nice work, good job”
If incorrect, “listen again...” and the examiner repeats the word.
Examiner shuffles the index cards for random ordering.
“Now, we’re going to go through the words again, only this time you will be reading them by yourself. Don’t worry if you don’t know a word, we’ll just skip past it and keep going.”
“Ready?” Examiner shows each of the index cards one by one to the student.
If correct, “Nice work, good job, etc.”
If incorrect, examiner ignores the response.
Examiner shuffles the index cards again for random ordering.
“Now we’re going to go through the words one more time”
“Ready?”
If correct, “Nice work, good job, etc.”
If incorrect, examiner ignores the response.
Examiner stops stopwatch.

Interspersal of Known Items (IST):
Examiner starts stopwatch.
“I am going to read some words so listen carefully as I read each word because I’m going to ask you to read it after me” Examiner reads aloud each of the six UNKNOWN words and asks the student to repeat the word by saying, “Now you read it”, before moving on to the next.
If correct, “Nice work, good job”
If incorrect, “listen again...” and the examiner repeats the word.
Examiner adds in the three KNOWN words and shuffles the index cards for random ordering, but ensures that the KNOWN words are in the 1st, 5th, and 9th positions.
“Now, we’re going to go through the words again, only this time you will be reading them by yourself. Don’t worry if you don’t know a word, we’ll just skip past it and keep going.”
“Ready?” Examiner shows each of the index cards one by one to the student.
If correct, “Nice work, good job, etc.”
If incorrect, examiner ignores the response.
Examiner shuffles the index cards again for random ordering, but ensures that the known
words remain in the 1st, 5th, and 9th positions.

“Now we’re going to go through the words one more time”

“Ready?”

If correct, “Nice work, good job, etc.”

If incorrect, examiner ignores the response.

Examiner stops stopwatch.

Word Boxes (WB):

Examiner starts stopwatch.

Examiner places letters below the respective boxes and then says, “Watch me”

The examiner moves each letter up into it’s respective box as it is pronounced “/s/ /u/ /n/”

Examiner then runs finger underneath the boxes while saying the word quickly as a whole, “sun”.

Examiner removes the magnetic letters and places them below the respective boxes again.

Examiner then prompts the student to repeat the process by saying, “Now you do it.”

“Say the word slowly as you move the letters into their boxes, then run your finger under the magnetic board like this (examiner demonstrates) while you say the whole word quickly.”

If correct, “Nice work, good job”

If incorrect, “Watch me again...” and the examiner repeats the process.

Examiner goes through each of the six target words using this process.

“Now, we’re going to go through the words again, only this time they will be on flash cards and you will be reading them by yourself. Don’t worry if you don’t know a word, we’ll just skip past it and keep going.”

“Ready?” Examiner shows each of the index cards one by one to the student.

If correct, “Nice work, good job, etc.”

If incorrect, examiner ignores the response.

Examiner shuffles the index cards again for random ordering.

“Now we’re going to go through the words one more time”

“Ready?”

If correct, “Nice work, good job, etc.”

If incorrect, examiner ignores the response.

Examiner stops stopwatch.
APPENDIX D

SESSION PROTOCOL FORMS
SESSION PROTOCOL

Student ID#____________________________

Session Number ________________________

Order of Conditions _____________________

Session Observed? ______________________

Traditional Drill and Practice (TDP):

<table>
<thead>
<tr>
<th></th>
<th>First Response</th>
<th>Correct Response?</th>
<th></th>
<th>Second Response</th>
<th>Correct Response?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of minutes ___________

Number of mastered words: _______

Known words:

Unknown words to be used for the next session:
Student ID# _________

Word Boxes (WB):

<table>
<thead>
<tr>
<th>First Response</th>
<th>Correct Response?</th>
<th>Correct Response?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of minutes ___________

Number of mastered words: ______

Unknown words to be used for the next session:

Interspersing (IST):

<table>
<thead>
<tr>
<th>First Response</th>
<th>Correct Response?</th>
<th>Correct Response?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>1. (K)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. (U)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. (U)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. (U)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. (K)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. (U)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Interspersing (IST):**

<table>
<thead>
<tr>
<th></th>
<th>Correct Response?</th>
<th></th>
<th>Correct Response?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>First Response</strong></td>
<td></td>
<td></td>
<td><strong>Second Response</strong></td>
</tr>
<tr>
<td>7. (U)</td>
<td>___</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>8. (U)</td>
<td>___</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>9. (K)</td>
<td>___</td>
<td>___</td>
<td></td>
</tr>
</tbody>
</table>

* K denotes a known word
* U denotes an unknown word

Number of minutes ___________

Number of mastered words: _______

Unknown words to be used for the next session:
APPENDIX E

TREATMENT INTEGRITY CHECKLISTS
TRADITIONAL DRILL & PRACTICE  
Treatment Integrity Checklist

Student ID # ______________________________

Date ____________________________________

Observer ________________________________

Instructional Material Used:  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.  3 x 5 index cards were used</td>
<td></td>
</tr>
</tbody>
</table>

Procedure:  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Read each word to the student and asked the student to repeat each word before moving to the next</td>
<td></td>
</tr>
<tr>
<td>2. Shuffled index cards for random ordering</td>
<td></td>
</tr>
<tr>
<td>3. Presented the student with the first trial of words</td>
<td></td>
</tr>
<tr>
<td>4. Provided appropriate feedback contingent upon response accuracy (e.g., “Good job,” “Nice Work” for correct responses)</td>
<td></td>
</tr>
<tr>
<td>5. Shuffled index cards for random ordering</td>
<td></td>
</tr>
<tr>
<td>6. Administered the second trial of the six words</td>
<td></td>
</tr>
<tr>
<td>7. Provided appropriate feedback contingent upon response accuracy for the second trial</td>
<td></td>
</tr>
<tr>
<td>8. Kept a record of correct and incorrect responses</td>
<td></td>
</tr>
<tr>
<td>9. Timed the condition</td>
<td></td>
</tr>
</tbody>
</table>
### Treatment Integrity Checklist

**Student ID #____________________________**

**Date ____________________________________**

**Observer ______________________________**

---

**Instructional Material Used:**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. 3 x 5 index cards were used

---

**Procedure:**

**The researcher:**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Read each *unknown* word to the student and asked the student to repeat each word before moving to the next

2. Shuffled the index cards for random ordering but kept the *known* words in the 1st, 5th, and 9th spots

3. Presented the student with the first trial of words

3. Provided appropriate feedback contingent upon response accuracy (e.g., “Good job,” “Nice Work” for correct responses)

4. Shuffled the index cards for random ordering but kept the *known* words in the 1st, 5th, and 9th spots

5. Administered the second trial of the six words

6. Provided appropriate feedback contingent upon response accuracy for the second trial

7. Kept a record of correct and incorrect responses

8. Timed the condition
WORD BOXES
Treatment Integrity Checklist

Subject ID# ____________________________
Date ____________________________________

Instructional Material Used: 

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Magnetic board with divided boxes was used</td>
<td></td>
</tr>
<tr>
<td>3. Magnetic letters were used</td>
<td></td>
</tr>
<tr>
<td>4. 3 x 5 index cards were used</td>
<td></td>
</tr>
</tbody>
</table>

Procedure:

The researcher:

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Placed the appropriate letters below the corresponding boxes</td>
<td></td>
</tr>
<tr>
<td>2. Slowly articulated the word while pushing the letters into respective divided boxes</td>
<td></td>
</tr>
<tr>
<td>3. Read the word aloud to the student while running finger under the boxes</td>
<td></td>
</tr>
<tr>
<td>4. Placed the magnetic letters for the word under the boxes and prompted the student to repeat the process himself/herself</td>
<td></td>
</tr>
<tr>
<td>5. Presented the student with the first trial of words</td>
<td></td>
</tr>
<tr>
<td>6. Provided appropriate feedback contingent upon response accuracy (e.g., “Good job,” “Nice Work” for correct responses)</td>
<td></td>
</tr>
<tr>
<td>7. Shuffled the index cards for random ordering</td>
<td></td>
</tr>
<tr>
<td>8. Presented the student with the second trial of words</td>
<td></td>
</tr>
<tr>
<td>9. Kept a record of correct and incorrect responses</td>
<td></td>
</tr>
<tr>
<td>10. Timed the condition</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

STUDENT QUESTIONS TO ASSESS SOCIAL VALIDITY
STUDENT QUESTIONS

Name ________________________

1. Did you like working together?

2. Did working together help you with learning new words?

3. Did working together help you with your reading?

4. Which of the three activities that we did together did you like the best?

5. Which of the three activities that we did together did you like the least?

6. Which of the three activities do you think helped you read the most?

7. Do you think that the three activities that we did together seem to be helpful for teaching students new words?
APPENDIX G

TEACHER QUESTIONS TO ASSESS SOCIAL VALIDITY
TEACHER QUESTIONS

Name __________________________

1. Did you notice any difference in the student’s word reading performance while he or she was participating in the study?

2. Upon examining the description of each intervention, which of the three instructional methods used do you think students would find most enjoyable and why?

3. Of the three instructional methods used, which do you think would be most efficient in enhancing student word reading performance?

4. Of the three instructional methods used, which do you think would be most effective in enhancing student word reading performance?

5. Do you feel as though the three instructional methods appear to be valid approaches, or appropriate approaches, for teaching words to students with word identification difficulties?

6. Are there any suggestions that you have regarding changing/improving the three approaches used in the study?

7. Which methods would you consider using in the classroom as part of your instruction to teach word reading?
BIBLIOGRAPHY


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