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Word Identification Strategies for Learners with Reading Disabilities

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Chapter 1: Introduction

The ability to read is possibly one of the most accurate predictors of future success in this country. Unfortunately, between 20-30% of school-aged children experience difficulty learning to read—which is roughly one out of every five children in the average-size classroom (Lyon, 1999). These children are more likely to experience school failure and are far more likely to drop out of high school (Paul, 2012). Included among these numbers are students with learning disabilities (LD) who experience even greater challenges learning to read. Sixty-nine percent of secondary students with LD have failed one or more courses, compared to 47% of students in general education (Cortiella & Horowitz, 2014).

In the United States, approximately 2.4 million school-aged children—roughly 5%—are identified as having a Specific Learning Disability (SLD). Of these students, 66% are boys and 80% are students identified with a learning disability in reading. Nearly half of all children who receive special education services fall into this disability category (Cortiella & Horowitz, 2014).

Word identification is the ability to recognize and analyze a printed word, make meaning of it, and understand its context in a sentence. This skill enables the reader to comprehend text, which is the ultimate goal of reading (National Reading Panel, 2000). Unfortunately, many learners who struggle to read lack word identification skills. To learn these skills, students with learning and reading disabilities must receive explicit, systematic, and individualized instruction (Spencer & Manis, 2010). In this paper, I review the most current literature evaluating instructional methods and strategies for teaching word identification skills to students with learning disabilities.

The Core Elements of Reading Instruction

In response to the growing number of students identified with reading delays and/or disabilities, the National Reading Panel (NRP) was formed in 2000. The NRP consisted of 14 members who gathered information from a database consisting of public records and regional hearings. The NRP (2000) identified five core elements in reading instruction: phonemic awareness, phonics, fluency, vocabulary, and text comprehension. A well-designed reading program incorporates all of these elements to gather meaning from text. Phonemic awareness and phonics are considered the first two pillars. Early reading programs begin with these foundational skills. Each core element builds upon the next. Phonemic awareness and phonics skills need to be solidified before growth is seen in the areas of vocabulary acquisition, fluency, and comprehension (NRP, 2000). For the purpose of this literature review, I focused on these two foundational skills.

Phonemic awareness. Phonemic awareness is the ability to hear and manipulate the individual phonemes, or sounds, within a word (Shanahan, 2006). Six tasks are commonly used to assess phonemic awareness: isolation, identity, categorization, blending, segmentation, and deletion.

1. *Phoneme isolation* is the ability to recognize individual sounds in a spoken word; for example, "Tell me the last sound you hear in the word *bed."* (/d/)
2. *Phoneme identity* involves identifying the common sound when given three different words; for example, "Tell me the sound that is the same in all three words, *fix, fall, fun*." (/f/)

3. *Phoneme categorization* requires students to identify the word that does not belong in a set of three words; for example, "Which word is the oddball, it doesn't belong, *can, cap, bed.*" (bed)
4. *Phoneme blending* consists of identifying a word when the sounds are segmented or broken apart; for example, "What is this word, /f/ /l/ /ow/ /er/?" (flower)
5. *Phoneme segmentation* is the reverse of phoneme blending. The examiner gives the word as a whole, and the student must break it into its individual phonemes by clapping or counting the sounds; for example, "How many sounds do you hear in the word *thin*?" (three)
6. *Phoneme deletion* requires the student to identify what word remains when a sound is removed from the word, either at the beginning or end; for example, "Say *sheet*…now say it again without the /sh/." (eat) (NRP, 2000)

Because the English writing system is alphabetic in nature, phonemic awareness is believed to be the foundation for learning to read well. However, it can be the most difficult for young children who cannot hear the individual phonemes. For the typical learner, this can be accomplished rather effortlessly, just as our lungs fill with air and we exhale. For someone with a learning disability in reading, this can be a rather daunting task (Spencer & Manis, 2010). Thus, explicit instruction to discover phonemic units is required.

Phonics. The second foundational skill is phonics. Through letter-sound correspondence, individual letter sounds are identified and then blended to create words. This skill is called decoding. Without established letter/sound correspondence, children do not have the necessary skills to decode unknown words (Wise et al., 2008). When students struggle to

decode words, they are unable to maintain the focus required to gain meaning from text (Ayala & O'Connor, 2013).

Phonics instruction is particularly effective when taught to young children between kindergarten and sixth grade. To be effective, it should be taught explicitly and systematically (NRP, 2000). The NRP identified six approaches for teaching phonics: synthetic phonics, analytic phonics, embedded phonics, analogy phonics, onset-rime phonics, and phonics through spelling.

1. Synthetic phonics instruction teaches the student to convert letters to sounds and then blend the sounds to form real words.
2. Analytic phonics does not ask the student to pronounce the sounds in isolation, but rather students are taught to analyze letter sound relationships after the word is identified.
3. Embedded phonics teaches the student to use sound-letter correspondence along with context clues within the text of a reading passage to identify unknown words.
4. Analogy phonics instruction teaches children to look for parts within a word that they already know to identify the unknown word.
5. Onset-rime phonics instruction involves analysis of and submission of word parts from known words to unknown by identifying the word family, the rime, and substituting the initial sound, or onset (Hines, 2009).
6. Phonics through spelling teaches children to sound out words phonetically and transcribe them into letters to make words.

Difficulties in learning phonemic awareness and phonics can directly affect the acquisition of skills in fluency, vocabulary, and text comprehension. Each skill builds on the other (NRP, 2000). Several different teaching approaches have been recommended as the best way to teach these skill areas. Three are discussed in the next section.

Theories of Reading Acquisition

The capacity to acquire basic reading skills is not a natural process; it is a learned process (Lyon, 1999). Three different schools of thought have emerged as to how children should be taught to read: constructivism, direct instruction, and balanced literacy. Although there is evidence supporting each of these approaches, there is considerable debate as to which is the best for students with learning disabilities (Bomengen, 2010).

Constructivism. Constructivists believe educational practices should be "student-focused, meaning-based, process-oriented, interactive, and responsive to students' personal interests and needs" (Johnson, 2004, p. 72). Constructivists believe in *whole language learning* that consists of seven critical elements: phonological processing, sight word vocabulary, reading comprehension, student assessment, use of whole pieces of literature, integration of literacy and language development, and student motivation through self-selected, functional learning activities (Johnson, 2004). Constructivism focuses more on process rather than product. "Prescribed curriculum" and scripted lessons are considered "dehumanizing" because the power is shifted from the child to the lesson materials (Johnson, 2004, p. 75). Classrooms that have adopted a constructivist approach to reading boast high levels of student engagement and motivation for learning (Fisher, 1991).

Direct instruction. In contrast to the constructivist theory, the *Direct Instruction* approach endorses mastery of reading through explicit teaching involving "fast-paced, scripted, well-sequenced, rule-based, and highly focused lessons" (Shippen, Houchins, Steventon, & Sartor, 2005, p. 176). Unlike direct instruction techniques that use explicit teaching strategies along with other resources, *Direct Instruction* is a packaged curriculum that delivers instruction in small groups with opportunities to respond both individually and chorally. Developed by Siegfried Engelmann, it is a three-step instructional prototype involving modeling (providing the correct response), leading (the student says the correct answer along with the teacher), and testing (giving immediate feedback). In 2003, Borman, Overman, and Brown conducted a meta-analysis of successful reading reform models and considered *Direct Instruction* within the top three of the 29 reviewed for its effectiveness with at-risk learners in urban and low-performing schools (as cited in Shippen et al., 2005).

However, Direct Instruction has been the focus of intense criticism. Shippen et al. (2005) reported that as several schools across the country adopted this model in an attempt to reform their reading programs, critics claimed the rigid programming "suppresses teacher creativity and promotes passive learning" (Shippen et al., 2005, p. 177). Others have claimed it is racist and dismissed direct instruction as a "pedagogy for the poor" (Louden, 2014, p. 1). Siegfried Engelmann, author of many direct instruction programs, defends such claims by inviting skeptics to investigate the plethora of research that supports the effectiveness direct instruction has had on students who are struggling readers (Adams & Engelmann, 1996).

Balanced literacy. A third approach, balanced literacy, weaves components from both whole language and direct instruction (Mermelstein, 2013). Balanced literacy's framework

incorporates five components: the read-aloud strategy, guided reading, shared reading, independent reading, and word study.

1. During the *read aloud*, the teacher reads aloud to the class, modeling correct strategies and behaviors. Students experience reading aloud with expression and rhythm. Listening comprehension is fostered as children witness the joys of reading (Carnahan, Williamson, Hollingshead, & Israel, 2012).
2. Within *guided reading* are students working in small groups that are focused on specific skills. Students are seated at a table with their own book. Teachers incorporate lessons that are individualized to students' identified needs.
3. *Shared reading* includes students and teachers reading together creating naturally occurring opportunities to expand vocabulary and activate background knowledge.
4. During *independent reading* time, students are offered the opportunity to read a book of their choice. By setting aside time for self-selected reading, teachers guide students in discovering reading is an enjoyable and important skill.
5. *Word study* involves teaching students letter sound correspondence through engaging and often hands-on activities. Skills taught in this component include root words, suffixes and prefixes, and word analysis to gain meaning of the word (Mermelstein, 2013).

Summary. For decades, educators have engaged in heated controversy over the best approach to reading instruction. As educators strive to improve reading outcomes for children, they will continue to conduct research on this important topic and design strategies and interventions that have a strong evidence base.

Research Question

One question guided this literature review: Which word identification strategies are effective in teaching literacy skills to students with reading disabilities?

Focus of Paper

The literature review includes 10 studies published between 2005 and 2014 that examine the effects of word identification or decoding interventions on elementary students with reading disabilities or who are considered at-risk for a learning disability. Participants in the Chapter II studies included students in first through fifth grade. All students included were identified as either having a reading disability or being at-risk for a reading disability. All quantitative studies were limited to those conducted in the United States.

I began my search using the Academic Search premier and PsychINFO databases. I used a variety of keywords and keyword combinations to find appropriate studies, including *learning disabilities, reading interventions, decoding, dyslexia, phonemic awareness, and word identification.* To locate additional current information on decoding interventions, I also conducted a search of the tables of contents in four journals from 2005 to 2014: *Journal of Learning Disabilities, Journal of Educational Psychology, Learning Disabilities: Research & Practice, and Journal of Reading.*

Importance of the Topic

The negative social and emotional ramifications of struggling readers are cumulative over time. At the elementary level, children are embarrassed when they discover classmates reading with ease. This produces feelings of shame and humiliation, which can lead to decreased motivation and low self-esteem. By eighth grade, 65% of students identified with a reading

disability read below the 20th percentile (National Center for Education Statistics, 2007). As adolescents, students who do not read with proficiency are more likely to drop out of high school.

I work with elementary school students in a special education pull-out resource model. Many of our students make slow and steady growth, whereas others who have more significant information processing deficits make little gains. I have been searching for effective interventions that are more intensive in nature and that target students who have not responded well to traditional interventions and reading strategies. In other words, I want to help those students who seem to have "hit a wall." With the pressure to meet Annual Yearly Progress goals and improve on high stakes state tests, I feel it is essential to critically evaluate the most current research supporting the interventions and strategies presently available.

Definitions

Acquisition rate. The amount of information a student can successfully rehearse and later recall without error (Burns & Dean, 2005).

Decoding. The process of using letter-sound correspondence to accurately sound out and read regularly spelled words (Vadasy, Sanders, & Peyton, 2005).

Dyslexia. A disorder in which the person presents difficulties in "accurate and/or fluent word recognition and by poor spelling" abilities (Torgesen, Wagner, Rashotte, Herron, & Lindamood, 2009, p. 41).

Effect size. The key feature of a meta-analysis, the researcher translates the results of a study numerically as a way of describing the strength of an intervention when comparing an experimental group to a control group. A large effect size (ex. .80), would indicate the

experimental group performed better, on average, than the control group (Gay, Mills, & Airasian, 2006).

Far transfer. When a student transfers their ability to decode words from their instructional intervention to novel words which have not been directly taught and do not follow previously learned rime patterns (Hines, 2009).

Near transfer. When a student transfers their ability to decode words from their instructional intervention to novel words which follow the same rime patterns (Hines, 2009).

Onset-rime. Onsets and rimes are two parts of a spoken syllable. The onset is the first consonant sound in a word (ex. the *f* in *fun*). The rime is the vowel and consonant, which come after the onset (ex. *un* in *fun*) (Hines, 2009).

Percentage of non-overlapping data (PND). A calculation used to determine the effects of an intervention. PND is calculated by taking the "number of data points above each student's highest individual baseline score during the intervention phase" divided by the total number of data points. Students whose PND ranged from 70-90% on each measure were considered to have a positive response to the intervention (Ayala & O'Connor, 2013, p. 147).

Phonics. The ability to identify a relationship between phonemes, spoken language and the letters they represent (Tankersley, 2003).

Phonological awareness. The ability to recognize that words are made by combining sound units or chunks (onsets and rimes). Rhyming is used to assess phonological awareness (Torgesen et al., 2009).

Rapid naming or rapid automatized naming (RAN). An assessment used to measure one's speed in naming letters, numbers, or objects. RAN is used to compare how quickly a

person can make an association between something they see and what it means (Torgesen et al., 2009).

Response to intervention. RtI is a three-tiered approach to teaching. Tier I is considered high quality instruction imbedded into general education curriculum. Tier II is considered for students not making adequate progress in an area such as reading or math. It is small group instruction centered on the skills the students in that group are missing. Tier III is individualized and may be a 1:1 teacher-student setting of intensive instruction in the area of greatest need (Niedringhaus, 2013).

Specific learning disability. SLD is a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such term includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such term does not include a learning problem that is primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage (Cortiella & Horowitz, 2014).

Syntax. A set of rules that sentences must follow to convey logical meaning (Anderson, Hiebert, Scott, & Wilkenson, 1985).

Word identification. Recognizing a word in print using letter-sound correspondence, syntax, and context clues from the text (Anderson et al., 1985).

Chapter 2: Review of the Literature

The purpose of this literature review was to examine which word identification strategies and interventions improve the reading skills of young learners who have a reading disability or are considered to be at risk for having a learning disability (LD) in reading. Chapter 2 is divided into two sections: interventions and strategies using traditional teaching materials and interventions and strategies using assistive technology, such as a computer program.

Traditional Reading Interventions

This section reviews six studies using traditional reading methods. Traditional reading methods examined in this section include letter cards, word cards, word lists, and decodable books.

Vadasy et al. (2005) investigated the effects of two different word study approaches on reading acquisition. Participants consisted of 57 first-grade students scoring in the lowest quartile for reading skills on a pretest conducted during the first month of school. Students were recruited from 12 urban schools in the same northwest school district and included English language learners and special education students. The researchers used *Sound Partners* phonics instruction in two treatment groups (Word Study and Reading Practice) and compared them with a no-treatment control group. Each group received general education reading instruction, and the two treatment groups received an additional 30 minutes of supplemental tutoring with a trained paraprofessional in a 1:1 setting.

The Word Study group spent 15-20 minutes with *Sound Partners* phonics instruction. Students worked on letter-sound correspondence, decoding, segmenting, spelling and sight words. This was followed by an additional 10-15 minutes of more intensive word study practice

that included more drill and practice with letter sounds and identifying words with vowel patterns such as *silent-e,* two-letter consonant and vowel combinations, and reading word lists containing sight words and decodable words. Over the course of the intervention the tutor introduced more complicated words and provided extra practice on reading and spelling decodable real words and nonsense words to reinforce letter-sound correspondence.

The Reading Practice group followed an identical format to the word study group for the first 15-20 minutes using *Sound Partners.* Instead of an intensive word study treatment, this group spent the remaining 10-15 minutes orally reading story books with words that corresponded to the lessons used in *Sound Partners.* Students spent the remainder of time either in *independent reading*, where the student reads all or most of the words; *partner reading*, where two students take turns reading with the tutor; or *echo reading*, where the tutor reads a sentence and then the student reads the same sentence. Over the course of the 8-month study, the Reading Practice group was exposed to a total of 4,901 words compared to the word study group, which was exposed to a total of 720 words.

This study followed a pretest/posttest design using information from the *Peabody Picture Vocabulary Test-IIA* (Dunn, Dunn, & Dunn, 1997), a 1-minute timing of letter names and letter sounds, a phonological measure from the *Comprehensive Test of Phonological Processing* (Wagner, Torgeson, & Rashotte, 1999), a reading accuracy test using three different reading measures, and a spelling test. The treatment groups were also assessed for attention during tutoring sessions using a rating scale.

Posttest analysis of the treatment groups compared to the control group showed significant effects on all posttest skills, with the exception of reading efficiency. Effect sizes

ranged from .43 to 1.33. The students who were in the Reading Practice group had a significantly higher mean reading fluency rate of 35 correct words per minute (wpm) compared to 27 correct wpm in the Word Study group. Individual posttest results showed significant treatment effects for all measures, excluding only reading fluency rate when reading passages. When comparing the two treatment groups, the only notable difference was between reading passage fluency and accuracy. Researchers did not find expected advantages in reading or spelling accuracy in the Word Study group.

The researchers concluded the study supports prior research indicating positive outcomes from supplemental explicit word-identification instruction in a 1:1 setting. Researchers also noted the importance of oral reading practice in a supplemental instructional setting with better outcomes in reading rate and spelling accuracy compared to word study alone.

The researchers listed lack of comparison of classroom instruction to the intervention and records of outside reading time as possible limitations. The tutors did not record the number of times students reread books or sight words during the intervention in the reading practice group. Researchers only used decodable books in this study and did not compare outcomes when using non-decodable books.

Schwartz (2005) investigated the effectiveness of *Reading Recovery,* an early intervention program designed for the lowest achieving first-grade students. *Reading Recovery* employs a specific lesson design with 1:1 instruction during daily 30-minute lessons. Thirty-seven teachers from 14 different states participated in this study. Each teacher submitted names of two at-risk students for the experimental group and names of one low-average student and one high-average student for the control groups.

The first round of *Reading Recovery* started at the beginning of the year, and the second round started at the transition mid-year period. Students were randomly assigned to either first or second round. In addition to the intervention, each student received classroom literacy instruction as well as other typical literacy supports. At the conclusion of the two rounds, the teacher submitted end-of-year data for all participants.

The *Observation Survey of Early Literacy Achievement* (Clay, 1993) was implemented to assess pre-post data. At mid-year and at the end of the year, an additional round of assessments were conducted that included the *Yopp-Singer Phoneme Segmentation Task* (Yopp, 1988), a sound deletion task, the *Slossen Oral Reading Test-Revised* (Nicholson, 1990), and the *Degrees of Reading Power Test* (Touchstone Applied Science Associates, 2000).

A 4 x 3 repeated measures ANOVA to examine the effectiveness of the intervention with the four groups included in this study: first round, second round, low-average, and high-average. Treatment effects from the *Observation Survey* measure were significant at the transition period in the areas of text level, letter identification, word identification, concepts about print, and vocabulary. This demonstrates that reading gains were a result of the intervention. The first-round group scored higher in most areas compared to the control low-average group and the second-round group that had not yet received the intervention. At the end-of-year assessment, results from the *Observation Survey* indicated the first-round group continued to score higher in the Text Level subtest (17 compared to 14 in the second-round group and 15 in the low-average control group). On the *Slossen*, oral reading measures for the first-round group had a mean of 49.38 (SD = 26.95) compared to the second-round group's mean score of 39.30 (SD = 17.82) and the low-average control group mean of 44.89 (SD = 21.36). Phoneme deletion was the only area

in which the second-round students performed better than the first round and low-average students at the end-of-year assessment.

Overall, the two intervention groups were able to close the gap in word identification skills when compared to the low-average group. This was particularly evident for the Text Level measure, which reflected that the two intervention groups were just four reading levels below their high-average peers at the end of the school year compared to the low-average group that scored six reading levels below their high-average peers.

The researcher noted lack of a double-blind design as a limitation of the study. Teachers' knowledge of treatment conditions may have caused bias. Reading Recovery guidelines call for another trained teacher to conduct the testing without knowledge of the treatment conditions.

Mathes et al. (2005) compared two word identification interventions for struggling readers in first grade: *Proactive Reading* and *Responsive Reading*. They implemented their study in six schools in a large district in Texas over the course of 2 years. Students were from both the general education and special education population, but did not include students with limited English proficiency or students in self-contained special education classrooms. Once students were identified as at-risk readers, they were randomly assigned to one of three conditions: enhanced classroom + Proactive Reading, enhanced classroom + Responsive Reading, or enhanced classroom only. A total of 78 students were in the *Proactive Reading* group, 83 students were in the *Responsive Reading* group, 91 students were in the at-risk enhanced classroom condition, and 94 students were typically achieving students and received regular general education instruction.

Proactive Reading is a direct instruction model which follows the behavior theory approach to learning. In this structured and systematic reading approach, teachers shape student behavior using praise and rewards, and students master basic skills before moving on to more difficult tasks. Students spend most of their time learning skills and reading words in isolation. The main writing component was practicing words they had learned in isolation.

Responsive Reading is a reading intervention that follows the cognitive theory model. The teacher must explicitly model strategies, coach, and then fade supports as students apply what they have learned in reading activities. It is similar in nature to the guided reading model, but differs in that guided reading is more explicit in teaching pre-reading skills. Students read leveled text rather than decodable text. The majority of time is spent applying strategies and skills to reading text and writing sentences about their experiences that are connected to the lessons.

Although the two interventions covered much of the same content, instructional methods were different, reflecting the two distinct theories of learning on which they were based. Both interventions were supplemental to the typical classroom instruction, and outcomes were evaluated to determine which approach had a greater impact on struggling readers.

Students met in groups of three, 5 days a week, for 40 minutes of intervention from October to May. Students were assessed four times per year at 2-month intervals on phonological awareness, rapid automatized naming of letters, untimed word reading, word reading fluency, non-word reading fluency, and passage reading fluency. At the end of the year, a battery of posttests included the Word Attack, Word Identification, Passage Comprehension, Spelling, and Calculations subtests of the *Woodcock Johnson III* (WJ-III; Woodcock, Shrank,

McGrew, & Mather, 2001), the *Comprehensive Assessment of Reading Battery Revised for First Grade* (CRAB-R; Mathes & Torgeson, 1998), and the Vocabulary subtest of the *Wechsler Abbreviated Scale of Intelligence* (WASI; Wechsler, 1999).

The overall impact of the two intervention groups was significant in the rate of growth when compared to the typical learner and enhanced at-risk groups in all areas assessed. The Proactive and Responsive groups outscored the at-risk group in all areas assessed. The Proactive group had a larger effect size than the Responsive group in the phonological awareness assessment ($F_{(3, 85)} = 15.71$, $p < .001$) and the slope/rate of growth ($F_{(3, 1431)} = 29.25$, $p < .001$). In addition, the Proactive group had a greater rate of growth in the area of word reading fluency ($F_{(3, 85)} = 36.08$, $p < .001$) and slope ($F_{(3, 1428)} = 4.53$, $p < .01$). Rate of growth was also significant in passage reading fluency, with the Responsive group reading more words per minute than the Proactive and at-risk group. The effect size for non-word reading fluency was moderate for the Proactive group and small for the Responsive group. Overall, both interventions had comparable positive effect sizes (Proactive ES = .84 and Responsive ES = .78). This demonstrates that the interventions, when paired with quality classroom instruction, increased the rate of reading skills development of students at-risk for LD when compared to classroom reading instruction alone.

The limitations considered when interpreting the results of this study include the amount of time given to delivery of the intervention, the use of small-group instruction, and utilizing teachers who were considered based on their teaching philosophy and high level of expertise in reading instruction. In this study, students participated daily for 40 minutes in groups of three

participants, and teachers were provided a considerable amount of coaching throughout the study. This type of support would be difficult to replicate as well as costly.

Hines (2009) conducted a single-subject multiple probe design study on the effectiveness of a color-coded, onset-rime intervention with first-grade students. One of the most difficult areas for students with LD to master in phonics instruction is short vowel sounds. Hines hypothesized that using a color-coded system to teach rimes would promote mastery and transfer of decoding skills at the CVC/CVCC level to novel words and increase the ability to maintain the skill over time.

Participants included four first-grade children, two boys and two girls, in an eastern United States school who were considered the most at-risk for LD. The color-coded onset-rime intervention served as the independent variable targeting short *a* and short *e* words with the consonant-vowel-consonant (CVC) and consonant-vowel-consonant-consonant (CVCC) spelling patterns. Phonics skills were taught using the *Rime to Read* series for beginning readers, which was based on rime patterns. Each rime contained a different shade of blue or red based upon the vowel featured.

Three dependent variables were assessed: the ability to read instructional CVC/CVCC words from a random eight-word list, the *near transfer* skill, (the ability to read novel words containing short a and e CVC/CVCC patterns that included the same rime patterns taught in the intervention), and the *far transfer* skill, (the ability to read words containing the short a and e CVC/CVCC rime patterns which were not included in the intervention). The number of words correct on instructional words, near-transfer words, and far-transfer words were recorded for

baseline and after instruction at 1 week and 1 month for comparison and to determine maintenance effects.

Each student received instruction four to five times per week for 15-30 minutes, depending upon their rate of acquisition. In each session, students read one of the *Rime to Read* books, while the researcher followed a script to introduce new skills and correct errors. If students had more than five errors on a book, they re-read the book during the next session. A word sort and flashcard routine followed the book in each session. Students sorted and read the words according to their rimes. The flashcards contained words from the book with corresponding color-coded rimes based on the vowel it contained (red for short *a* and blue for short *e*). After completing all eight books in the series, flashcards were presented without the color-coding as a fading technique. Audio recording was used to collect the data.

Results revealed an average correct word increase of 73% for all participants compared to the baseline score. Results also supported transfer of decoding skills to uninstructed words following the same rime patterns used in the intervention. An increase of 56% on near-transfer words and 29% on far-transfer words was also noted. All students were able to maintain scores and in some cases increase their scores at the 1-week and 1-month posttest. In addition, each student required a relatively short time (2-8 hours) to complete the program and master the skills, which is notable given the at-risk status of the participants.

Hines (2009) cited several limitations of the study. First, the researcher conducted the intervention and collected the data; an unfamiliar person would have been preferred. Second, it was difficult to pinpoint the effectiveness of the color-coding variable because of the three

dependent variables. The final limitation is that this study did not compare the onset-rime intervention to other comparable interventions.

Niedringhaus (2013) conducted a mixed-methods case study in a dissertation using end-of-the-year report card data to analyze the effectiveness of the *Rigby Intervention by Design Program*. Two questions were assessed in this study:

1. In what ways will teachers' beliefs and perceptions about the *Rigby Intervention by Design Program* affect student achievement of students who are at-risk of having LD?
2. In what ways will the implementation of *Rigby Intervention by Design Program* affect achievement of students at risk of developing a LD?

The case study took place at a suburban school in the central region of Missouri. Sixteen male and 14 female students in second and third grades participated in this study. All participants were significantly below grade level or had specific skills deficits in the area of reading.

Rigby Intervention by Design is an intervention that follows the Response to Intervention (RTI) model and is implemented when students experience skill deficits that are not remedied through traditional teaching methods. Systematic structured lessons and strategies are provided in small groups of three to five students to support the five pillars of reading instruction: Phonics, Phonemic Awareness, Vocabulary, Fluency, and Comprehension. The dependent variable in this study was the effectiveness of the intervention program as measured by the students' reading grades on their end-of-the-year report card. Teacher perception survey data and fidelity-of-

implementation data were collected in order to analyze the overall success of the reading intervention program.

Niedringhaus (2013) used a *Z* test to analyze end-of-fourth quarter report card data from the end of first grade (baseline) with end of second- and third-grade scores. Results showed 80% of students achieved *Meets Expectations* and 20% *Not Meeting* expectations at the end of first grade prior to the *Rigby Intervention by Design Program.* After the first year of implementation, 3.3% advanced to *Above Expectations*, whereas the number of students *Not Meeting* expectations remained at 20%. Results from the end-of-third grade scores showed the number of students receiving a *Not Meeting* expectations had increased to 33.3%, which was not a statistically significant difference between first- and second-year scores.

Two measures assessed content and instructional fidelity. Ten of 15 teachers completed the *Content Knowledge Survey* (Niedringhaus, 2013) that also evaluated the degree to which prior knowledge in literacy instruction and the balanced literacy approach affected teachers' perceptions and beliefs regarding the effectiveness of the intervention. Results showed teachers did not have consistent positive feelings about the success of the *Rigby Intervention by Design Program.* Only 50% of the teachers surveyed felt the knowledge they had gained from the program changed the way they taught reading. They also did not feel the intervention provided them with new ideas on how to implement a reading intervention.

A "literacy intervention walkthrough" was also used to assess content and instructional fidelity (Niedringhaus, 2013, p. 66). Three times each semester the researcher spent 5 to 7 minutes observing teachers and students during the intervention class period. The researcher used numeric indicators to indicate high, inconsistent, or low levels of implementing the program

with attention to skills acquisition, teacher pacing, fidelity of instruction, and student engagement. The walkthrough results showed 22 of 30 teachers demonstrated a high level of implementation, five an inconsistent level of implementation, and three teachers showed a low level of implementation. The researcher concluded teachers were using the intervention with a high level of competency.

Survey results showed after 1 year of delivery, 50% of teachers reported the *Rigby Intervention by Design Program* provided them with new ideas regarding implementation of reading interventions or in delivering more effective reading instruction in the five pillars of literacy. The researcher listed implementation of a new and unfamiliar curriculum as a possible limitation to the results of the case study. Although teachers showed a high level of proficiency overall in delivering the intervention, these students had no previous exposure to the curriculum before the start of the study. Because the researcher was the principal of the school and conducted all of the walkthrough observations, she believes it may have affected teachers' attitudes toward the new intervention and felt added pressure in the first year of delivery.

Haegele and Burns (2014) conducted a study to determine how the size of an instructional set of flashcards affected student word retention and how it generalized to reading fluency. The researchers hypothesized that the memory deficits of students with LD would diminish their ability to recognize words in larger instructional sets.

Participants included three fourth- and fifth-grade students with a learning disability in reading who attended a suburban elementary school in Minnesota. The one female and two male students were selected because they had the lowest reading scores among all students in this school identified with LD; IQ scores were in the average range.

The researchers used an intervention called *Incremental Rehearsal* (IR; Burns & Dean, 2005), which uses flash cards to assess acquisition rate (AR) and generalization of word identification skills. Typically, the program uses a ratio of 1 unknown to 7 known words. For this study, the researchers assessed the outcomes of three different conditions using IR with a set of two cards: (1 known and 1 unknown), the traditional eight cards (1 unknown and 7 known), and the student's individual AR. Acquisition rate is determined by teaching the unknown word using IR.

Each participant was randomly assigned to one of the three conditions five times throughout the study. During an experimental session, participants were taught using either two flashcards, the traditional eight flashcards, or their AR flashcards. The rehearsal intervention follows a sequence in which the unknown word is presented first followed by the first known word. The sequence builds so that the unknown word is presented after each known word. Once the word was successfully recalled, it became the first known word in the deck and the eighth known word is removed, retaining a nine-card deck for each session. Unknown words were selected using a sight word list at the participants' current grade level, and known words were selected from a first- and second-grade sight word list that the students could recall within 2 s.

Outcomes were assessed using two measures: retention of words taught with the three different conditions and efficiency of each condition. The percentage of words identified within 2 s from two previous sessions determined retention rates. Generalization was measured by the percentage of sentences read correctly containing words from the previous two sessions. Efficiency was determined by calculating the amount of time required to teach new words.

Seventeen sessions were conducted over an 8-week period. The first two sessions were spent teaching the unknown word, and the next 13 entailed teaching the unknown words and assessing for retention and generalization. The final two sessions were dedicated to testing for retention and generalization. All sessions were conducted in the afternoon, three times per week lasting 10-20 minutes each.

A multi-element design with a counterbalanced condition order was used to evaluate the number of words recalled, generalized, and the overall efficiency of the intervention. Results show that retention was the highest in the AR condition for all three participants (range = 63-85%, *M* =4.4 words). The lowest overall percentage of retention was found in the two-word condition. The AR condition also had the highest mean number of words generalized for all three students (range = 80-84%). The mean number of words retained and generalized per instructional minute was also highest for the AR condition for all three students (*M* = .57 words per instructional minute).

The researchers indicated the two-word set did not offer enough practice opportunity for students to retain and generalize unknown words. In addition, they believed the traditional eight-card set was too overwhelming with too much time between the unknown word and the last known word, which proved to be the least efficient method (*M* = .41 words per instructional minute). Because words were taken from a grade-level word list, it is not known for certain if the students learned the words as a result of the intervention or from some other source of instruction. Time factors may also have affected outcomes. One week after the intervention started, the students went on a week-long spring break, which may have affected the rate of

retention. Time between condition and retention assessments varied between 4 and 10 days, which also may have affected retention.

Technology-Based Reading Programs

Greater and easier access to technology has enabled professionals to integrate its use in reading interventions. This section reviews four studies using technology-enhanced reading methods that include the use of computers, personal electronic devices such as an iPad, and video recording devices.

Denton, Fletcher, Anthony, and Francis (2006) evaluated the effects of an intensive reading intervention using the *Phono-Graphix* phonics program followed by *Read Naturally* fluency building program. Prior research investigating the use of intensive phonics instruction showed insufficient generalization to reading fluency. The researchers developed and evaluated an intervention for students in first through third grade who had not responded to previous primary- and secondary-level phonics interventions by adding an additional fluency program.

Participants included 15 girls and 12 boys in grades 1-3 from a large urban school district in the southwest. All students showed continuing deficits in reading, and six received special education services. The students in this study received two 8-week reading interventions daily with a teacher to student ratio of 1:2. The first 8 weeks consisted of intensive phonics instruction using the *Phono-Graphix* program for two 50-minute sessions with a 10 minute break between sessions. The second 8-week session included 1 hour daily of *Read Naturally* fluency intervention, which used a computer application to scaffold accuracy and fluency.

Phono-Graphix (McGuiness, McGuiness, & McGuiness, 1996) uses 140 different picture cards representing the sounds used in the English language. Students are taught explicitly and

systematically that one picture card can represent more than one sound (for example, the letter combination *ind* can represent sounds as in *wind* and as in *find*) and that more than one picture card can represent the same sound (e.g., the long *a* sound can be found in the letter combination *ai* and *ay*). Participants transition through four basic stages from identifying letter-sounds to decoding multi-syllable words, and extensive practice opportunities are provided to manipulate letter sounds and read decodable text.

Read Naturally (Ihnot, Masoff, Gavin, & Hendrickson, 2001) is an intensive oral reading fluency program designed for students in grades 1 through 8. Students read self-selected nonfiction passages at their instructional reading level following specific procedures. Students make predictions, participate in an initial timed reading and graph correct words per minute (CWPM). They then read the passage a second time while supported by a computer application that reads the passage with the student and complete a multiple choice comprehension quiz. After a final timed reading, students graph CWPM and retell the passage. Criteria to pass the level included meeting a pre-determined fluency goal rate with no more than three errors.

Students were randomly divided into two groups. Group 1 received the *Phono-Graphix* intervention for 8 weeks followed by the *Read Naturally* intervention for 8 weeks. Group 2 had an 8-week baseline phase followed by the *Phono-Graphix* intervention for 8 weeks and the *Read Naturally* intervention for the next 8 weeks. The multiple baseline design was implemented with four assessment waves occurring before the intervention, after the initial 8 weeks, the subsequent 8 weeks, and a fourth assessment at week 24. Assessments included subtests of the *Test of Word Reading Efficiency* (TOWRE; Torgesen, Wagner, & Rashotte, 1999), the WJ-III (Woodcock

et al., 2001), and the *Gray Oral Reading Test-Fourth Edition* (GORT-4; Wiederholt & Bryant, 2002). Specifically, researchers looked at the subtests that included spelling, nonsense word, sight word, and phonemic-decoding reading fluency. In addition, the reading comprehension subtests of the WJ-III and GORT-4 were used.

ANOVAs were conducted to analyze data. Students in both groups showed significant growth on the WJ-III, but not for the GORT-4, comprehension subtest. Wave 1 assessment data for Group 1 showed average scores to improve significantly in word attack, word identification, sight word fluency, and phonemic decoding fluency for non-words. Wave 1 assessment data for Group 2 showed little growth in decoding, spelling, or comprehension during the baseline phase in which they received no intervention.

Researchers reported results thereafter of Group 1 Wave 1 and Group 2 Wave 2 together. After 8 weeks of *Phono-Graphix* intervention, students' scores in both groups improved on the WJ-III Word Attack ($F_{(1,25)} = 72.64$, $p < .0001$), Letter-Word Identification, ($F_{(1,25)} = 46.63$, $p < .0001$), and Spelling ($F_{(1,25)} = 14.48$, $p < .008$) when compared to pre-test scores. Sight word fluency and phonemic decoding fluency also improved significantly on the TOWRE after Wave 2 for Group 2 and Wave 1 for Group 1, following the 8-week phonics intervention. Students' scores on word attack, word identification, and spelling did not improve significantly for either group after 8 weeks of *Read Naturally*. However, the reading fluency scores for both groups did improve as measured by the TOWRE Sight Word Fluency subtest ($F_{(1,25)} = 35.43$, $p < .001$), Phonemic Decoding Fluency ($F_{(1,25)} = 16.20$, $p < .0001$), and GORT-4 text reading rate, ($F_{(1,24)} = 43.45$, $p < .0001$) with larger effect sizes for reading real words in isolation and in text than for reading nonsense words.

The researchers reported the two interventions had a positive impact on all students, as demonstrated by significant increases in decoding, reading fluency, and comprehension in 12 of the 27 students. When discussing limitations to the study, Denton et al. (2006) listed time spent in the phonics intervention as being insufficient. Some students were still in the process of acquiring basic skills when they started the *Read Naturally* intervention. The researchers concluded students should reach a certain level of mastery in decoding skills before starting an intervention targeting fluency. The lack of a follow-up posttest also provided no information regarding the long-term effects of the intervention.

Torgesen et al. (2009) studied the effectiveness of two computer-based reading interventions: *Read, Write, and Type* (RWT; Herron, 1995) and the *Lindamood Phoneme Sequencing Program for Reading, Spelling, and Speech* (LIPS; Lindamood & Lindamood, 1998). Researchers hypothesized more rapid growth in early reading skills. They also hypothesized better retention scores in students who received one of the two interventions compared to students in a control group who received high-quality classroom instruction and typical supplemental instruction.

A total of 112 first graders were selected from three elementary schools to participate in the study spanning over a 2-year period. Half of the students were recruited during the first year of the study and the other half in the second year. Of the 112, 62 were male and 50 were female. Students were randomly assigned to one of three conditions: 36 children received instruction in the RWT group, 36 in the LIPS group, and 40 children were in the control group. Students received the intervention from October to May, 4 days per week for 50 minutes in groups of

three students each. None of the students missed their general education reading block during this time.

Read Write and Type is a computer program that teaches phonemic awareness, letter-sound correspondence, and phonemic decoding through interactive writing activities. Activities included 40 teacher lessons, keyboarding, review of previous lessons, and free writing. Students spent a significant amount of time learning how to use the program and how to process written language. Intensive instruction in proper fingering techniques for typing was a big part of the intervention.

The LIPS program also provided intensive phonemic awareness instruction. It is a unique program that teaches children phonemes through mouth-form picture cards, colored blocks, and letters. Students spent the majority of their instruction learning phonics, but also had exposure in text reading. Part of their reading instruction was taught using a computer-based program called *Poppin Readers* (Smith, 1992), which was designed especially for this study. *Poppin Readers* uses decodable text that follows the same instructional format as the LIPS program.

All participants received a pretest, posttest, and an additional posttest 1 year after the intervention had ceased. At pretest, no significant differences were found among the three groups. A MANOVA showed significant reading improvement in both groups when compared to the control group: word accuracy/fluency ($F_{(2, 105)} = 9.5$, $p < 0.001$), phonemic decoding accuracy/fluency ($F_{(2, 105)} = 11.3$, $p < 0.001$), phonological awareness ($F_{(3, 105)} = 6.8$, $p < 0.001$, rapid naming ($F_{(2, 105)} = 5.0$, $p < 0.01$), reading comprehension ($F_{(2, 106)} = 6.7$, $p < 0.05$), and spelling ($F_{(2, 106)} = 8.7$, $p < 0.01$). No significant differences were reported between the two

intervention groups on word accuracy/fluency, phonemic decoding accuracy/fluency, phonological awareness, and rapid naming. Similar differences were observed at the 1-year posttest, though they were less robust. The reading comprehension posttest also found no significant difference when comparing the two intervention groups.

Researchers also considered the percentage of students who remained significantly behind their peers in reading following the intervention. More students from the control group (34%) continued to fall below the 30th percentile on standardized measures when compared to those in the intervention groups (10%). Scores on the second posttest showed the discrepancy continued after instruction had ended (36% and 11%, respectively).

Results from this study indicated the introduction of intensive computer-based reading instruction could reduce the number of children with significant reading deficits at the conclusion of first grade. Although the LIPS group had slightly stronger outcomes when compared to the RWT intervention, the lack of statistical significance means one program cannot be recommended over the other. It is important to also note the interventions were offered as a supplement and did not interfere with general education reading instruction. Those in the control group did not receive additional reading instruction outside of their reading block. Any supplemental or differentiated instruction occurred within their reading block. Therefore, students in the intervention groups received significantly more reading instruction than the control group. Another limitation to the study is that all the students in the intervention received a combination of teacher-led and computer-based instruction. Therefore, it is not clear if both components were necessary for the success of the programs.

Ayala and O'Connor (2013) utilized a Video Self-Modeling (VSM) intervention to improve the decoding skills of 10 first-grade students who were not responding to a Tier 2 reading intervention. Researchers hypothesized if students observed themselves displaying the target behavior of reading with accuracy and fluency, it would improve their reading self-efficacy. This study included three girls and seven boys from a low socioeconomic status elementary school in southern California. Researchers compared September and January results from the *Basic Phonics Skills Test* (BPST; Shefelbine, 2006), following 15 weeks of instruction using the *Systematic Instruction in Phoneme Awareness, Phonics, and Sight Words* (SIPPS; Shefelbine, 2006) to identify the participants for this study.

Video Self-Modeling was used as a Tier 3 intervention over the course of 10 weeks. The SIPPS was continued during the VSM intervention and instruction was provided during 25-minute sessions four times per week. Researchers recorded participants reading decodable CVC and sight words while receiving their instruction. The video was later edited to remove any prompting or coaching from the instructor. A 2-minute video of the student reading with fluency and accuracy was created and shown to the student on the next intervention day. These visual and auditory images of their own successful reading were the independent variable used to measure its effects on word identification.

The BPST was administered three times during the study: once in September to determine a baseline prior to the Tier 2 intervention and then again in January and April as pre- and posttest measures following the 10-week VSM intervention. The Nonsense Word Fluency probe from the *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS; Good et al., 2004) and two curriculum-based measures from the SIPPS program (decodable and sight word cards)

were used for baseline and progress monitoring tools. Progress monitoring occurred twice per week following the students viewing their customized video and having received their SIPPS instruction.

Ayala and O'Connor (2013) compared pre-post intervention scores and used the Percentage of Non Overlapping Data (PND) points to determine the effectiveness of the intervention. Nine of 10 students showed an increase in decoding skills within four to five data points. Progress in decoding nonsense words followed this same pattern. Three of the students did not show sight word improvement until 3 weeks (six data points) into the intervention. Pre- and posttest scores on the BPST showed all 10 students increased in consonant, vowel, and digraph identification gaining average scores for a typical first grader. Posttest SIPPS scores showed an average mastery of 20 lessons over the course of the intervention (approximately two reading levels). When calculating PND, eight of 10 students' scores fell in the effective range of 70-90% in decodable words, and seven of 10 fell in the effective range for sight words and nonsense words.

In an interview with the first author at the conclusion of this study, students reported they enjoyed making and watching the videos and would play them at home and for others. Researchers observed students were motivated and worked hard while making the videos, which they hypothesize attributed to their academic gains.

Researchers indicated a longer intervention phase may have shown if the intervention had a stronger effect or if the effect diminished over time. They also reported they did not address treatment fidelity prior to the VSM intervention, which began in January. Dosage was also

indicated as a possible limitation. In other words, the number of times a student watched their videos was not recorded or controlled.

Larabee, Burns, and McComas (2014) explored the use of an electronic word identification reading application and compared it to a traditional reading intervention using similar methodology. The intervention involved teaching letter sounds and decoding using the *Word Box* intervention (Joseph, 1998). The researchers hypothesized the students would be more engaged and therefore have better retention when the intervention was presented on the mobile device than when it was presented using a traditional method.

Two males and one female first-grade student participated in this study conducted at an urban elementary school in the midwestern United States. These students were selected based on benchmarking data involving letter-sound fluency (LSF), letter naming fluency (LNF), nonsense word fluency (NWF), and teacher input. The interventions were conducted outside of the students' classroom by the same researcher, while an additional researcher measured student engagement through observation, for each session.

The researchers used the *Word Box* intervention with both traditional materials and an iPad application (app) called *Build-A-Word-Easy Spelling with Phonics* (AtReks, 2013). Traditional materials included a magnetic white board with three boxes outline with tape for building CVC words. The researcher selected a mix of target and random magnetic letters needed for each session. The iPad app had a similar display with the target letters and five random letters, including the three boxes to represent the initial, medial, and final sounds in a CVC word.

Generalization and retention were tested before each session using NWF probes. Students were timed while reading a list of nonsense CVC words. Students were asked to say the sound of each letter or read the word in its entirety. Recorded times were then translated into correct sounds per minute and used as the dependent variable. Each session targeted a letter sound from the previous session, and retention was then assessed by presenting the target sound in isolation on an index card. Data were recorded as a percentage of correct sounds. Time on-task was calculated from 10-s interval observation recordings.

The intervention procedure started with a pretest involving two tasks, a letter sound survey, and a reading probe that included five real CVC words and five nonsense CVC words. Each meeting started with a NWF exam and retention task followed by the intervention. The *Word Box* intervention was executed using a scaffolding approach in which the task was first modeled, followed by guided practice and independent practice with frequent feedback. Both the traditional materials and iPad app conditions used the same script and nearly identical procedures. Each session targeted a specific letter sound and used a word list containing 7-10 words with that sound in either the initial, medial, or final position. In the traditional group, the researcher said the words and guided instruction. In the iPad condition, the device produced the sound of the letter as the student touched it on the screen. Once the word was built, the app then read the sounds in isolation and blended them together to make the word. The researcher cued the student to identify all three letters prior to building the word to make conditions more equivalent with regard to procedures.

The researchers used a multi-element design to calculate generalization, retention, and time on-task. The three students received a total of 11 sessions with two of those sessions

involving data assessment. The sessions lasted between 4 to 19 minutes. The iPad method lasted an average of 6 minutes compared to 9 minutes with the traditional materials. The three students were randomly assigned to the first condition and then followed an alternating pattern for the remainder of the sessions.

Generalization results were mixed. Two students in the NWF condition were higher (*M* = 35) after the iPad condition, whereas and the other students' scores were higher following the traditional materials condition (*M* = 26). Mixed results were also found when assessing retention. The two students who showed better generalization with the iPad condition also showed better retention for letter sounds (*M* = 75% accuracy) compared to the other student who had higher retention with the traditional materials (*M* = 100% accuracy). Student engagement was overall higher with the iPad application (*M* = 93.16 %) compared to traditional materials (*M* = 87.28%). Overall, a consistent pattern in decoding performance was not determined when evaluating the two interventions. Task engagement was considered high for both conditions, with a small effect size on decoding performance for the iPad application when compared to the traditional *Word Box* method.

The limited number of data points, inconsistent length of time spent engaged in the intervention, and the novelty of mobile devices were considered to be study limitations. In addition, the interventions and observations were conducted by the researchers rather than by teachers, which may have caused the students to be distracted—especially initially. Although researchers concluded a small positive effect using the iPad application, it is unclear from this study which students would benefit most from technology-based reading interventions.

Summary

In this chapter, I reviewed 10 studies that examined the effectiveness of reading interventions on word identification for students in first through fifth grade. Table 1 provides a summary of the participants, type of intervention, and results of each study. These findings are discussed in Chapter 3.

Table 1: Summary of Word Identification Strategies and Interventions

Traditional Reading Interventions			
AUTHOR (DATE)	PARTICIPANTS/ SETTING	INTERVENTION	RESULTS
Vadasy, Sanders, & Peyton (2005)	57 first-grade students scoring in the lowest quartile for reading skills	*Sound Partners* decoding intervention, a text reading intervention, and a control group	Students receiving interventions outperformed non-treatment peers on all posttest skills except reading efficiency.
Schwartz (2005)	148 at-risk, low-average, and high-average first-grade students	Pre-test/post-test using *Reading Recovery* and a regular classroom instruction control group	Students who received *Reading Recovery* outperformed the low-average group on mid-year assessments in phonemic awareness and word identification assessments.
Mathes et al. (2005)	252 first graders from six urban schools in Texas at-risk for a reading disability and a group of 94 typically achieving students	Two reading interventions: *Proactive Reading* and *Responsive Reading*	Students who received either of the two interventions performed better than those who received only classroom instruction in both rate of growth and posttest results.
Hines (2009)	Four most at-risk first graders in a class of 87	A color-coded, onset-rime-based decoding intervention	Students' reading skills improved significantly at the instructional word level, near-transfer level at both 1-week and 1-month posttest.
Niedringhaus (2013)	30 students considered at-risk for LD	The *Rigby Intervention by Design* curriculum and a control group	No statistical difference was observed in reading ability of the intervention group when compared to the control group over a 3-year period.
Haegele & Burns (2014)	One fourth- and two fifth-grade male students identified with LD	*Incremental Rehearsal* in three conditions	Retention and generalization was highest under the individual acquisition rate (AR) condition for all three participants.

Table 1 (continued)

Technology-Based Reading Interventions			
AUTHOR (DATE)	PARTICIPANTS/ SETTING	INTERVENTION	RESULTS
Denton, Fletcher, Anthony, & Francis (2006)	27 students in first through third grade from four schools who did not respond to 1-2 tiers of intervention	*Phono-Graphix* decoding intervention followed by *Read Naturally* fluency intervention in two groups.	Though all showed some reading improvement, 12 of 27 showed statistically significant improvement in decoding, fluency, and comprehension.
Torgeson, Wagner, Rashotte, Herron, & Lindamood (2009)	Two cohorts of 112 first-grade students at-risk for reading disabilities in three elementary	Over a 2-year period to investigate RWT, LIPS, and a control group	No significant differences were found between the two intervention groups that performed significantly better than the no- intervention control group.
Ayala & O'Connor (2013)	Ten first-grade students who did not respond to a Tier 2 reading intervention	CBMs every 2 weeks to assess the effectiveness of a video self-modeling intervention	All 10 participants showed an increase in decoding skills and sight word recognition.
Larabee, Burns, & McComas (2014)	Three first-grade students who were considered at-risk for a reading disability; two were ELL	*Word Box* intervention compared to the same intervention delivered on an iPad	No consistent trends were observed when using the iPad app over standard instructional materials in all three students. Task engagement was high for all three students in both conditions.

Chapter 3: Conclusions and Recommendations

Many students lack the word identification skills necessary to comprehend text and read fluently. In this Starred Paper, I reviewed the effects of traditional and technology-based word identification reading interventions on elementary students who were at risk for a reading disability. In Chapter 1, I discussed the importance of teaching effective word identification strategies at the elementary level, and I summarized the findings of 10 studies that investigated the topic in Chapter 2. In this chapter, I discuss Chapter 2 findings and present recommendations for future research and current practice.

Conclusions

The 10 studies included in this literature review were organized into two different types of reading intervention approaches: those that used traditional teaching materials and interventions that used a technology-based approach. A common theme noted in eight of the 10 studies was that daily, individualized, intensive instruction in small groups or in a 1:1 setting had the most notable outcomes.

Traditional reading interventions. Five of the six traditional reading interventions showed positive outcomes for participants. Niedringhaus (2013) used the *Rigby Intervention by Design Program,* which was the only intervention that did not show significant growth in word identification skills. The researcher noted the teacher's lack of enthusiasm for the program as a possible reason for the outcomes. Four of the traditional intervention studies used a packaged curriculum, three of which followed the *Direct Instruction* model with scripted lessons (Mathes et al., 2005; Schwartz, 2005; Vadasy et al., 2005). *Rigby Intervention by Design Program*

follows a Balanced Literacy approach. Word identification is not taught explicitly and intensively in this intervention, which may be why it did not have positive outcomes.

When evaluating the outcomes of the interventions, it is important to consider under what circumstances students made the most gains. Certainly, group size and the amount of time spent in an intervention are noteworthy. As mentioned in Chapter 1, in order for students at risk for a learning disability to make adequate gains, instruction needs to be explicit, systematic, and individualized (Spencer & Manis, 2010). Table 2 outlines the Traditional Reading Interventions by name, theory in which they follow, group size, and length of intervention sessions.

Table 2: Summary of Traditional Reading Interventions

AUTHOR (DATE)	INTERVENTION	READING ACQUISITION THEORY	GROUP SIZE	TIME PER SESSION
Vadasy, Sanders, & Peyton (2005)	*Sound Partners*	DI	1:1 provided by paraprofessional tutors	30 minutes 4 days per week
Schwartz (2005)	*Reading Recovery*	DI	1:1 provided by trained teachers	30 minutes daily
Mathes et al. (2005)	*Proactive Reading* and *Responsive Reading*	DI	Small group of three students provided by trained teachers	40 minutes daily
Hines (2009)	Color-Coded Onset-Rime intervention using *Rime to Read* series		1:1 provided by the researcher	Varied, 15-30 minutes, 4-5 times/week
Niedringhaus (2013)	*Rigby Intervention by Design*	Balanced Literacy	3-5 students per group provided by trained teachers	3 days per week, no time was specified
Haegele & Burns (2014)	*Incremental Rehearsal*		1:1 provided by the researchers	3 days per week for 10-20 minutes

Technology-based reading interventions. Three of the four technology-based reading interventions showed positive outcomes for participants (Ayala and O'Connor, 2013; Denton et al., 2006; Torgeson et al., 2009). Larabee et al. (2014) observed inconsistent positive outcomes for word identification when using the *Word Box* intervention on an iPad, although

high student engagement was noted. Table 3 outlines the Technology-Based Reading Interventions by name, theory in which they follow, group size, and length of intervention sessions.

Table 3: Summary of Technology-Based Reading Interventions

AUTHOR (DATE)	INTERVENTION	READING ACQUISITION THEORY	GROUP SIZE	TIME PER SESSION
Denton, Fletcher, Anthony, & Francis (2006)	*Phono-Graphix* and *Read Naturally*	DI	1:2 provided by the researchers	Two 50-minute sessions daily for 8 weeks followed by *Read Naturally* 1 hour daily for 8 weeks
Torgeson, Wagner, Rashotte, Herron, & Lindamood (2009)	RWT and LIPS	DI	1:3 provided by the researchers	4 days per week for 50 minutes
Ayala & O'Connor (2013)	Video Self-Monitoring		1:1 provided by the researchers	4 days per week for 25 minutes
Larabee, Burns, & McComas (2014)	*Word Box*	DI	1:1 provided by the researchers	11 sessions lasting 4-19 minutes

Summary

When considering which type of intervention to use for teaching word identification skills to learners with reading disabilities, it is important to consider how much instruction must occur and what level of intensity must occur for it to be effective. In analyzing the results of this literature review, students who received 1:1 instruction daily using DI methods made significant gains. This is important to note because even when high quality instruction is given, 5-7% of the students still do not meet grade-level standards (Niedringhaus, 2013).

Ayala and O'Connor (2013) addressed an important aspect of students' reading outcomes—self-efficacy, which is the belief that they can learn to read. This study sheds light on an important element in intervention design with regard to individualization. Students who

are engaged and "buy into" the intervention are more likely to develop self-efficacy skills and improve reading comprehension.

Recommendations for Future Research

Limitations and findings in the studies reviewed are important when considering needs for future research. Some of the studies lasted 1-2 years, whereas others lasted only a few months. It is difficult to know the potential future outcomes when an intervention is so short. Future studies should extend the time frame of the interventions. This would enable the researchers to gather data on how word identification gains generalize to other areas of reading, such as comprehension. If the duration was extended, information on maintenance would also be useful information to share with educators.

Cost and time are two common themes for future research. Most of the interventions were conducted in addition to general education reading curriculum. Special education supplementary instruction typically is delivered during a student's language arts block so that students do not miss any other important classes during this time. Future research should address this limitation, as it can be viewed as impractical. Hiring staff to maintain a 1:1 setting is out of reach for many school districts. Financial considerations can deter implementation of new interventions of this sort.

Most of the studies in this literature review were conducted by trained researchers or teachers under highly controlled conditions. Researchers spent a considerable amount of time training, coaching, and supporting educators during the intervention phase. Future research is needed to determine how much training and support is needed to ensure teachers are implementing the interventions with fidelity and efficiency.

Finally, group size is an important consideration when considering future research avenues. Studies in this literature review highlighted the importance of a 1:1 setting in student outcomes. Future research needs to expand to attempt to replicate these interventions in larger group sizes to make them more practical for school districts to employ.

Implications for Practice

In this review of literature, I have learned that providing research-based interventions lasting 30-40 minutes and using explicit materials in a 1:1 setting are critical aspects of word identification instruction for students with a learning disability. I have also learned the importance of students developing self-efficacy in order to make continued gains. Students need to believe the intervention will help them. I have experienced this in my own classroom. The intervention I use is explicit, presented in a small group, follows the DI model, but is dry. I have experienced negative self-talk, students questioning the teaching methods (how is this going to help me?), and complaining that the lessons are boring. Educators must take this into consideration when delivering reading interventions for a population of students who are already feeling defeated.

As my district faces budget cuts, I will advocate for the curriculum I am currently using, which follows the recommendations of the researchers in this literature review. I will look for new ways to build and increase self-efficacy skills in my students while maintaining the level of rigor required to close the gap. I would like to explore the use of SVM using an iPad to record my students' reading fluency. Because we already have iPads available, this would be a no-cost intervention option that could generate positive outcomes.

I would also like to advocate that my reading interventions be implemented at a time when the students are not receiving language arts in their classroom. I feel it is imperative they receive high-quality reading instruction in their classrooms in addition to supplementary instruction tailored to their individual needs. I will encourage parents, teachers, and administrators to forgo subjects such as music or the social sciences to implement instruction in their area of greatest need. Students need to learn to read before they can read to learn. When a student has an identified reading disability, explicit reading interventions should receive priority over other subjects in a child's early elementary school years.

Summary

Eighty percent of students identified with a learning disability cannot read with sufficient accuracy and fluency to meet grade-level expectations (Cortiella & Horowitz, 2014). Because the ability to read is one of the most critical skills for future success, it is imperative that educators invest the time and resources needed to adequately teach these students. Ignacio Estrada said it best when he said, "If a child can't learn the way we teach, maybe we should teach the way they learn."

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