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**Examining the Benefits of Intervention in Decoding Plus Vocabulary Compared to  
Intervention in Decoding Alone Using an Adapted Alternating Treatment Design**

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**by**

**Clinton Eric Moore**

**DISSERTATION**

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## **Abstract**

### **Examining the Benefits of Intervention in Decoding Plus Vocabulary Compared to Intervention in Decoding Alone Using an Adapted Alternating Treatment Design**

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Theoretical perspectives hypothesize that struggling readers can increase their reading comprehension from integrating instruction in decoding and vocabulary. For older students who continue to struggle with understanding what they read in their increasingly difficult content classes, direct instruction in both areas might help improve their reading comprehension. There have been some investigations into the combined effects of combining decoding and vocabulary instruction, but the results are inconclusive. The current study used an adapted alternating treatments design (AATD) to examine the relative benefits of providing intervention in decoding plus vocabulary compared to intervention in decoding alone. For this single case design study, four participants progressed through three phases: baseline, a first instructional phase, and a second instructional phase. One instructional phase consisted of instruction on targeted words only (decoding) and the other consisted of instruction on a different set of targeted words along with their meaning (decoding + vocabulary). At the end of each session,

students read several passages and answered the accompanying reading comprehension questions. The passages from Test A were aligned with decoding instruction and the passages from Test B were aligned with instruction in decoding and vocabulary. Another set of passages comprised Test C, which did not contain any instructional words. Results did not reveal a benefit from instruction in either decoding or instruction in both decoding and vocabulary on students' reading comprehension on passages aligned with instructional content. The effects may be attributable to participants' reading skills, which were low on a standardized test, but possibly sufficient to understand what they read on the daily assessments.

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## **Chapter 1: Introduction**

In its most simplified definition, reading comprehension is how one gains an understanding or makes meaning from text. The search for how one arrives at that understanding is what drives researchers and educators alike and involves extremely complex processes and specific cognitive skills with which even professionals continue to grapple (Pearson & Cavetti, 2017). Prevailing reading theories posit that word reading skills (decoding) and the ability to ascertain the correct meaning of unknown words (vocabulary knowledge) are critical to successful reading comprehension (Gough & Tunmer, 1986; Perfetti, 2007). In their adolescent years, students are required to understand increasingly complex content area texts as part of their curriculum (Kamil et al., 2008). This makes reading comprehension even more difficult for those students who continue to struggle with intractable word reading issues. If the applicable reading theories can be instructive in this regard, then those students should benefit from interventions that combine foundational work on decoding skills with direct instruction in acquiring vocabulary instruction. While there is some evidence that shows a correlation between decoding and vocabulary (Swanson et al., 2003) more research is needed to determine the effectiveness of combining a decoding component with instruction in vocabulary on increasing reading comprehension.

As children progress through school, reading becomes an increasingly integral part of their curriculum. Even as early as first grade, this means more than just reading for accuracy; it means that the reader needs to create an understanding from a text

(Berkeley et al., 2010). By late elementary school, students are expected to be proficient with the mechanics of reading and must now learn and gather information from the texts they read (Gajria et al., 2007). For many typical readers, this kind of reading for comprehension is an appropriate advancement in their development of understanding what they read, but for struggling readers who have yet to master skills such as word reading, comprehension is elusive (Oslund et al., 2018).

The most recent statistics from the National Assessment of Educational Progress (NAEP) assessment, administered in 2017, report that in 8<sup>th</sup> grade, 61% of students with disabilities (SWD) scored below a basic level in reading compared to 19% of students without disabilities (U.S. Department of Education, 2017). These data demonstrate that there is a significant need for effective reading comprehension interventions, especially those aimed at older struggling readers. The issue is particularly critical for students who continue to struggle with the basic mechanics of reading, such as reading words accurately, which affects whether the correct word meanings are activated. Much of the reading at the secondary level is focused on content acquisition on a given subject and not actual instruction in reading, so students who are already struggling with reading find it increasingly harder to overcome these problems (Simmons, et al., 2014). Factors such as amount of content, larger class sizes, student malaise, behavioral issues, and varying ability levels combine to influence many schools' reluctance to adapt materials (Wexler et al., 2015).

### **Importance of Vocabulary**

Researchers have known for some time that when a reader has difficulty understanding the meaning of words, then their ability to understand what they read is impaired (Anderson & Freebody, 1981). Even when a reader knows as much 98% of the words in text, the remaining 2% can impair their comprehension (Hsueh-Chao & Nation, 2000). Beginning at an early age vocabulary is a strong predictor of successful reading comprehension for students in this age range (Joshi, 2005). Vocabulary has also been tied to background knowledge, another component that can assist struggling readers in making sense of what they read (Ahmed et al., 2016). To be successful in secondary grades, adolescent struggling readers need to acquire, and practice more basic skills associated with building vocabulary. Thus, adolescent struggling readers need to build their vocabulary knowledge, and develop strategies that help them decipher new word meanings as they progress toward becoming better readers.

### **Theoretical Perspectives of Reading Comprehension**

The Simple View of Reading, outlined in the seminal article by Gough and Tunmer (1986), contends that reading comprehension is the product of decoding and linguistic comprehension. To clarify, the authors distinguished linguistic comprehension as extended from word meanings through to sentences and then a larger discourse. Their discussion is primarily concerned with establishing that decoding and linguistic comprehension skills are necessary to achieve reading comprehension, because in the absence of one of those areas, reading comprehension cannot take place. For example, reading comprehension cannot exist if the reader cannot read the words in the text accurately. Similarly, if words are read correctly but the meanings of the words are

unknown, comprehension cannot be achieved. Only through the combination of decoding and linguistic comprehension can reading comprehension be achieved. Reading comprehension can then be analyzed in terms of a breakdown in either or both of these two components. This has enormous implications for the classroom because teachers can separately target decoding or linguistic skills in an effort to determine the optimum proportion needed for reading comprehension overall (Kendeou et al., 2009).

Additional theories and models have been posited to explain how reading comprehension occurs and how it can break down. According to Perfetti's Lexical Quality Hypothesis (LQH), readers rely on high-quality representations of words for reading comprehension. Those high-quality representations involve knowledge of how a word is pronounced (a phonological representation), how a word is spelled (an orthographic representation), and the meaning of a word (a semantic representation; Perfetti & Hart, 2002). While reading, skilled readers are able to connect all three almost instantaneously and with little conscious effort, which facilitates reading text with efficiency (i.e., fluency) and allows high-order linguistic comprehension processes to take place. However, when connections between those representations are broken or weak, lexical quality is considered low. This can occur when a reader reads a word incorrectly, indicating a lack of a link between the phonological and orthographic representations thereby preventing access to its meaning, or when a reader pronounces a word correctly, but the word's correct meaning remains unknown (i.e., a poor connection to the semantic representation; Perfetti & Stafura, 2014). Under each of these

circumstances, the readers' strained attentional resources make reading for comprehension difficult or impair it altogether.

### **Implications of Decoding and Vocabulary on Reading Comprehension**

Two of the most basic components for reading comprehension, but arguably the most critical, are decoding (i.e., reading words accurately) and vocabulary knowledge (i.e., understanding the meaning of words). The role of these two components—effectively reading a word and understanding what it means—is made even more important in the process of comprehension because it is often in these two areas where struggling readers have the most difficulty (Nation & Snowling, 1998). When a reader has knowledge of a word's meaning and how it is used, reading the word accurately in print allows it to be connected to its meaning (Perfetti, 2010). When words are more familiar, these connections occur more efficiently and with little conscious effort. Thus, word spellings are firmly linked to their meanings. These efficient, effortless connections between decoding and vocabulary are crucial to overall comprehension because the increased automaticity that follows allows comprehension to take place (Perfetti, 2010).

Unfortunately, in instances where students continue to be frustrated with decoding and have insufficient vocabulary knowledge, their problems with understanding what they read can extend even into their adolescent years where the problems can be much more entrenched. As previously mentioned, this is likely because much of the reading at the secondary level is focused on content acquisition on a given subject and not actual instruction in reading, combined with expectations to read text that is increasingly complex. Students who are already struggling with reading find it increasingly harder to

overcome these problems (Simmons et al., 2014). Many of the reading comprehension interventions designed to directly assist struggling readers concentrate on providing the skills necessary to digest and make functional use of the information in their content area classes and not on foundational word level skills (Seifert & Espin, 2012).

### **Problem Statement**

There is a need for more studies that systematically manipulate vocabulary and decoding components in a way that allows for stronger inferences regarding the effects of the respective components. Studies should employ a design with two treatments; one treatment group should receive instruction in decoding, and another should receive instruction in decoding and vocabulary. Studies of this type would help determine whether integrating decoding and vocabulary instruction improves reading outcomes, as suggested by connectionist frameworks and the LQH.

There is also a need for studies that analyze the effects of these types of interventions with adolescents. Struggling readers in middle and high school often need explicit instruction at the word level because they encounter larger, less common, multisyllabic words in academic texts (Kamil et al., 2008; Solis et al., 2014). These can include exception words that do not follow the pronunciation rules in English. When this is the case, semantic information may help support word recognition (Hulme & Snowling, 2009). Additionally, vocabulary instruction is important to build students' knowledge of words that are more common in academic texts than in everyday speech, and these words are often important for comprehending content-area texts. Combining decoding and vocabulary instruction can be critical for improving reading comprehension



for older students with reading difficulties. To better make causal inferences about the relationship between decoding and vocabulary knowledge, these kinds of investigations must occur.

### **Purpose and Research Question**

The purpose of this investigation was to analyze the effects of explicit instruction in decoding combined with instruction in vocabulary skills over instruction in decoding alone for adolescent struggling readers. To that end, the following research question was investigated:

What are the relative benefits of an intervention that targets decoding only compared to targeting decoding plus vocabulary on the reading comprehension of adolescents with reading difficulties?

## **Chapter 2: Review of Literature**

The literature review begins with a discussion of the relevant theories of reading at its most fundamental level. These theories seek to explain the underlying processes that take place when reading occurs. They also highlight the importance of both word-reading skills and attaching meaning to words in learning how to read. Then, investigations that analyzed the effects of interventions that contained only decoding and vocabulary components were reviewed. These studies examined at least one of the following outcome measures: decoding, vocabulary, and/or reading comprehension. Next, additional investigations on the relationship between word reading and word meaning are discussed. These studies further clarify the interrelatedness of decoding skills and vocabulary acquisition beyond the investigations reviewed in the previous section. Finally, the general discussion succinctly summarizes the issues previously discussed and provides a framework for conducting further investigations.

### **Theories About the Skills that Underlie the Development of Reading Proficiency**

The Simple View of Reading contends that reading comprehension is the product of decoding and linguistic comprehension (Gough & Tunmer, 1986). Words must be read correctly (i.e., decoding), but for reading comprehension to be achieved a reader must have sufficient linguistic knowledge (i.e., vocabulary, syntax, inference) to obtain meaning from text. Reading difficulties usually represent a breakdown in either or both of these two components, decoding and linguistic comprehension.

As students begin the process of reading words, a series of connections take place that link three different codes: Orthographic (how words are spelled), phonological (how

words are pronounced), and semantic (what words mean; Seidenberg & McClelland, 1989). Connectionist models of reading seek to explain, among other things, how reading is acquired, and knowledge is constructed through the links between phonology, orthography, and semantics. The model explains that typical readers are able to link understandings of a printed word to how it is pronounced and what it means, especially based on previous exposure to words that are spelled or pronounced similarly (Seidenberg, 1985, 2017). The resultant network that develops from these connections explains how students can make sense of what they read. Providing explicit instruction in decoding and vocabulary can therefore strengthen the network and make reading acquisition more efficient.

Perfetti's Lexical Quality Hypothesis explains how well-established connections between how a word is pronounced (phonology), how a word is spelled (orthography) and its meaning (semantics) result in more efficient reading, and consequently facilitate reading comprehension (Perfetti, 2007). When a reader can connect each of those three elements then a high-quality representation of a word can develop and reading should occur more efficiently. However, when that process is interrupted, that is, when students cannot connect how a word sounds to how a word is spelled, then they will have difficulty constructing meaning and an understanding of what is being read cannot take place. It is under these circumstances that more explicit instruction of how to develop word meaning must occur in order to facilitate a reader's ability to understand what they read (Perfetti & Hart, 2002).

In summary, several models of reading comprehension underscore the critical importance of decoding proficiency and vocabulary knowledge. Understanding and learning from print cannot occur if one or both aspects are under-developed or insufficient for a given text. For these reasons, interventions aimed at improving reading comprehension have targeted decoding skills, vocabulary knowledge, or both domains.

### **Findings from Interventions with Only Decoding and Vocabulary Components**

A small number of studies have utilized randomized controlled trials to examine the effects of interventions consisting of only decoding and vocabulary components on reading outcomes for struggling readers. These studies can be categorized according to which relevant outcomes they measured. Two of these studies measured decoding, vocabulary, and reading comprehension (Clarke et al., 2014; Duff et al., 2014), two measured decoding and vocabulary (Gillon et al., 2019; Zoski & Erikson, 2017), and one measured decoding and reading comprehension (Parmer et al., 1997). Two other studies measured a single reading outcome; Vellutino and Scanlon (1987) measured only decoding, and Elleman et al. (2017) only measured vocabulary acquisition.

Within each of these categories organized by the reading outcomes they measured, the studies can be further divided into two categories: (a) Those that combined decoding and vocabulary components into a single treatment and compared outcomes to business-as-usual instruction (i.e., studies without a decoding-only treatment), and (b) those that included a separate treatment group that only received instruction in decoding and compared outcomes to a group that received some combination of decoding and vocabulary instruction. This distinction among studies is necessary because the inclusion

of a decoding-only group allows for stronger inferences regarding the benefits of integrating decoding and vocabulary instruction.

### ***Interventions with Decoding, Vocabulary, and Reading Comprehension Outcomes***

Duff et al. (2014) employed the Reading and Language Intervention (RALI) with a subsample of 56 six-year-olds who fell in the bottom tier of a two-measure word reading screener and were thus determined to be at risk for developing dyslexia. In the reading strand of the RALI, instructors encouraged students to primarily use taught decoding skills, even though students were also taught other strategies such as using context and pictures. Phonological awareness, phoneme manipulation, and phonetic decoding exercises were also emphasized in this strand. This portion of the intervention was conducted one-on-one with students and consisted in part on increasing phoneme awareness through explicit instruction of phonetic decoding. The language strand of RALI focused on explicit multi-contextual and interactive teaching of target vocabulary words, and then reading a story with those words. Researchers described instruction received by the waitlisted control group as standard classroom education.

The investigators compared the RALI intervention that combined decoding and vocabulary instruction to the business-as-usual control group (which received what was described as typical classroom instruction) on measures of decoding, vocabulary, reading comprehension. For the initial nine weeks of the investigation, the waitlisted control group received the standard curriculum in their classrooms. At post-test, the treatment group outperformed the control group on the Early Word Reading measure of the York Assessment of Reading Comprehension (YARC; Snowling et al., 2009) with an effect

size of .34. Three other decoding measures, single word reading ( $d = .05$ ), nonword reading ( $d = .10$ ), and prose reading accuracy ( $d = -.03$ ) showed no differences between groups. Duff et al. (2014) also compared their intervention and control groups on measures of vocabulary. On a measure that assessed knowledge of words taught in the first nine weeks of the intervention, the treatment group outperformed the control group with an effect size of .40, but on a measure of expressive vocabulary there were no differences between groups ( $d = -.10$ ). They used a single measure, the Passage Reading subtest of the YARC (Snowling et al., 2009), to report differences in reading comprehension between students in the RALI treatment group and the control group. Results revealed no differences between groups with an effect size of .03.

Clarke et al. (2017) investigated whether students who struggle with word reading would benefit more from an intervention that focused only on explicit instruction of decoding skills, or one that also included a language comprehension component with a heavy emphasis on vocabulary instruction. Researchers recruited students between the ages of 11 and 13, by first asking teachers to identify students who they believed were at least one grade below in their reading level. After taking the Single Word Reading Test (SWRT; Foster & National Foundation for Educational Research, 2008), students who received a standard score of 91 or below were included in the study. They utilized a three-pronged intervention that compared a Reading Intervention (RI) group that solely received instruction in decoding skills, a RI + Comprehension (RI + C) group that received that same instruction in decoding but also received instruction in reading comprehension that focused on vocabulary development, , and a wait-listed control group

that received business as usual instruction. Clarke et al. randomly assigned 277 students to one of the three conditions. Students in the treatment conditions received intervention for 35 minutes three times a week over a 20-week period, totaling 35 hours.

Each RI session began with students first reading an easy book followed by a grade level instructional book. Then students received instruction in letter knowledge, word identification, and phonological awareness, and were then required to write a sentence with the studied words. At the end of each RI session, students were introduced to a new instructional level book that would be considered in more detail at the start of the next session.

Students in the RI + C condition received the same number of total intervention hours, but their weekly schedule consisted of only two RI sessions with the third being replaced by the Comprehension component. These sessions began with vocabulary instruction in the form of a word of the day. Instructors taught these words using a version of the Multiple Learning Context approach (Beck et al., 2013) which involved students using graphic organizers and cards with the definition written on them. Students then listened to the new words from a passage in one of two books followed by game-like activities, exploration of figurative language, and story maps, all related to the previously practiced words. Finally, they used this information to engage in discussions of the story.

Clarke et al. (2017) reported that students in the waitlisted control group primarily received normal classroom instruction. Although there was nothing reported by the participating schools that would indicate the presence of a specific confound, it is possible that individuals in this group might have received some type of individual or

small group instruction. The authors did not give any further indication as to the instruction in these various classrooms.

Using latent variable modeling, Clarke et al. (2017) found that at posttest there were no differences between either of the treatment groups and the control group on a decoding measure. At immediate posttest, neither the RI treatment group ( $d = .06$ ), which focused only on decoding, nor the RI + C group ( $d = .10$ ), showed gains over the control group. An 8-month follow up assessment revealed the same between-group differences.

On a latent variable model of vocabulary knowledge, Clarke et al. (2017) found that the RI + C group outperformed the control group at immediate posttest with an effect size of .34. After eight months, the RI + C group continued to show differences over the control group with an effect size of .33. In that same model, the RI decoding-only group showed no differences with a control group at immediate posttest ( $d = .10$ ) and at an 8-month follow up ( $d = .11$ ).

On a latent variable model for reading comprehension, Clarke et al. (2017) found marginal differences between the RI + C group and the control group with an effect size of .29 at posttest. There were no differences between the RI and control group ( $d = .08$ ).

In summary, students in the RI + C group showed gains in both vocabulary and reading comprehension over the control group whereas students in the RI only group did not. As part of their study design, the researchers compared the gains each treatment made over the control group and did not analyze differences between the two treatment groups. Researchers explain that gains in comprehension were attributable only to the



NGRT measure which has a multiple-choice format susceptible to guessing and gains on the WIAT II were negligible.

### ***Interventions with Decoding and Vocabulary Outcomes***

Gillon et al. (2019) tested the effects of the Better Start Literacy Intervention with 141 five- and six-year-olds. They used the Clinical Evaluation of Language Fundamentals Preschool—Second Edition-Australian and New Zealand Edition (CELF-P2; Semel, Wiig, & Secord, 2006) and the initial phoneme identity subtest of the Computer Based Phonological Awareness Assessment (CBPA; Carson, Gillon, & Boustead, 2011) to identify students with below average performance in oral language and phoneme identification, two areas vital to literacy development. Students in the treatment group received the Better Start Literacy Intervention, which consisted of a section that emphasized decoding that was adapted from the Phonological Awareness Training Programme, and a separate section on vocabulary, for 10 weeks. In the section adapted from the Phonological Awareness Training Programme, all activities were based at the phoneme level, and letter-sound knowledge was integrated into the activities. Children were provided with opportunities (i.e., phoneme identity, phoneme segmentation/blending and phoneme manipulation activities) to use their increased phonological awareness knowledge to assist in their reading for every lesson. In the vocabulary section, children were exposed to a targeted vocabulary word and its elaboration, within the context of a story. These elaborations were reviewed each time the story was read or summarized. The comparison group followed a business-as-usual curriculum which focused on listening, reading, viewing, speaking, writing and

presenting; it also included some instruction on letter sound knowledge, in addition to teacher provided prompts to provide meaning, structure, visual, grapho-phonetic and prior knowledge to comprehend written text to recognize in print a large bank of high frequency words. It was reported that teachers are free to provide an early word reading curriculum of their own choosing and that they focus on literacy for at least one lesson per day.

The researchers employed a stepped wedge design which consisted of a 10-week baseline period with no intervention, followed by a 10-week period where a treatment group (Group A) received instruction in decoding and vocabulary while a second group (Group B) continued to receive business-as-usual instruction. There was also a third 10-week period when Group A returned to business-as-usual instruction and Group B received the intervention. A multivariate repeated measures approach compared differences in assessment results administered 3 times, once at the end of baseline (time 1), once after Group A received intervention (time 2), and once after Group B received intervention (time 3).

On a researcher-developed nonword reading measure requiring the use of decoding skills, Group A outperformed Group B at both time 2 [ $F(1, 141) = 26.654$  ( $d = 0.88$ )] and time 3 [ $F(1, 139) = 7.365$  ( $d = 0.46$ )]. Vocabulary was assessed by measuring knowledge of elaborated words, which were words whose meanings were explicitly taught in the intervention, and unelaborated words which students were merely exposed to during the intervention. For elaborated words each group outperformed the other immediately following their respective intervention time. Group A outperformed Group

B at time 2 [ $F(1, 141) = 5.650$  ( $d = 0.40$ )] and Group B outperformed Group A at time 3 [ $F(1, 139) = 12.561$  ( $d = 0.61$ )]. For unelaborated words, no differences were found between groups A and B at any assessment time. In summary, results indicated that students who received the Better Start Literacy Intervention had increased gains in targeted vocabulary over students receiving business-as-usual instruction, but that students in that regular classroom setting demonstrated no difference than students in the intervention on letter knowledge. Students who received the intervention also demonstrated stronger decoding skills on a non-word measure than students who received regular classroom instruction.

Zoski & Erikson (2017) compared the effectiveness of three intervention conditions: One that included phonological awareness, letter knowledge, and morphological awareness (PA/LK/MA); an intervention that contained only phonological awareness and letter knowledge components (PA/LK); and an intervention consisting solely of instruction in morphological awareness (MA). Students were administered the First Sound Fluency (FSF) subtest and the Phonemic Segmentation Fluency (PSF) subtest, both from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) test to determine if they were persistently at risk for reading difficulties. Then, because it was necessary for students in the interventions with an MA component to correctly produce the phonemes -ed and -s, eligible students were also required to produce certain word-final phonemes on the TEGI Phonological Probe (Rice & Wexler, 2001) with 80% accuracy. Fifty-one students with an age range between 5.6 and 6.11 were randomly assigned to one of the three interventions through a process that was partially based on

when students were available for intervention times. Each treatment group contained 17 students, but intervention was delivered in groups of 4 or 5 students. Students received the intervention for 30 minutes, four times a week for six weeks for a total of 12 hours.

Students in the PA/LK treatment received instruction in how to correctly pronounce certain letters. This treatment targeted blending, segmenting, and letter–sound relationships, then used PASS curriculum in shared reading and games that centered on lessons such as blending phonemes. Students in the MA only treatment used a “word detective” strategy to recognize certain suffixes and their meanings. Then, students participated in a shared reading activity where the students needed to identify words that contained the previously studied morpheme. A third treatment combined the PA/LK treatment with the MA treatment, and devoted equal time in the 30-minute intervention to each component. Letters used in the PA/LK portion of the intervention corresponded to the suffixes used in the MA portion. For example, when /d/ was a target phoneme of the first part of the lesson, -ed was the suffix targeted in the second part. After completing a posttest battery that consisted standard measures of phonological awareness, morphological awareness, word reading, and morphological spelling, comparisons were made within and between each of the groups.

Within-group comparisons were made on all four dependent variables, word reading, PA, MA, and spelling of morphological endings. Both the PA/LK group ( $t(5) = -5.36, d = 2.19$ ) and the MA group ( $t(5) = -5.06, d = 2.07$ ) showed significant gains in word reading, but there were no other significant pre- to posttest gains in any of the three groups. For the between-group comparisons, data analyses revealed that the combined

treatment group (PA/LK/MA) contained many outliers which prohibited the data from meeting the assumption of univariate normality. Subsequent non-parametric tests did not observe significant main effects of treatment type on any measure at posttest. MANOVA did not detect any difference between the PA/LK or the MA approach to early reading ( $F(4, 7) = .645$ ).

In summary, there were no differences between groups, but all groups had increased gains at posttest over pre-test. Even when a morphological component was added to the intervention, decreasing the intervention time spent on word reading level instruction, there were still increased decoding outcomes at posttest.

### ***Interventions with Decoding and Reading Comprehension Outcomes***

Parmer et al. (1997) examined the effects of a decoding and vocabulary intervention without the use of a decoding only treatment group. They sought to determine the effectiveness of a novel approach to reading that incorporated instruction in both word recognition and constructing meaning through vocabulary development. The researchers randomly assigned 130 fourth and fifth graders whose standardized scores on the Iowa Test of Basic Skills (ITBS) indicated they were at least one grade level behind in reading, to either the experimental condition or the control condition. The experimental group received one-on-one instruction by preservice teachers for 50 minutes twice a week for 10 weeks totaling approximately 16 and a half hours of total intervention time.

The integrated instructional format employed by the preservice teachers included instruction in phonics, sight words, and word recognition strategies. Reciprocal teaching, semantic mapping, and explicit teaching that focused on vocabulary expansion. Students

assigned to the control condition received their business-as-usual classroom instruction administered by the classroom teacher. This group received reading lessons in a small group setting where the teacher taught directly from a basal reader, a reading source specifically not used as a part of the integrated instructional format in the experimental group. Classroom teachers were instructed by researchers to precisely follow the teacher guides accompanying the basals.

At post-test there were no differences between groups on the Slosson Oral Reading Test [ $F(1, 118) = .17, p > .05$ ] which tested decoding skills. On the Analytical Reading Inventory, a measure of reading comprehension, the treatment group outperformed the control group on all four measures of reading comprehension, cause and effect ( $d = .70$ ), main idea ( $d = .41$ ), factual ( $d = .36$ ), and terminology ( $d = 1.01$ ).

### ***Intervention with only a Vocabulary Outcome***

Elleman et al. (2017) studied the effects of a decoding and vocabulary intervention with 68 struggling readers in grades 3 to 5. To be eligible for the study, students had to score below the 25th percentile on the Fluency portion of the Gray Oral Reading Test (GORT) and at or below the 25th percentile on the GORT Comprehension subtest. Participating students were assigned to one of two conditions; both conditions received the same decoding instruction, but one condition then received explicit instruction in vocabulary, while the other received traditional instruction in reading comprehension. The decoding portion of their intervention which both conditions received consisted of Phonological and Strategy Training (PHAST; Lovett, et al., 2000) and QuickReads (Heiber, 2003), which focused on decoding, word recognition, and

fluency. The vocabulary portion involved teaching students four strategies for learning new words: Identify part of speech, word analysis, context clues, and looking up a word in the glossary (only used if necessary). Students in the other condition received instruction in reading comprehension strategies instead of the vocabulary strategies. These comprehension strategies were meant to mirror typical classroom reading comprehension instruction, which primarily consisted of students reading text and completing worksheets. Elleman et al. (2017) then compared the group of students who received the decoding and vocabulary treatment to the group of students that received the same decoding instruction paired with commonly used reading comprehension strategies.

To conduct their data analysis, researchers used item-response based crossed random effects models to determine the variance across children and words. In the resultant conditional model, there was a significant main effect for the group ( $z = 3.305$ ,  $p < .05$ ) in which the students in the vocabulary group answered significantly more questions correctly on a researcher designed vocabulary measure than the traditional comprehension group. This means that students in the vocabulary group were 63% likely to choose a correct response, whereas the comprehension group was only 40% likely to achieve the same goal. There was an additional significant interaction between the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 2011) vocabulary measure and group ( $z = 2.006$ ,  $p < .05$ ), which can be translated to mean that those students who had high pretest scores on that measure and were in the vocabulary group had a higher probability of answering correctly than children with low pretest scores.

### ***Intervention with only a Decoding Outcome***

In the second experiment of a larger longitudinal study, Vellutino & Scanlon (1987) examined the extent to which either phonemic segmentation and name encoding or word retrieval are differentially affected by problems with phonological coding. One of the things they sought to explore with this experiment was the idea that letter naming and phonemic segmentation are skills that both contribute to word identification and that if either one is negatively affected then reading difficulties will occur. According to the authors, this is consistent with the idea that when a developing reader is presented with a new word, they need to draw upon both phonological and semantic information for successful word identification to take place.

To conduct their experiment, researchers enlisted 300 students with half of that number from 2<sup>nd</sup> grade and the other half from 6<sup>th</sup> grade. Students in each grade level were then separated into subgroups of poor and normal readers. Poor readers were identified by scoring a 90 or above on the Slosson Intelligence Test and were at or below the 10<sup>th</sup> percentile on the Gilmore Oral Reading Test (Gilmore & Gilmore, 1968). Students identified as normal readers scored at or above the 50<sup>th</sup> percentile.

Each of the four subgroups of 75 students (e.g., 2<sup>nd</sup> grade poor readers) were randomly assigned to one of five treatment groups. One treatment group only received instruction in phonemic segmentation training (PST), which consisted of students being taught to segment pseudowords into their component sounds or phonemes. This training replicated the process where early readers learn different grapheme-phoneme correspondences and then transfer that knowledge to allow for their identification in new words. The treatment consisted of a training phase which lasted a half hour for either five



or six days, followed by a researcher developed content acquisition subtest, and a transfer phase subtest which required students to read the pseudowords used in the training phase in reverse. Another group received instruction in response acquisition (RA) which simulated the process of acquiring vocabulary by using pseudowords. In a later chapter that referenced this study, the instruction this group received was referred to as whole word (WW) training (Vellutino & Scanlon, 1991). After the introduction of the pseudowords, students were provided concrete meanings that paired with the nonsense syllables. Following the intervention, students took the same training and transfer subtests administered to the PST group. A third condition (PSTRA) combined both of these treatments; students then took the same two content acquisition subtests administered to the previous treatment groups. Two different control groups were used; one control group (C1) was administered both the training and transfer phase subtests, whereas (C2) was only administered the transfer phase subtest.

The investigators used an ANCOVA design (2 reader abilities x 5 treatments) to analyze their data. Results for the transfer subtest indicate that there were no interactions in either 2<sup>nd</sup> or 6<sup>th</sup> grade. Investigators report that this indicates that both struggling readers and students in the normal reader group benefited from the PST and RA training. However, the researchers also note that students in the PSTRA group outperformed ( $p < 0.05$ ) students in either the PST or the RA groups, with the one exception where the second grade poor readers in the combined PSTRA group did not outperform students who received training in only PST (Vellutino & Scanlon, 1987). These results indicate an

additive effect of combining instruction in decoding and vocabulary on word reading outcomes.

### **Additional Investigations into the Effects of Combining Decoding and Vocabulary Instruction on Reading Skills**

Research on the combined effects of decoding and vocabulary components has also been conducted with other populations that are not classified as struggling readers. Studies are briefly reviewed here to provide context for the present investigation. Filippini et al. (2012) sought to determine if students who received an intervention with a vocabulary component added to a decoding component had greater gains in vocabulary than students who only received instruction in decoding. Researchers utilized a three treatment design that included a group that only received instruction in phonemic awareness and decoding (PAD), which would serve as a control. A second group received PAD plus vocabulary instruction in the form of morphological awareness (PAD-MA), and a third group received PAD combined with semantic reasoning (PAD-SR).

Filippini et al. (2012) recruited and randomized at the classroom level with one classroom receiving the PAD treatment alone, and three classrooms assigned to PAD plus a vocabulary condition. Then, students within each class were ranked based on their pretest scores on the Nonsense Word Fluency subtest of DIBELS. Based on these rankings, students were put into four groups within each class. In the classrooms randomly assigned to receive the PAD with vocabulary condition, the four groups were randomly split between either the PAD-MA or the PAD-SR. This resulted in two PAD-MA groups and two PAD-SR groups in each of the three classrooms originally

randomized to receive the added vocabulary condition. On average, students received 15 minutes of intervention, four times a week for eight weeks. At the end of the intervention, it was reported that students spent an average of 394.5 minutes in intervention.

In the PAD condition, phoneme sequences were introduced in order of complexity, and instructional lessons moved from word identification to production to manipulation of sounds, decoding activities including decoding within the context of a sentence. In both PAD plus vocabulary conditions, high-frequency target words were introduced with a picture followed by direct instruction on word meaning; however, the content of that instruction varied by condition. In the PAD-SR (semantic reasoning) condition, students grouped words according to the relationship of their meanings. In the PAD-MA (morphological awareness) condition, students were taught the meaning of individual morphemes including derivational and inflectional forms.

Researchers used the NWF subtest of DIBELS to measure differences in decoding between the control group which only received instruction in phonological awareness and decoding (PAD), and the two treatment groups that also received vocabulary instruction in addition to decoding (PAD-Morphological Awareness or PAD-Semantic Reasoning). At posttest, the PAD-Morphological Awareness group outscored the PAD group on the decoding measure with an effect size of .44, and the group that was taught to categorize words based on their meaning (PAD-Semantic Reasoning) outscored the PAD group on a decoding measure with an effect size of .37. At post-test there were no differences between the PAD-MA and PAD-SR groups on the NWF ( $d = .09$ ). Filippini et al. (2012) also used a researcher-designed assessment to measure knowledge of words taught in

both treatment conditions that contained an added vocabulary component (PAD+MA and PAD+SR). Students in the decoding only condition (PAD) were not explicitly taught these words. At post-test on the taught-word measure, students in the MA group outperformed students in the PAD condition with an effect size of .64 and students in the SR group outperformed students in the PAD condition with an effect size of .54. At post-test there were no differences between the PAD-MA and PAD-SR groups on a measure that assessed target vocabulary knowledge ( $d = .08$ ). In summary, this study indicated that instruction targeting both vocabulary growth and decoding skills can improve both areas. It was expected that groups with the added vocabulary component showed greater gains over the decoding only group on a target word vocabulary measure. However, those groups with the vocabulary components also performed at least as well as the decoding only group on word reading measures despite having only 30% of their intervention time devoted to instruction in decoding.

Some studies have explored the effects of combined instruction in decoding and vocabulary, but they have employed designs that make it difficult to discern precise causal inferences as to what component was directly responsible for any gains that might have occurred as a result of the intervention. These studies can still provide valuable information on the link between decoding and vocabulary instruction because they can serve as foundational support for future studies that seek to analyze the contributions of these two components on increased reading outcomes. Duff et al. (2008) implemented an intervention that combined vocabulary instruction with phoneme awareness activities for students who previously responded poorly to interventions that only focused on decoding

skills. Participating students made gains in decoding skills after nine weeks but without a control group for comparison it is impossible to establish a causal effect of the vocabulary instruction (Duff et al., 2008).

Even when researchers used a design that allowed them to determine if an added vocabulary component can increase decoding skills, the results can be contradictory from what is expected in the prevailing reading theory. Hogaboam & Perfetti (1978) conducted a within-subjects experiment with 10 skilled readers and 10 less skilled readers in the fourth grade. Students were presented with a booklet of pseudowords and were told to repeat the word after hearing the word pronounced correctly. Some of these pseudowords were accompanied by a meaning read by one of the researchers. There was no explicit instruction, students were merely prompted to repeat what they heard to make sure they could decode a pseudoword, and when relevant repeat its meaning. Researchers found that with regard to a student's subsequent ability to decode a pseudoword, there was no effect of having meaning attached to that pseudoword.

Michaud et al. (2017) also used a within-subjects design to examine the value-added effect of vocabulary instruction to decoding instruction for at risk beginning readers. They found that providing the meaning of words had no effect on students' decoding ability or their expressive vocabulary knowledge of taught words. Findings such as these emphasize the need for additional studies that adhere to this same design so that a stronger evidence base can be compiled.

## **General Discussion**

Based on this review, interventions that combined decoding with vocabulary instruction had mixed results on students' reading outcomes. Based on the current intervention research there is insufficient evidence to show that a combination of these two components alone results in improved reading for struggling readers.

There are strong theoretical perspectives that suggest that vocabulary might strengthen decoding skills when they are both targeted in an intervention. In their Connectionist Model, Seidenberg & McClelland (1989) advocated for a single system for learning to read words that link how a word sounds (phonological representation), how a word is spelled (orthographic representation), and the meaning of that word (semantic representation). Through the connections between these three representations, skilled readers can effectively develop an understanding of a word and as they automatize this process, increase their ability to read for comprehension (Seidenberg & McClelland, 1989). For less skilled and struggling readers, a weakened connection between one of these representations results in impaired reading. According to the model, when a reader is unable to connect the information about how a word sounds with how that word is spelled in an efficient manner, then it is difficult to determine what that word means (Seidenberg, 1985). Adhering to this theory, providing explicit instruction on both how to connect a word's sound to how it is written (decoding) with the meaning of a word (vocabulary) should improve reading acquisition. Ultimately, these connections should result in more efficient reading and stronger comprehension.

Another theory provides a similar explanation for word reading acquisition and the connection of information to support reading comprehension. Perfetti's Lexical

Quality Hypothesis states that high quality representations of words are developed from how a word is pronounced (phonological), how a word is spelled (orthographic), and a word's meaning (semantic; Perfetti & Hart, 2002). Skilled readers can utilize all three of these sources of information to create high quality lexical representations in their memory that can be recalled with increasingly greater efficiency (Perfetti, 2007). When a struggling reader mispronounces a word because of a poor link between what has been heard (phonological) and what is written (orthographic), then the meaning of that word cannot be effectively determined (Perfetti, 2007). This theory can then be understood to mean that if struggling readers received instruction in how to bolster the link between how a word sounds and how it is spelled (i.e., decoding) with instruction on what a word means (vocabulary), then both reading efficiency and reading comprehension should improve.

In short, both the connectionist framework and the LQH suggest that reading skills, particularly decoding and reading comprehension, should benefit from reading instruction that integrates vocabulary and decoding instruction. Despite the logical and intuitive appeal of these perspectives, the intervention research thus far that has combined decoding and vocabulary instruction is limited, and what exists has produced mixed findings. Based on the current intervention research there is insufficient evidence to show that a combination of these two components results in improved reading over interventions that emphasize only instruction in word reading, for struggling readers.

The wide range of effect sizes on decoding outcomes can possibly be a result of various factors inherent to the original interventions. Most of these studies did not have

strong enough designs to thoroughly and accurately test the effectiveness of combining decoding and vocabulary instruction. In order to clearly show that vocabulary instruction is an important component as theorized, then a study design is needed that tests the relative benefits of decoding compared to decoding and vocabulary. As of now, however, findings from the current corpus of research from available investigations on all reading outcomes were mixed and inconclusive regarding the unique effects of combined instruction in word reading and word meaning on decoding, vocabulary development, and reading comprehension.

Interventions demonstrated more consistent effects in improving vocabulary knowledge. Increasing vocabulary knowledge is not specifically a reading skill, but it is critical for reading comprehension and vocabulary knowledge improves through reading. When struggling readers were provided an intervention that contained explicit instruction in both decoding and vocabulary, evidence from the relevant studies indicated that students generally increased their vocabulary knowledge. These results indicated that when researchers administered an assessment of words taught in the intervention, struggling readers were able to make moderate gains compared to a comparison group of students who did not receive the intervention (Clarke et al., 2017; Duff et al., 2014; Gillon et al., 2019). However, it should be noted that in each of these studies, students were assessed on their knowledge of words that were taught to them in the intervention. Students in the comparison groups did not receive instruction on the meaning of the words in the assessment.



The effects of the interventions on vocabulary knowledge are not surprising given that the words on which they were assessed were taught to them in the intervention. Nevertheless, an additional possible explanation for the moderate gains in vocabulary outcomes when students were assessed on words taught in the intervention can be traced to combining a decoding and vocabulary instruction. The decoding practice that these students received in the relevant interventions could have helped them acquire meaning for those words that they were able to retain for a subsequent assessment. The decoding skills that students learned could have helped them create stronger and higher-quality lexical representations of words when they are instructed on the meaning of those words (Perfetti & Hart, 2002). Students who received the intervention were then able to use those strengthened connections between the phonological representation and orthographic representation of a word to recall its meaning on vocabulary measures of words taught in the intervention (Perfetti, 2010).

There were little to no gains observed on standardized measures of reading comprehension in the relevant studies. In order for there to be any conclusive evidence on the effectiveness of integrated decoding and vocabulary interventions on reading comprehension, interventions need to be designed that more closely evaluate the processes by which struggling readers' increase their automaticity by creating higher lexical representations of words. This was represented in a single instance; Clarke et al. (2017) in which a treatment group with combined instruction in decoding and vocabulary made greater gains in reading comprehension over a comparison group that only received instruction in decoding (Clarke et al., 2017). While this is promising evidence of the

added benefit of a vocabulary component, it is difficult to draw broad conclusions from this one study.

There have been several meta-analyses that have examined the effectiveness of interventions on improving reading comprehension (Edmonds et al., 2009; Scammacca et al., 2015; Wanzek et al., 2013). However, the interventions in these meta-analyses were generally multi-component or were concerned with deriving word meaning through instruction on skills such as inference-making or finding the main idea. In the reading comprehension interventions examined by Edmonds et al., (2009) students were taught a combination of comprehension skills and strategies such as previewing and summarizing. Scammacca et al. (2015) examined interventions that consisted of only one component such as word study, vocabulary, comprehension, and fluency, in addition to multicomponent studies. They reported that almost all of the interventions they classified as multicomponent contained instruction in both fluency and comprehension, and two-thirds contained vocabulary. The multicomponent interventions analyzed by Wanzek et al. (2013) were categorized as having at least three components of a list that included word recognition, fluency, vocabulary, and comprehension. Because decoding skills and knowledge of vocabulary words are central elements in predominant theories of reading, it is important to understand the effects of these specific components in interventions for students who struggle to read (Gough & Tunmer; Perfetti, 2007; Seidenberg & McClelland, 1989). Clearly, more research is needed that helps determine the unique effects of targeting decoding, vocabulary, or both skills on students' reading comprehension outcomes.

### **Chapter 3: Methodology**

The purpose of this study was to compare the benefits of explicit instruction in decoding combined with instruction in vocabulary skills over instruction in decoding alone on the reading comprehension skills of adolescent struggling readers. As such, my investigation asks the question: What are the relative benefits of an intervention that targets decoding only compared to targeting decoding plus vocabulary on the reading comprehension of adolescents with reading difficulties? Based on relevant reading comprehension theory (Gough & Tunmer, 1986; Perfetti, 2007; Seidenberg, 1985, 2017), I hypothesized that instruction in both decoding and vocabulary would result in stronger reading comprehension than instruction in decoding alone.

#### **Participants**

Participants were secondary-grade students with an age range of 13 years and six months to 15 years and five months. Each participant was identified by either a teacher or a parent as a struggling reader with dyslexia. After parental consent and student assent was confirmed, each student was given an online administration of the Test of Word Reading Efficiency 2 (TOWRE-2; Wagner et al., 2011). Both subsets of the TOWRE-2, the Sight Word Efficiency (SWE) subtest and the Phonemic Decoding Efficiency (PDE) subtest were administered in order to accurately determine the word level skills of the participants. All four students were in the lowest 10<sup>th</sup> percentile in their age group for both the SWE and the PDE.

Those four students were then randomized into groups of two that determined which treatment they received first, either instruction in decoding alone, or instruction in

decoding and vocabulary. Two students received decoding instruction in the first instructional phase followed by decoding plus vocabulary instruction, and two students received decoding plus vocabulary instruction first followed by decoding only. The purpose behind alternating the order in which students received each of the two different types of instruction was to provide information about the unique benefits of one instruction compared to the other.

### **Dependent Variables and Measures**

Two dependent variables were measured in this investigation, reading comprehension and fluency. Both reading comprehension and fluency were measured using passages from EasyCBM (Alonzo et al., 2006).

#### ***Reading Comprehension***

Nine passages along with their corresponding multiple-choice questions were selected from the EasyCBM Basic Reading measures. To achieve equivalency among the passages, each passage was selected from the 8<sup>th</sup> grade content level. Those nine passages were randomly divided to form three tests: Test A, B, and C. Each test included three passages and the corresponding comprehension questions for each. Test A consisted of three passages that contained words that were emphasized in the decoding instruction. Test B consisted of three passages that contain words that were emphasized during the decoding and vocabulary instruction. Test C was included as a control test, in which none of the words were targeted in instruction. Words were selected that are difficult to pronounce based on the number of syllables and the presence of complex vowel and syllabication patterns. It was also important that the words have a meaning that is integral

to understanding the story. The words from each passage were identified prior to their randomization into Tests A, B, and C.

Each passage was followed by five reading comprehension questions so that each test (A, B, and C) contained a total of 15 questions. Each reading comprehension question was multiple choice and had three possible answer choices. After the first participant completed all 18 sessions of the study, the lead researcher made the determination that there needed to be an additional answer choice for each question. This additional answer choice also served as a near discriminator to the correct answer choice. This decision was made in an attempt to increase the difficulty of each question and each test as a whole. After the near discriminator was written, it was randomly inserted into the order of the answer choices for each question. Therefore, the remaining three participants had four answer choice from which they could choose.

### ***Oral Reading Fluency***

Each student was also assessed on their oral reading fluency ability by reading aloud one of the nine reading comprehension passages each session. A student's oral reading fluency ability is considered a good indicator of not only their decoding skills, but of their overall reading comprehension as well (Fuchs et al., 2001). The ORF passage selected for each session was determined systematically by starting with the first passage of Test A in the first session, then the first passage of Test B in the second session, followed by the first passage in Test C for the third session. This continued until the third passage of Test C was read for an ORF score on the ninth session. For the following day,

session 10, the series repeated itself. Students knew each day which passage was read for an ORF score.

## **Design**

This study used an adapted alternating treatments design (Sindelar, et al., 1985) to compare the effectiveness of a decoding only treatment with a decoding plus vocabulary treatment on reading comprehension. In baseline, participants did not receive any instruction. Instead, for the first session, students were administered the passages in Test A and asked to answer the questions for each reading. For the next session, students read the passages in Test B, followed by the passages in Test C the following day. Students remain in baseline until two data points per test were collected.

Following the baseline phase, students moved into the first instructional phase. This stage consisted of either direct instruction in decoding only, or in direct instruction of decoding plus vocabulary. The first instructional phase alternated for each participant such that half the participants received decoding only first, and the other half received decoding plus vocabulary first.

In their first instructional phase, students were administered a test at the end of each session were then required to read the passages and answer the reading comprehension questions. Across the instructional phase, students were administered each test (A, B, or C) twice. Students advanced to the second instructional phase when they were taught all of the words in that condition.

In the second instructional phase, those students who initially received instruction only in decoding, were given instruction in decoding plus vocabulary, and vice versa.

Participants received the intervention for 20-30 minutes, 4 days a week for a total of 18 sessions.

## **Procedures**

For each baseline session no instruction occurred. Each student was administered a test, A, B, or C, during the session. The purpose of this stage of the experiment was to gather data on the existing reading comprehension skills of the students participating in the study.

### ***Decoding-Only Phase***

Students in the decoding treatment received direct instruction in how to pronounce key words found in the passages from Test A. For each decoding lesson, three words were introduced. Instruction with the new words followed the “Every syllable has at least one vowel (ESHALOV)” procedures described by O’Connor, et al. (2015, 2017). Lessons were prewritten on power point slides and shared with the student online. At the start of each lesson, I presented the first new word on the screen and modeled a correct pronunciation. On the screen, I underlined each vowel; any vowel teams that make a single sound were underlined together. I then asked the student to first identify any known word parts and to then count the number of word parts. The student then said each word part before being asked to pronounce the entire word. Beginning with the second lesson, all the words from the previous day were shown on a single slide and the student was asked to pronounce each word. If the student pronounced each word correctly, then instruction began on the new words for that day; however, if the student mispronounced

any of the review words, then the instructional procedures for new words were then repeated.

There was no instruction on the meaning of any words during this phase. All words were chosen from the passages in Test A and were taught across all the sessions in the instructional phase. Sessions continued until the student learned the set of target words. At the end of each session a test was administered, beginning with Test A. Participants were presented with the first passage on a shared screen and read the entire passage out loud. Following each passage, students then read each of the five multiple-choice questions out loud and responded with the correct answer which was recorded by the researcher. A test was administered at the end of each session until each test (A, B, and C) was administered twice (six sessions). Scores were collected at the end of each session in the form of a percentage of reading comprehension questions answered correctly. During the administration of each test, an oral reading fluency (ORF) score was also obtained on one of the passages from each test.

### ***Decoding Plus Vocabulary Phase***

In the decoding plus vocabulary phase, students received direct instruction on the pronunciation and meaning of words from the passages in Test B. As in the decoding-only condition, the words targeted for instruction were important for comprehension of the relevant passage. The instructional procedures used in the decoding only phase on how to pronounce words were also followed for the first part of each of the sessions in this phase. In addition to instruction on how to pronounce the word, participants also received instruction on the meaning of each word. After a word was pronounced



correctly, students were shown a student friendly definition of that word on the same power point slide. Students were then asked to read the definition on the screen out loud. Each definition was developed by the lead researcher and provided a student-friendly explanation that provided the student with an opportunity to understand how the word might be used in conversational language (Beck, et al., 2013).

In this instructional phase, the set of target words and accompanying definitions selected from Test B and were taught across all sessions of this instructional phase. As in the decoding only phase, sessions continued until a student learned all the words and definitions from this instructional phase. Tests were administered following the same procedure as in the decoding-only phase. After each session, a test was administered until each test (A, B, and C) was delivered at least twice. After the student read each definition, they were asked if they had any questions. After this procedure was repeated for all three words for that day, they were presented with a series of questions designed to connect that word with something from the student's personal experience and ensure that they fully understood the definition of each word. These questions took the form of either a word association, or one of the following question stems, Have you ever...?, Which would you...? These follow up associations and questions were also researcher developed (Beck, et al., 2013).

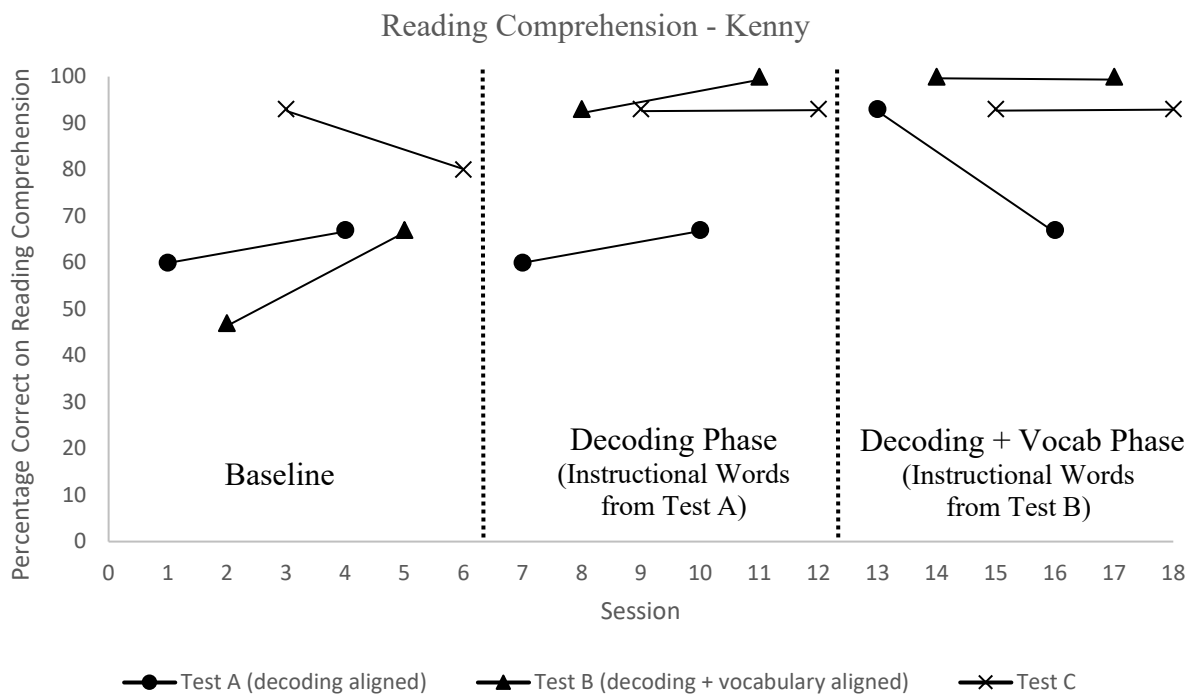
## Chapter 4: Results

The results section is organized by each participant in this adapted alternate treatment design study. For each participant, scores on the reading comprehension measure are discussed first. Each point on the chart represents the percentage correct out of the 15 questions from that session's set of three passages. Next, results of the Oral Reading Fluency (ORF) measure are reported. For each participant, one ORF score was taken per session.

Each test, A, B, and C had three passages for a total of nine passages that were administered across the study. ORF data were collected on one of the three passages used for instruction each day.

### **Student 1 – Kenny**

Figure 4.1  
Reading Comprehension – Kenny

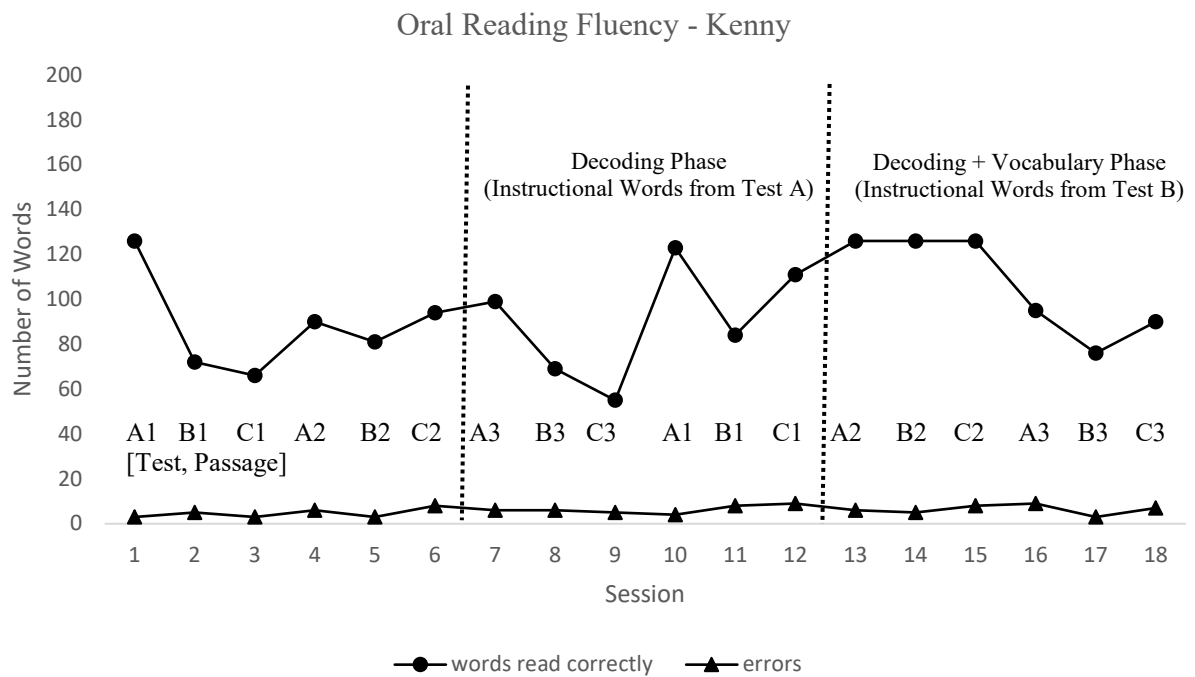


**Daily Reading Comprehension Assessment**

Fig. 4.1 shows the percentage of correct answers on the daily reading comprehension quiz for Kenny. In the baseline phase, with no instruction, Kenny scored 60% and 67% on each administration of Test A, 47% and 67% on each iteration of Test B, and relatively higher scores of 93% and 80% on Test C. After these initial six sessions of baseline with no instruction, Kenny began to receive daily instruction in decoding. The words that were used in the explicit instruction portion of each session during this phase were taken from Test A. During this phase, Kenny’s reading comprehension scores on Test A remained exactly the same at 60% and 67%, but his scores on Test B rose to 93%

and 100%. Kenny’s scores on Test C during the decoding phase remained relatively the same with a score of 93% on both iterations. In the final stage, Kenny received explicit instruction in both decoding and vocabulary, with the words utilized during instruction coming from Test B. Kenny’s reading comprehension scores on Test A during this phase were initially high at 93% but then dropped to 67% for session 16. His scores on Test B during this phase were 100% for both administrations of that test, and his scores for Test C remained relatively high with a 93% for both administrations of that test.

Figure 4.2  
Oral Reading Fluency – Kenny



**Oral Reading Fluency**

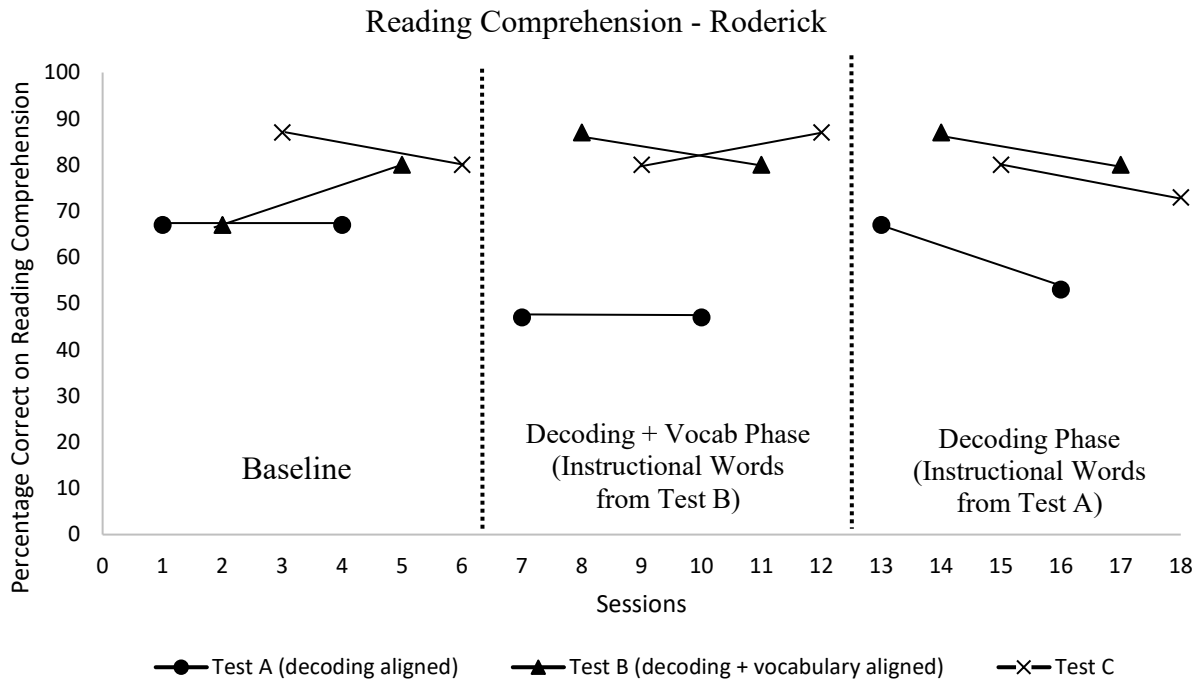
Figure 4.2 shows the number of words read correctly and the number of errors made by Kenny across the study. Kenny’s errors on the ORF ranged from 3 to 9 across 18 sessions. This is interesting to note because Kenny received explicit instruction in

decoding during his first intervention phase, which occurred in sessions 6 through 12. When Kenny first read the 2<sup>nd</sup> passage in Test A during baseline, he incorrectly pronounced the words ‘carotene,’ and ‘hemisphere.’ He received explicit instruction on those specific words in his first instructional phase during sessions 9 and 10 respectively. This section only focused only on decoding. When he read the 2<sup>nd</sup> passage in Test A again in session 13, he pronounced both of those words correctly. This was not the case with the instructional word ‘peculiar,’ which Kenny missed during his ORF readings in session 7 and session 16, despite also having explicit instruction on that word in session 8. Kenny also mispronounced ‘rehearse,’ and ‘excursion’ both times he saw those words on their respective ORF tests, despite receiving explicit instruction in how to pronounce those words and their meanings prior to seeing them the second time on the ORF measure.

Overall, the instruction in this study does not seem to have benefited Kenny. His reading comprehension scores on Test A (decoding aligned) did not improve from baseline ( $M = 63.50$ ) to his first treatment phase, decoding only ( $M = 63.50$ ), where he received instruction on words taken from that test. Kenny did show improvement from baseline ( $M = 57.00$ ) to the decoding phase (96.50) on Test B (decoding plus vocabulary aligned), but he did not receive instruction on those words until the second intervention phase. Kenny also had relatively high reading comprehension scores on Test C (control) for the entire study ( $M = 90.80$ ), despite not receiving instruction on any words from that test.

### **Student 2 – Roderick**

Figure 4.3  
Reading Comprehension – Roderick

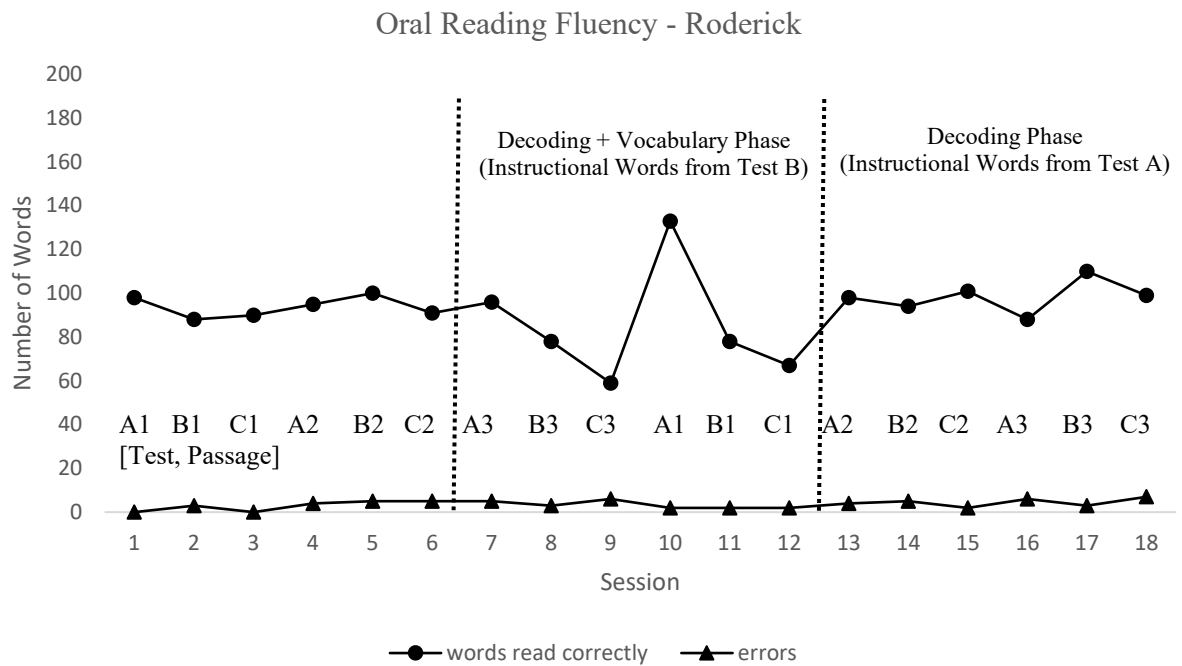


**Daily Reading Comprehension Assessment**

Fig. 4.3 shows Roderick’s scores on the reading comprehension measure across the 18 weeks of the study. In the baseline phase, with no instruction for the first six sessions, Roderick scored 67% for both administrations of Test A, and 67% and 80% on the two administrations of Test B. His scores on Test C were slightly higher with scores of 87% and 80%. For his first instructional phase, Roderick received explicit instruction in decoding and vocabulary. The words used in this phase were taken from Test B. During this phase his scores on Test B, which included the words of instruction during this phase, rose slightly to first 87% and then to 80%; however, his scores on Test A fell to 47% for both sessions. His scores on Test C remained consistent at 80% and 87%. In

the final six-session phase, Roderick received instruction only in decoding, with the words coming from the passages in Test A. His scores on Test A were similar to what they were in the baseline phase at 67% and 53%. His scores on Test B were identical to what they were in the previous phase at 87% and 80% and his scores on Test C were nearly consistent with what they had been throughout the study at 80% and 73%.

Figure 4.4  
Oral Reading Fluency – Roderick



**Oral Reading Fluency**

Fig. 4.4 shows the number of words read correctly and errors made on Roderick’s Oral Reading Fluency assessments. Roderick had a wide range of errors, from zero to 11. Based on the consistent number of words read correctly and errors made, Roderick’s

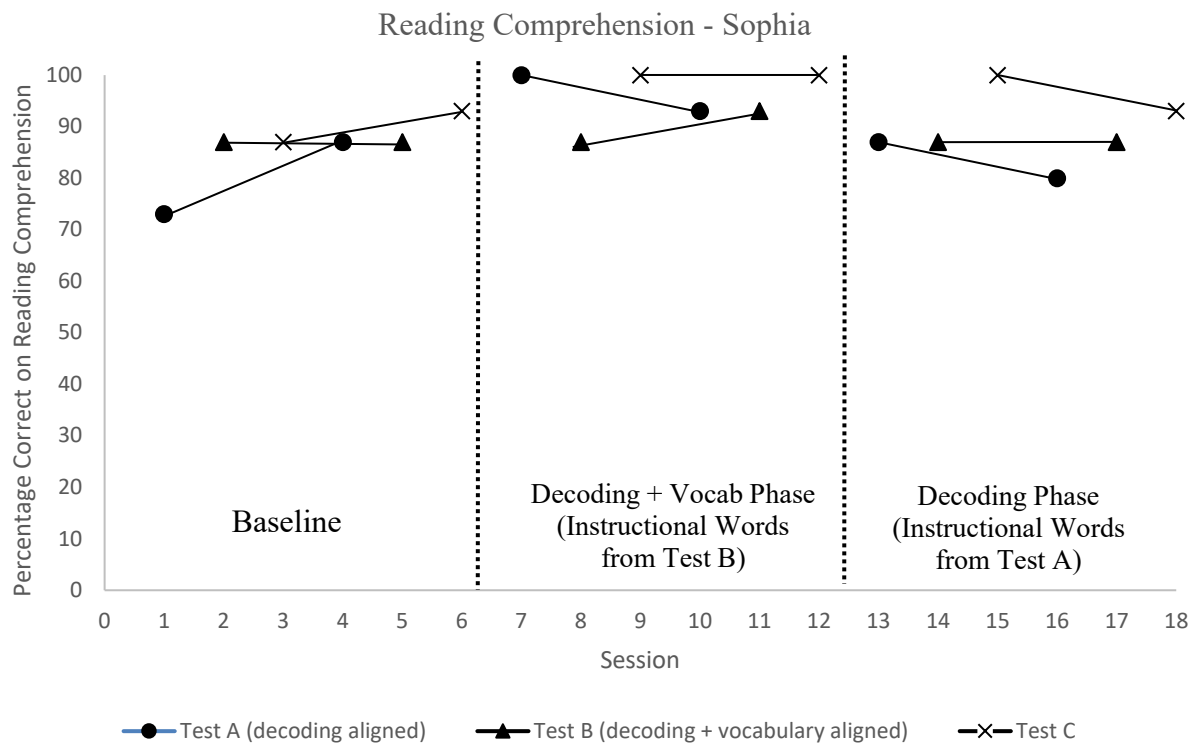
word reading accuracy does not seem to have improved as a result of the decoding instruction in this study.

Overall, Roderick does not seem to have benefited from the interventions in this study. His reading comprehension scores on Test B (decoding plus vocabulary aligned) only improved slightly between baseline ( $M = 73.50$ ) and his first treatment phase ( $M = 83.50$ ) where he received instruction in both the pronunciation and meaning of words from that test. His scores on Test A (decoding aligned) never improved from baseline ( $M = 67.00$ ) throughout the duration of the study even when he received instruction on words from that test in the second phase ( $M = 60.00$ ), which focused only on decoding. Roderick did have relatively higher scores on Test C (control) for all 18 sessions ( $M = 81.20$ ) despite receiving no instruction on those words.

### **Student 3 – Sophia**

Figure 4.5  
Reading Comprehension – Sophia



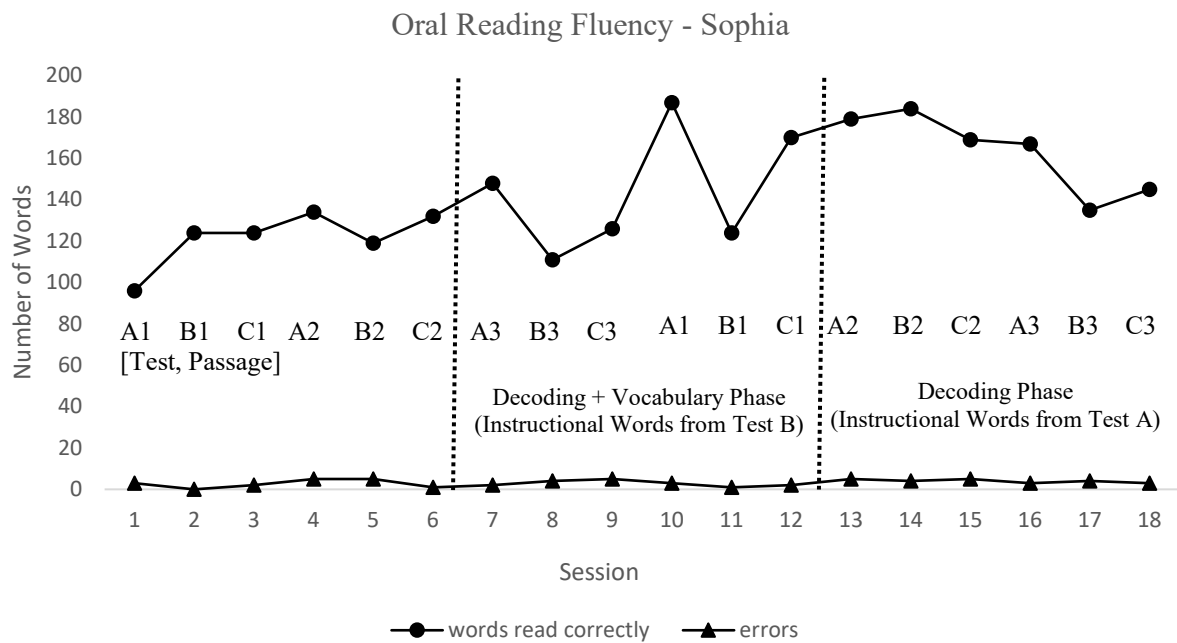


### Daily Reading Comprehension Assessment

Fig. 4.5 shows Sophia’s score on the reading comprehension assessment. In the baseline phase she had consistent scores across all tests with the exception of the first session. For the two administrations of Test A, she had scores of 73% and 87%, for Test B she had scores of 87% and 87%, and for Test C she had scores of 87% and 93%. Like Roderick, Sophia’s first treatment phase consisted of instruction in decoding and vocabulary with the instructional words drawn from the passages in Test B. For Test B, her scores remained close to baseline at 87% and 93%. For Test A, from which no instructional words were used in this first treatment phase, Sophia raised her scores to 100% and 93%. She made no mistakes on Test C during this phase with a score of 100% for both administrations of that test. For her second treatment phase, Sophia only

received decoding instruction on words taken from Test A. Sophia’s scores on Test A fell slightly to 87% and 80%, despite receiving decoding instruction on words taken from that test. In this second treatment phase, her scores on Test B were the same as they had been for the entire study with scores of 87% for both administrations. Her scores on Test C remained high at 100% and 93%.

Figure 4.6  
Oral Reading Fluency – Sophia



**Oral Reading Fluency**

Fig. 4.6 shows the number of words read correctly and the number of errors made by Sophia for the Oral Reading Fluency measure across the 18 sessions. She consistently made a low number of errors ( $M = 3.20$ ; range = 0 – 5) while increasing her number of words read correctly from an average of 114.67 words correct per minute across the first three sessions to an average of 149.00 words correct per minute across the last three

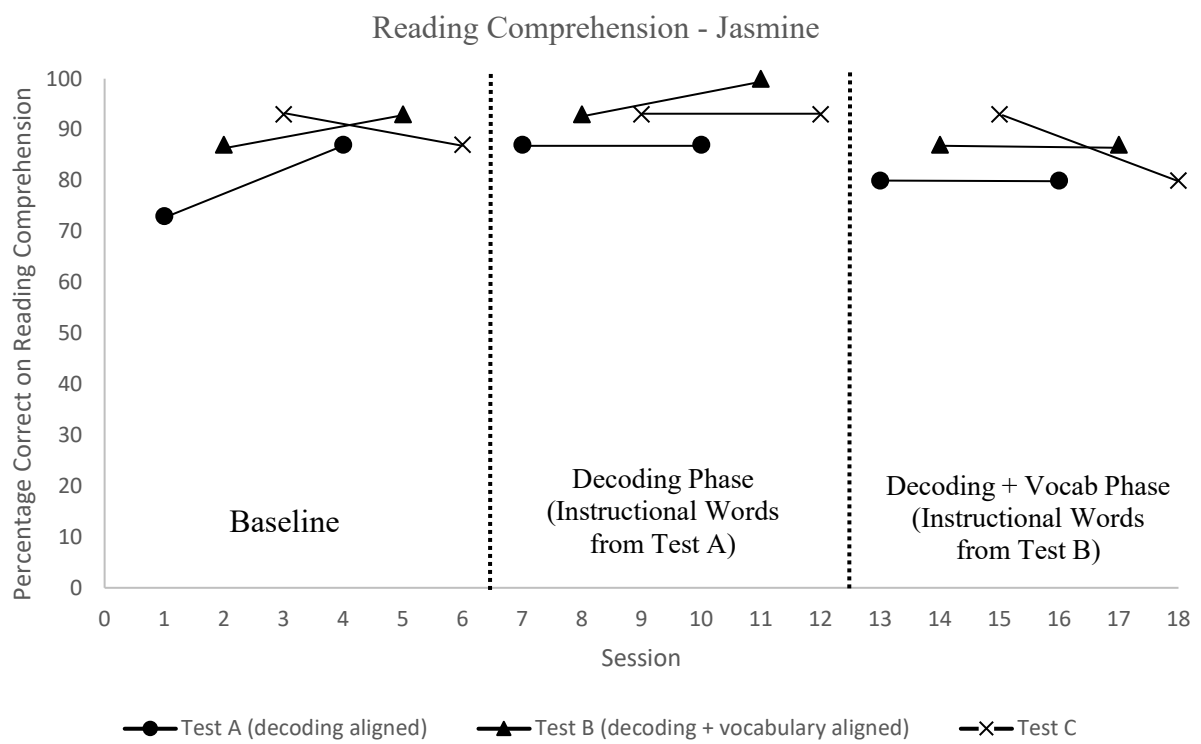
sessions. For session 5, during her first ORF assessment of the second passage in Test B, she mispronounced the words ‘besieged’ and ‘epitome.’ These were target words that she received instruction on both how to pronounce the word and the meaning of the word during the first instructional phase, specifically session 10. When she read the same passage again, the second one in Test B for session 14, she pronounced both words correctly. She mispronounced the word ‘rhubarb’ in both administrations of the ORF assessment of the second passage in Test A during sessions 4 and 13 but did not receive direct instruction on how to pronounce the word until session 17.

Overall, it does not appear that Sophia benefited from instruction. Her reading comprehension scores did not improve due to the instruction she received in this study. When she received instruction in decoding and vocabulary during sessions 7 through 12, her reading comprehension scores on Test B (decoding plus vocabulary aligned) ( $M = 90.00$ ) did not change from baseline ( $M = 87.00$ ). This is despite receiving direct instruction on both the pronunciation and the meaning of words in Test B. Her scores on Test B remained unchanged during her decoding phase ( $M = 87.00$ ) in her final six sessions, 13 through 18. Sophia’s scores on Test A (decoding aligned) did improve during her first instructional phase, sessions 7 through 12, ( $M = 96.50$ ) over baseline ( $M = 80.00$ ), but in that phase she received instruction on the pronunciation and meaning of words from Test B. Therefore, that improvement on Test A cannot be attributable to the direct instruction in decoding and vocabulary she received during that first phase on words from Test B (decoding and vocabulary aligned). When Sophia did receive instruction on how to pronounce words taken from Test A during the second phase, her

scores declined ( $M = 83.50$ ) back to near baseline levels ( $M = 80.00$ ). She did not receive instruction on any of the words from Test C (control) but had maintained high scores ( $M = 95.50$ ) throughout the study.

### Student 4 - Jasmine

Figure 4.7  
Reading Comprehension – Jasmine

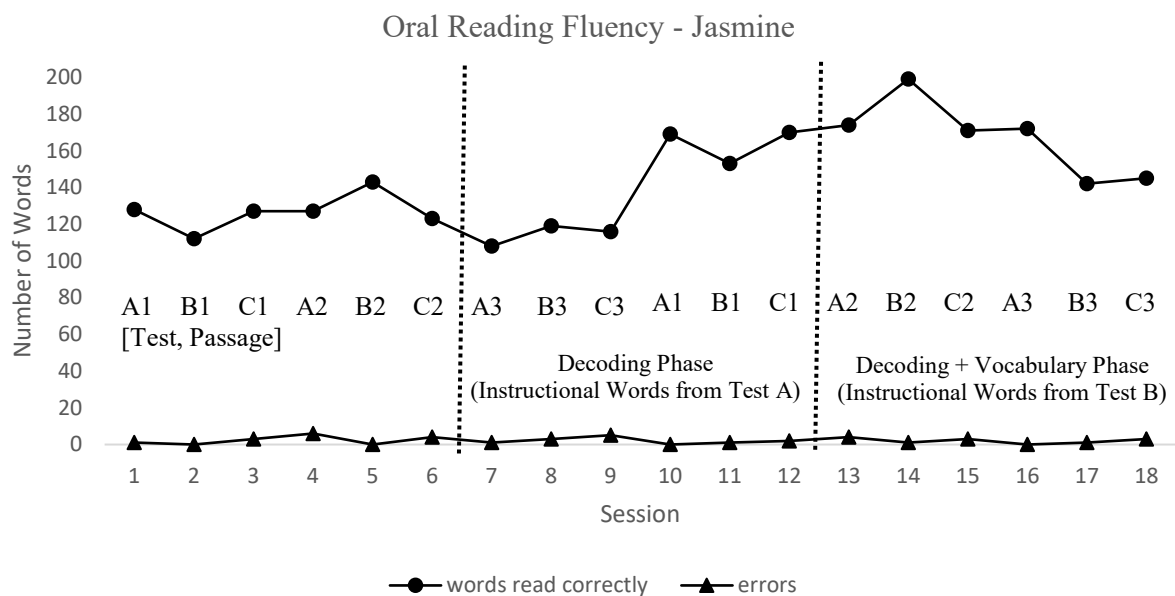


### Daily Reading Comprehension Assessment

Jasmine’s scores on the reading comprehension assessment are shown on Fig. 4.7. At baseline her scores on Test A were 73% and 87%, but her scores for the remainder of the baseline were consistently higher with scores of 87% and 93% on Test B, and 93% and 87% on Test C. Jasmine’s first instructional phase consisted of explicit instruction in

decoding only, with the words taken from Test A. Her scores on Test A remained the same for this phase as they had for the second administration during baseline, at 87% for both administrations. Jasmine’s scores on Test B increased to 93% and 100% and she scored 93% both times she took Test C in this phase. For her second treatment phase, which consisted of the final 6 sessions, she received instruction in both decoding and vocabulary with the words of instruction drawn from Test B. Overall, her scores fell slightly during this phase, with scores of 80% both times on Test A, 87% both times on Test B, and scores of 93% and 80% on Test C.

Figure 4.8  
Oral Reading Fluency – Jasmine



**Oral Reading Fluency**

Fig. 4.8 shows the words read correctly and the errors of Jasmine’s ORF assessments. Her error rate was consistently low for all 18 sessions ( $M = 2.10$ ; range 0 – 6). Jasmine increased the number of words read correctly from an average of 122.33

words correct per minute across the first three sessions to an average of 1535.00 words correct per minute across the last three sessions.

Overall, however, Jasmine did not seem to have benefited from the instruction in this study. Her reading comprehension on Test A (decoding aligned) did not appreciably improve between baseline ( $M = 80.00$ ) and receiving instruction on decoding words from that test in her first instructional phase ( $M = 87.00$ ). Her scores on Test A then decreased back to baseline levels during the final six sessions of the study ( $M = 80.00$ ). Her scores on Test B (decoding plus vocabulary aligned) rose from baseline ( $M = 90.00$ ) during the first instructional phase when she was not receiving instruction on words from those tests ( $M = 96.50$ ). Her scores on Test B then decreased in the second instructional phase ( $M = 87.00$ ) while she was receiving instruction on how to pronounce and the meaning of words from that test. Like many of the other participants her scores on Test C (control) were relatively high for the entire study ( $M = 90.00$ ) despite not receiving instruction on any words from that test.

## **Chapter 5: Discussion**

The purpose of this investigation was to analyze the effects of explicit instruction in decoding combined with instruction in vocabulary skills over instruction in decoding alone on the reading comprehension of adolescent struggling readers. Previous investigations that have analyzed the effects of combined intervention in both decoding and vocabulary-building have yielded mixed results (Clarke et al., 2014; Duff et al., 2008; Duff et al., 2014; Hogaboam & Perfetti, 1978; Michaud et al., 2017). Recently, Austin et al. (2021) found that for students in 4<sup>th</sup> and 5<sup>th</sup> grade, the addition of word meaning instruction significantly improved their word reading accuracy, fluency, and word meaning knowledge over instruction in word reading alone.

The following research question was considered: What are the relative benefits of an intervention that targets decoding only, compared to targeting decoding plus vocabulary, on the reading comprehension of adolescents with reading difficulties? To investigate the research question, an adapted alternating treatment design was used with three different phases, which included baseline, instruction in only decoding, and instruction in both decoding and vocabulary. Three separate tests were used to measure reading comprehension, Test A was aligned with decoding instruction, Test B was aligned with instruction in decoding and vocabulary, and Test C was used as a control. Reading comprehension and oral reading fluency were assessed in each session.

### **Main Findings**

When participants received instruction in decoding, aimed at improving reading accuracy in the target passages, there was not an associated improvement of reading

comprehension in those passages. In the decoding instruction phase, Kenny had the same reading comprehension scores ( $M = 63.50$ ) on the test aligned with decoding instruction, Test A, that he had in the baseline phase. Another student, Roderick, had average reading comprehension scores of 60.00 on the decoding aligned Test A, while he was receiving direct instruction on words from that test. This is a lower average score than he had on that same test at baseline ( $M = 67.00$ ). Jasmine had slightly higher reading comprehension scores ( $M = 87.00$ ) on Test A during the phase in which she received decoding instruction compared to her scores at baseline ( $M = 83.50$ ). However, in her final six sessions her reading comprehension scores on Test A fell below her average reading comprehension scores at baseline ( $M = 80.00$ ). Sophia's average reading comprehension scores on Test A during the decoding only phase were also only slightly higher ( $M = 83.50$ ) than they were at baseline ( $M = 80.00$ ).

Similarly, when participants received instruction in decoding and vocabulary, aimed at improving both reading accuracy and vocabulary knowledge in the target passages, there was not an appreciable increase in reading comprehension on those passages. In his second treatment phase, during which he received instruction in decoding and vocabulary, Kenny had higher average reading comprehension scores ( $M = 100.00$ ) on Test B, which was aligned to decoding and vocabulary instruction, than when he was at baseline ( $M = 57.00$ ). However, those scores were only slightly higher than his scores on Test B during the decoding treatment phase ( $M = 96.50$ ) when he did not receive any vocabulary instruction. In that decoding treatment phase, Kenny's average score on the



decoding and vocabulary aligned Test B increased even though he was not receiving instruction in the pronunciation and meaning of words from that test.

Another student, Roderick, received instruction in decoding and vocabulary during his first treatment phase. His average reading comprehension scores on Test B, aligned to decoding and vocabulary, increased slightly ( $M = 83.50$ ) from his average scores at baseline ( $M = 77.00$ ) when he received instruction on how to pronounce and the meaning of words from that test. However, an analysis of his individual scores on Test B during the phase he was receiving instruction on the meaning and pronunciation of words from that test, shows that his scores declined in that phase from 87.00% to 80.00%. A third student, Sophia, also made only slight gains on her reading comprehension scores on Test B, aligned with decoding and vocabulary, while she was receiving instruction on the meaning and pronunciation of words from that test. Her average reading comprehension scores on Test B during the decoding and vocabulary instructional phase was 90.00%, while her average score at baseline was 87.00%. Sophia's average on Test B across all six times that she took that test during the study was 88.00%.

Like Kenny, Jasmine received instruction on the meaning and pronunciation of words from Test B during her second treatment phase. Her average reading comprehension scores on Test B during that phase ( $M = 87.00$ ) was the same as her reading comprehension scores on Test B during baseline ( $M = 87.00$ ), when she received no instruction at all. Furthermore, her scores on Test B during the decoding and vocabulary instructional phase, when she was receiving instruction on the meaning and

pronunciation of words from that test, was lower than her scores on Test B during her decoding instructional phase ( $M = 90.00$ ), which was aligned with Test A.

For three of the four participants there was not consistent improvement in oral reading fluency over the 18 sessions of the investigation. One of the participants, Jasmine, demonstrated a sustained increase in number of words read correctly from her first three sessions to her last three sessions, but this did not correspond to increases in her comprehension scores in any phase. For instance, in the final phase of the study she received instruction in pronunciation and meaning of words from Test B; however, her comprehension scores on Test B in that phase were lower than they had previously been. This is despite reading 199 words correctly with one error on Test B during that same phase.

There were specific instances when participants originally mispronounced target words on the oral reading fluency passages but pronounced those words correctly after receiving instruction on those words. However, those adjustments do not seem to have influenced their scores on the reading comprehension assessments.

### **Interpretation and Limitations**

There are at least two factors that could have influenced these results. First, even though participants demonstrated deficits in word reading ability on the TOWRE-2 screener, their decoding and fluency skills might have been sufficient enough to understand the reading comprehension passages on the daily assessments. Each of the four participants scored within the lowest 10<sup>th</sup> percentile for their age group on both the Sight Word Efficiency (SWE) and Phonemic Decoding Efficiency (PDE) subtests of the

TOWRE-2 screener. For example, one student, Jasmine, who was 13 years and 6 months old when she took the TOWRE-2, scored in the 8<sup>th</sup> percentile for her age group on the SWE and in the 1 percentile for age group on the PDE, and yet had relatively high scores on the reading comprehension assessments in the study. She had high reading comprehension scores in her baseline phase without receiving any instruction. Her initial oral reading fluency (ORF) score on the first passage on Test A was 128 words read correctly with 1 error. For the second passage of Test A, it was 112 words read correctly with zero errors and on her the third passage of Test A she read 127 words correctly with 3 errors. Despite her low scores on the standardized TOWRE measure, her word reading accuracy on Test A (aligned with decoding instruction) may have been sufficient for reading comprehension, thus rendering the decoding instruction of little added value.

Another student, Roderick, was 14 years and seven months old when he took the TOWRE-2. His scores were in the 10<sup>th</sup> percentile for the SWE and in the 5<sup>th</sup> percentile on the PDE. His average score on all reading comprehension assessments taken at baseline, during which he received no instruction, was 89.17%. He had little trouble answering the reading comprehension questions, even without decoding or vocabulary instruction. His initial ORF score on the first passage of Test A , aligned with decoding instruction, was 98 words read correctly with zero errors, his ORF score on the second passage of Test A was 95 words read correctly with four errors, and his ORF score on the third passage of Test A was 90 words correctly with five errors. These scores indicate his word reading accuracy on Test A was sufficient for reading comprehension without receiving any instruction in decoding.

Sophia, 15 years and five months old at the time of the study, was in the 5<sup>th</sup> percentile for SWE and the 3<sup>rd</sup> percentile for the PDE on the TOWRE-2. She also had high scores at baseline ( $M = 85.67\%$ ). Her initial ORF score on Test A, aligned with decoding instruction was 96 words read correctly with three errors, her initial ORF score on the second passage of Test A was 134 words read correctly with 5 errors, and her initial ORF score on the third passage of Test A was 148 words read correctly with 2 errors. Despite making some word accuracy errors on the passages in Test A, her word reading ability appears to have been sufficient to comprehend the passages on that test without decoding instruction.

Kenny was 14 years and 4 months old at the time of the study, and he was in the 6<sup>th</sup> percentile for his age group on the SWE and the 3<sup>rd</sup> percentile for the PDE of the TOWRE-2. Unlike the other participants, Kenny did not have particularly high reading comprehension scores during baseline ( $M = 69.00\%$ ). Whereas Kenny's reading comprehension scores improved over the course of the 18 sessions, culminating in an average reading comprehension score of 93.00% for his last six sessions, those gains are not reflected in the reading comprehension scores on the test that was aligned to the instruction he was receiving in either instructional phase. For example, in his first treatment phase, Kenny received decoding instruction on words found in the passages of Test A. His scores on Test A during this phase ( $M = 63.50\%$ ) remained exactly the same as they were during baseline ( $M = 63.50\%$ ). His average reading comprehension scores on Test B, however, rose to an average score of 96.50%, despite not receiving instruction on any words on that test during this phase. When he did move into the second treatment

phase during which he received instruction on the pronunciation and meaning of words from Test B, which was aligned to his instructional words, his scores were only slightly higher as they had been during the previous phase when there was no instruction on those words ( $M = 100\%$ ). Kenny does not seem to have benefitted from instruction in either of his treatment phases.

A potential explanation for the participants' high scores on the reading comprehension passages is that they have developed compensatory strategies, such as the use of prior knowledge, that allow them to understand some of what they read despite having word reading difficulties.

The lack of test equivalency is also a potential factor as to why there were no perceived improvements across the treatment conditions. Even though all nine passages were randomly assigned to tests A, B, and C, the scores on Test C were higher across all three conditions for all four participants. Words from Test A were used for decoding instruction, words from Test B were used for instruction in decoding and vocabulary, and Test C served as the control. The consistency of high scores on Test C, across all three conditions for each participant, indicates that Test C contained passages with reading comprehension questions that were less challenging to the participants in the study. The relative easiness of Test C, intended to be a control set of passages with no instructional words, resulted in elevated scores for the control set across all three conditions for each participant.

According to the publisher, all forms of the EasyCBM Basic Reading comprehension measures are equivalent and contain literal comprehension questions

(Alonzo, et al., 2006). Researchers have found that literal comprehension questions, which can be answered based on information in the text, are easier to answer than inferential comprehension questions, which require readers to engage more closely with the text (Alonzo, et al., 2009). When I originally constructed each test, I chose nine passages, from the available 40, that included multisyllabic words that were expected to be difficult for the students. I identified six words from each passage that could potentially be used for instruction prior to randomization. I then randomized these nine passages into three tests (A, B, and C) with three passages each. Following data collection, closer examination of Test C revealed that it consisted of three narrative text passages, whereas Test A and Test B consisted of two expository text passages and one narrative text. Researchers have determined that narrative passages can present fewer challenges to struggling readers than expository passages (Best, et al., 2008). Among a group of 3<sup>rd</sup> grade students, Best, et al. (2008) found that they performed better on narrative questions ( $M = 0.72$ ) than expository questions ( $M = 0.49$ ). Best, et al. found that expository passages contained words that relied more on prior knowledge than narrative passages.

### **Implications for Research**

There remains a need to determine the effect of combining decoding and vocabulary building instruction over instruction in decoding alone for adolescents with severe reading difficulties. Struggling readers in middle and high school often need explicit instruction at the word level because they encounter larger, less common, multisyllabic words in academic texts (Kamil et al., 2008; Solis et al., 2014).

Further research should take the form of a randomized control study to determine if instruction in decoding and vocabulary-building will result in increased gains in decoding, vocabulary, and reading comprehension over instruction in decoding alone. That study might employ a design with two treatments and a business-as-usual control group. One treatment group should receive instruction in decoding, and another should receive instruction in decoding and vocabulary. Careful attention must also be paid as to what kinds of passages are involved in the intervention, either narrative or expository, and they need to be of sufficient difficulty. In order to increase experimental control, the same word list taught in the vocabulary instruction should also be used for the decoding instruction. Studies of this type would help determine whether integrating decoding and vocabulary instruction improves reading outcomes, as suggested by connectionist frameworks and the LQH.

### **Implications for Practice**

There was no observed benefit from the interventions in this study, but that only enhances the need for there to be research conducted on interventions that provide direct instruction in decoding and vocabulary. Many adolescents still struggle with their ability to pronounce multisyllabic words and understand what those words mean (Archer, et al., 2003). This is particularly true when students are expected to learn a set of vocabulary words in a content area (Harmon, et al., 2006). An intervention that combines decoding and vocabulary work can help students who struggle with reading to gain access to what those words mean. Even though there were no observed benefits from the interventions

used in this study, it is very unlikely that integrating decoding and vocabulary components will be detrimental.

### **Summary**

This purpose of this study was to analyze the effects of instruction in decoding and vocabulary compared to instruction in decoding alone using an adapted alternative treatment design. Results did not reveal a benefit from instruction in either decoding or instruction in both decoding and vocabulary on students' reading comprehension on passages aligned with instructional content. This might be attributable to participants' reading abilities, which were low on a standardized test, but sufficient to understand what they read on the daily assessments. Further studies should be implemented with this population to determine the degree to which they can benefit from instruction in decoding and vocabulary to improve their reading comprehension.



## Appendices

### Appendix A. Instructional Words

| Instructional Words |                 |               |               |              |                  |             |
|---------------------|-----------------|---------------|---------------|--------------|------------------|-------------|
|                     |                 |               |               |              |                  |             |
| Test A              |                 |               |               |              |                  |             |
| reading 1           | technique       | sarcastically | hemispheres   | accompanied  | contributions    | scientific  |
| reading 2           | mathematicians  | slicing       | sophisticated | complexity   | celery           | coincidence |
| reading 3           | anonymously     | peculiar      | encourage     | carotene     | rhubarb          | expecting   |
|                     |                 |               |               |              |                  |             |
| Test B              |                 |               |               |              |                  |             |
| reading 1           | prestigious     | distinguish   | traditional   | conservation | escalating       | necessarily |
| reading 2           | rehearsed       | rehabilitated | epitome       | besieged     | autobiographical | vulnerable  |
| reading 3           | excursions      | sanctuary     | charity       | quizzical    | excellence       | legitimate  |
|                     |                 |               |               |              |                  |             |
| Test C              |                 |               |               |              |                  |             |
| reading 1           | screechy        | mischievously | warily        | screeching   | enthusiastically | mysterious  |
| reading 2           | reimburse       | complexity    | accelerate    | coaxing      | ecstatic         | accelerate  |
| reading 3           | extraordinarily | compulsive    | peculiar      | aghast       | curiosities      | examined    |

## Appendix B: Lesson Plan Scripts

### Decoding Only Intervention

#### Pronunciation Instruction

- Present the first word, for example, *distinguish*, on the shared screen. The word will be in Times New Roman size 80
- Explain that ‘Every Syllable Has At Least One Vowel’ as you underline and space apart each one. Recognize any vowel teams that make a single sound.

dis tin guish

- Ask the student if any word parts look familiar and briefly discuss any known parts.
- The student should then say each word part
- The student should pronounce the entire word.

Repeat the above procedure for all 3 words

After the first day, the following review procedure will begin each lesson.

- Present a review word from the previous day’s instruction and ask the student to pronounce the word.
- If the word is pronounced correctly, then move on to the new words for that day. If the word is not pronounced correctly, then go through the procedures outlined above for the review word.

#### Assessment

Following the instructional part of each lesson the student will take either Test A, B, or C depending on where they are in the schedule.

Each Test contains 3 passages with 5 multiple choice reading comprehension questions.

The student will read each passage out loud and then orally respond to each of the 5 questions.

For the first passage only, an ORF score will be taken. The first minute of that reading will be timed and scored.

## Decoding Plus Vocabulary Intervention

### Pronunciation Instruction

The same procedures outlined in the Decoding Only Intervention will be followed

### Vocabulary Instruction

The same 3 new words introduced in that day's Pronunciation Instruction will be used in the Vocabulary portion of the lesson.

1. Introduce the first word and its definition on the screen. This should be a student-friendly definition with Times New Roman size 28 font.

## **distinguish:** To notice a difference between people or things.

2. Have the student read the definition out loud and then ask them if they have any questions.
3. Repeat the above procedure for all 3 new words.
4. Engage the student in a follow up activity for each word. The activities can take the form of the following examples:
  - word association – Example: The kids were amazed with the shop teacher's special skill with the miter saw. [Given a list of words learned that day, the student should choose *technique*].
  - Have you ever...? – Example: Have you ever had to *distinguish* between two cars that you've seen driving around, like a Mustang or a Charger? What were some of those differences?
  - Which would you...? – Example: Which one do you think is more *sophisticated*, an online computer game, or a deck of cards? Why?

Activities can vary according to word usage. For example, all activities for a given day can be word associations.

### Assessment

The same assessment procedures from the Decoding Only Intervention should be followed here as well.

## Appendix C: Reading Comprehension Tests

### Test A

#### Wildcat George

George was the shyest kid in class. He never raised his hand to talk, and if a teacher ever asked him a question, he would blush and sink down in his seat before mumbling an answer. Kids didn't really tease him. They just left him alone. Luckily he had one really good friend, Diane. They had been friends since elementary school, and even though they had changed a lot growing up, they still got along and supported each other. Diane was a cheerleader, and she wasn't shy at all. One day, when the two of them were walking home from school, Diane made a suggestion to George.

"I think I've figured out something for you to do to help the eighth grade win the school spirit prize," she said. "I know you hate to make yourself the center of attention, but I was thinking maybe you could be spirited anonymously!"

"What, you mean like no one would know who I am? You want me to wear a fake mustache or something?" George asked sarcastically.

"No, but you're on the right track! Ms. Gregson needs someone to be the new mascot for next week's pep rally." Me, be the Jefferson Wildcat?" asked George, shocked. "No way, everyone would look at me during the school assembly, and you know how shy I am."

"No one will know it's you," Diane assured him. "Besides, I kind of already told Ms. Gregson you would do it. She's expecting both of us at practice tomorrow."

"Diane! How could you do this to me?" protested George. But the next day, he accompanied Diane to cheer practice. As the cheerleaders practiced their jumps, Ms. Gregson instructed George on the goofy antics that the mascot was supposed to do to get the crowd excited. George felt really silly at first, but when he put the costume's head on, he felt safer. In front of the smiling cheerleaders, he twirled, ran back and forth, and pretended to scratch the air with his big furry claws.

The day of the pep rally, George was nervous. But when the time came, George put on the costume and ran out onto the gym floor. Everyone cheered! Feeling braver, he ran over to Principal Wheeler and gave him a high five. People yelled even louder. George started clapping his hands over his head, encouraging the crowd to do the same. Cheering and rhythmic clapping filled the gym as George danced around.

At the end of the assembly, Principal Wheeler got up to announce which class had done the best job to encourage school spirit. "The Spirit Award goes to the class with the craziest Wildcat Jefferson has ever seen," he said, and everyone turned to look at George in his costume. George slowly lifted the head off his costume to reveal his identity. The eighth grade class recognized him and went wild, whistling and yelling. Diane screamed the loudest, cheering for her brave best friend.

#### 1. Which theme is most important in the story?

- |                         |                            |
|-------------------------|----------------------------|
| A. overcoming shyness   | B. supporting your friends |
| C. trying something new | D. having school spirit    |

#### 2. George helps his class win the spirit prize by being:

- |                         |                          |
|-------------------------|--------------------------|
| A. nervous and clownish | B. athletic and daring   |
| C. brave and energetic  | D. anonymous and raucous |

- 3. George asks Diane if she wants him to wear a fake mustache. He means to say that Diane's suggestion was:**
- A.** silly
  - B.** mysterious
  - C.** awkward
  - D.** brilliant
- 4. Who is probably at the assembly?**
- A.** only the cheerleaders and athletes
  - B.** all the students and teachers at Jefferson
  - C.** just students from the eighth grade class
  - D.** school principals from all over the county
- 5. At the end of their conversation, Diane convinces George to:**
- A.** wear the costume to be the school mascot
  - B.** tell the principal that crowds made him nervous
  - C.** talk to Ms. Gregson about how to be less shy
  - D.** be a loyal and trusting friend to her

## Helpful Food Hints

It is an odd but interesting coincidence that many fruits and vegetables give hints about how we can take better care of our health if we take a closer look at them.

Have you ever heard that carrots are good for your eyes? Well, slicing this veggie into circles shows you rings that resemble the pupil and iris of your eye. Carrots are excellent sources of Vitamin A, which is essential for good vision. They also contain a nutrient, called carotene, that protects eye health.

Which food resembles the left and right hemispheres of the brain? Crack open a walnut along the seam of the shell and you'll see the two halves inside the shell. Walnuts offer protein, fiber, and no cholesterol. All of these things can improve brain function.

What do celery, rhubarb, and bok choy look like? They resemble the long bones in our bodies. These healthy foods are great sources of calcium and Vitamin K, which are good for bone health.

The next time you're chomping on a fruit or vegetable, take a closer look. It could be telling you something about how it's helping to keep your body healthy.

### 6. Which food resembles the brain?

- A. celery
- B. walnut
- C. rhubarb
- D. carrot

### 7. Which food resembles the long bones in your body?

- A. walnut halves
- B. sliced carrots
- C. bok choy
- D. onions

### 8. Which is good for bones?

- A. fiber
- B. protein
- C. cholesterol
- D. calcium

**9. The author might suggest that the round shape of potatoes is a clue that eating too many potatoes will:**

- A.** complete your diet
- B.** make your eyes rounder
- C.** improve brain function
- D.** give you a round belly

**10. The author seems to think that:**

- A.** the way foods look suggests their function
- B.** a food's shape can tell you if it is healthy
- C.** eating carrots does not keep your body healthy
- D.** all fruits and vegetables help bone health

## **Jackson Pollock**

There are some works of modern art people look at and think, "I could do that! Why is it in a museum?" People said this a lot about Jackson Pollock. He was a modern artist, famous for his unique drip painting style.

Pollock worked on large flat canvases that he would lay on the ground and stand over. He had a peculiar splatter paint technique. He would fling paint from his brush over the canvas as he moved around it. His movements were so fluid when he painted that he seemed to be dancing. People began calling him an "action painter." Pollock used this technique to apply layers and layers of splattered paint. The result was a thick canvas of many different colors and abstract forms.

The art world was critical of his paintings at first. People thought he lacked talent and was simply a mad man creating garbage. But recently, experts have begun to show that there is something special and unique about Pollock's paintings.

The experts looking at Pollock's paintings may surprise you. They are not art experts, but scientists and mathematicians. Using sophisticated computer programs, they have scanned Pollock's paintings and found that they have a unique kind of pattern. They have found the same kinds of patterns in images of nature scenes.

When people look at a Pollock painting, they may feel like they do when they look at pictures of the natural world, like forests or oceans. People who try to copy Jackson Pollock's style can't reproduce the same kind of pattern complexity. His paintings are not as easy to make as they might seem!

Studies continue to determine exactly how Pollock produced this special effect in his art. Perhaps it had something to do with the unique way in which he painted, and his dance-like painting style. One thing is for sure: the scientific analysis of his works has silenced Pollock's critics.

Everyone should recognize Pollock's contributions to the world of art and his place as one of the great American artists of all time.

### **11. The author of this article probably thinks that: A.**

science is the best way to understand art

**B.** Jackson Pollock's art is too complex for most people

**C.** math patterns are confusing and uninteresting

**D.** Jackson Pollock is an underappreciated painter



**12. This article is mostly about how:**

- A. "action painting" is the best way to paint because it's fun to move
- B. scientists and mathematicians gained an appreciation for Pollock's art
- C. splatter painting is not a serious form of art because anyone can do it
- D. Pollock's paintings show that complex art can have hidden value

**13. The author of this article wants to:**

- A. prove that people cannot easily reproduce Pollock's art
- B. complete more scientific analyses of artwork
- C. persuade readers that Pollock was very talented
- D. show that anyone can create modern pieces of art

**14. The very last sentence of the article is an example of a(n) \_\_\_\_\_ sentence.**

- A. descriptive                      B. informational
- C. factual                          D. persuasive

**15. What is probably different about this article from others on famous painters?**

- A. it mentions critics' interpretations of the artist's work
- B. it describes the artist's painting style and techniques
- C. it makes people believe that anyone can create art
- D. it contains information about the scientific analysis of art

## *Test B*

### **Graphic Novels**

Not all people enjoy reading books in their spare time, but most people enjoy comics. These days, however, a new genre of literature that combines traditional books and comics is becoming more and more popular. Authors are using both their artistic and story telling skills to make graphic novels for readers of all ages.

Graphic novels are stories told in images, like comics. The stories are long and complex, however, like more traditional novels. They often deal with serious subject material. They are not necessarily meant to be funny. Graphic novels look more like traditional books too. They may have sturdy bindings and hard covers.

Graphic novels have a long, rich history, but the form really took off in the late twentieth century. In 1971, Gil Kane and Archie Goodwin together published "Blackmark," a science fiction story about swordplay and sorcery. The story was told over the course of 119-pages of black and white drawings with captions. Thirty years later, the American Academy of Comic Book Artists named the book "the very first American graphic novel." The authors were awarded the prestigious Shazam Award shaped like a lightning bolt for excellence in the comic arts.

The term "graphic novel", however, didn't become widespread until years after "Blackmark" was published. People finally began using the term to distinguish graphic novels, more serious works, from conventional comics.

Today, many graphic novelists have become famous for their work. Not only are they talented artists, they are also telling important, gripping stories about history. Art Spiegelman, for example, won a Pulitzer Prize for his graphic novels about his family's experience in Europe during World War II. Marjane Satrapi, another famous graphic novelist, wrote an autobiographical graphic novel about her family's experience during the revolution in her home country of Iran.

As the number of compelling graphic novels increases, people's attitudes towards graphic novels are changing. Graphic novels are increasingly regarded as serious works of art and literature, and a legitimate way to tell valuable stories to a wide audience.

- 1. Gil Kane and Archie Goodwin are famous for:**
  - A.** painting a famous historical mural
  - B.** writing a Pulitzer Prize winning book
  - C.** writing gripping stories about history
  - D.** writing the first official graphic novel

**2. The "Shazam Award" looks like a:**

- A.** lightning bolt
- B.** pirate sword
- C.** golden trophy
- D.** human statue

**3. Graphic novels are often used to tell:**

- A.** humorous jokes for kids
- B.** how to use electronics
- C.** how to write comic books
- D.** serious historical stories

**4. In the future, teachers will probably:**

- A.** recommend their students read traditional books
- B.** scold their students who read comics in class
- C.** use graphic novels more often in their classes
- D.** not be aware of how to use graphic novels

**5. The author thinks graphic novels are:**

- A.** not appropriate for use in schools
- B.** an interesting and valuable artistic form
- C.** a confusing mix of drawings and stories
- D.** childish and best read only by kids

## School Social

It was the first social event of the school year. Roman was as nervous as a cat. He wanted to ask Soriah to the dance, but couldn't get up the nerve. Every day for the past week he rehearsed what he would say to her. "Hey Soriah, would you like to go?" or maybe, "Soriah, how about you and I..." He would revise what he wanted to say a dozen times. He was absolutely besieged with panic. Soriah was a girl with a lot of zest. She gave a hundred percent in everything she did. And everything she did was to perfection. She was the epitome of organization. Roman was the opposite. It wasn't that he wasn't smart. He just didn't have the perfection part down. Most of his papers would have comments such as, "Your handwriting is like chicken scratch", or "I can't read what you write. Re-do". But one thing Soriah and Roman had in common was humor. They both loved to laugh and tell jokes. That was the connection Roman had with her right off the bat.

The dance was two days away, and Roman still hadn't figured out how to get beyond his nervousness. And then it happened. He was entering the classroom and saw a large group of kids surrounding Mr. Arnold. Roman had a quizzical look on his face. The laughter coming from the group was escalating. Soriah turned and motioned for Roman to join in. As he approached he could see someone dressed like a pirate. It was Mr. Arnold! He had lost a bet with one of his students and had to wear a feathered hat, an earring and an eye patch. Roman looked at Soriah and they both burst out laughing uncontrollably. The next thing he knew he was asking her to the dance in between breaths of laughter. She said, "Absolutely, yes"! It was all so much easier than he'd thought it would be.

**6. Roman was nervous about asking Soriah to the dance because he:**

- A. didn't want Mr. Arnold to tease him
- B. thought she would reject him
- C. believed she would ask him later
- D. thought they didn't have anything in common

**7. Which shows how Roman is not a perfectionist like Soriah?**

- A. he loves to laugh and tell jokes
- B. he rehearses what he wants to say
- C. he was nervous about the dance
- D. his handwriting is often messy

**8. Which unexpected event eased Roman's anxiety?**

- A. The upcoming school dance
- B. Mr. Arnold dressing like a pirate
- C. the first social of the year
- D. the large group of kids in the classroom

**9. How does the mood in Mr. Arnold's class make Roman feel?**

- A. nervous and anxious
- B. quizzical and confused
- C. eager and excited
- D. relaxed and happy

**10. What shows that Roman was nervous?**

- A. He laughed all the time.
- B. He asked Mr. Arnold for advice.
- C. He rehearsed his questions
- D. His papers had comments about his handwriting

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## **Inti Wara Yassi**

Skip the zoo, and go straight for a monkey hug! At the Inti Wara Yassi wild animal reserve in Bolivia, a deep passion for animal care and well-being draws many visitors off the beaten path to this unique refuge in the jungle.

Juan Carlos Antezana founded the Inti Wara Yassi organization in 1992, as a charity to support orphaned Bolivian children. Antezana took the children on excursions around the country, and began to notice the horrible impact of unchecked development. Construction was harming Bolivia's most vulnerable animal treasures.

To address the needs of animals and children alike, he decided to combine his children's charity with an animal rescue program. He started a wildlife sanctuary in the Machi Park, near the small town of Villa Tunari. The children could live there, and learn to take care of the animals.

Now, the sanctuary rescues monkeys, parrots, bears, and wild cats. Often times the animals have been traded on the black market. Some have been neglected or abused. At Inti Wara Yassi, they finally have a safe place to be rehabilitated with the love of attentive caregivers.

People come from all over the world to volunteer their time at Inti Wara Yassi. Volunteers stay for a minimum of two weeks, and do all kinds of important jobs, like feeding and caring for the animals, giving tours to visitors, and even taking bears for walks!

Inti Wara Yassi is special because it takes a holistic approach to complex problems. It empowers Bolivian youth, and gives them valuable skills in animal care. It provides a safe, nurturing environment to animals in need. It raises awareness of nature conservation and animal rights issues across the world.

As more people visit and learn about this unique opportunity for meaningful, hands-on conservation work, hopefully the Inti Wara Yassi project will continue to expand and flourish for years to come.

### **11. Originally, Inti Wara Yassi was a:**

- A.** volunteer group
- B.** jungle zoo
- C.** animal sanctuary
- D.** children's charity

### **12. Which kind of animal would most likely be at Inti Wara Yassi:**

- A.** Bengal tiger
- B.** guinea pig
- C.** spider monkey
- D.** sea lion

### **13. The volunteers at Inti Wara Yassi:**

- A.** come only from Bolivia
- B.** must be nature conservationists
- C.** stay at least two weeks
- D.** capture new animals

**14. In the future, most likely:**

- A.** fewer people will visit Bolivia because of the wild animals
- B.** Inti Wara Yassi will change from an animal sanctuary into a petting zoo
- C.** more people will find out about Inti Wara Yassi and want to volunteer
- D.** many animals will be released back into the wild

**15. When the author uses words like: "special," "critical," and "hopefully," it shows she thinks that:**

- A.** Bolivia is a wonderful place to visit and volunteer
- B.** the animals would be better off if they were free
- C.** zoos are the best places to experience animals
- D.** Inti Wara Yassi is an important organization

## *Test C*

### The Neighbor

All the children in the neighborhood avoided Old Man Connely's house. "He's so weird!" the kids said to one another. "Why does he have a hook where his left hand should be?" They also wondered why, every night, at exactly 11 pm, they heard strange screechy noises coming from his home.

"Maybe he has some weird cats," one boy, Milo, guessed.

"He must use them to do horrible experiments!" said his friend Eli.

One night, at the end of summer, all the neighborhood kids had a campout in Milo's backyard. They set up tents and played "truth or dare" around a campfire. When it was Milo's turn, he picked a dare.

"I know," Eli said mischievously. "I dare you to go to Old Man Connely's door and find out what the mysterious noises are!" Milo was scared to take the dare, but he was more scared of saying no and looking like a coward.

"Fine!" he said bravely, and stomped off down the street. When he got to Mr. Connely's front door, he raised his hand to knock. Just then, he heard a voice bark from inside.

"Who is it? It's late! What do you want?!?" Mr. Connely said angrily.

"Um, it's me, Milo," Milo whispered. "I'm your neighbor down the street.

I wanted to see if you could tell me what the noises are that are coming from your house?"

Mr. Connely's tone softened. "Oh," he said opening the door. "That's all you want? Come inside then."

Warily, Milo stepped in. Mr. Connely led him down a dark hall. They came to a small room in the back of the house. Mr. Connely turned on the lights. Milo flinched. What was he going to see? He slowly opened his eyes, and was amazed at what he saw there. It wasn't a scary laboratory filled with cats at all! It was just a music room with a folding chair and a violin. The walls were covered in awards and ribbons for music performance.

"I used to be one of the world's best violin players," Mr. Connely said sadly. "But one day, I got in a horrible accident at the zoo, and lost my left hand. I've been trying to re-teach myself to play the violin ever since. It isn't easy."

"So that's where all the screeching noises were coming from!" thought Milo. Suddenly, he was no longer afraid of Mr. Connely. He admired him.

"I play the violin too!" Milo said enthusiastically. "We have a wonderful band teacher at my school! I'm sure he could help you learn how to play your instrument again, even with a hook!" Mr. Connely looked at Milo gratefully.

"Do you really think so?" he asked hopefully.

The next week, Mr. Connely began attending orchestra classes at Milo's school. With the teacher's help, Mr. Connely soon regained his violin playing skills. Eventually, the neighborhood kids stopped calling him "Old Man Connely." Instead, they called him "Grandpa Fiddle." That suited Mr. Connely just fine.



- 1. The neighborhood kids think Mr. Connely is strange because he:**
  - A.** has a lot of cats
  - B.** lives alone
  - C.** has a hook
  - D.** plays music
  
- 2. Milo goes to visit Mr. Connely one night because:**
  - A.** his friends dare him to go
  - B.** he wants to meet Mr. Connely
  - C.** heard strange noises there
  - D.** he likes meeting new people
  
- 3. When Milo sees Mr. Connely's practice room he is:**
  - A.** surprised
  - B.** nervous
  - C.** alarmed
  - D.** frightened
  
- 4. Mr. Connely feels \_\_\_\_\_ when Milo invites him to come to orchestra class.**
  - A.** embarrassed
  - B.** depressed
  - C.** grateful
  - D.** anxious
  
- 5. Which is the theme of the story?**
  - A.** Don't play truth or dare.
  - B.** Don't fear strange noises
  - C.** Don't disturb your neighbors
  - D.** Don't jump to conclusions

## **Stop Tagging!**

"Stop tagging!" Sam shouts at his older brother Duncan. "What are you thinking? Everywhere you go, you leave a mark. Your marks are illegal! Your imprint offends most of the people in our town!"

Duncan listens, but does not respond. He is invested in his plan. He wants to mark every region of their small town. He wants everyone to notice him, and this is the way to do it.

Their mom, Sheila, is eternally upset. Her job at the town's only bank, is at risk. Her supervisors are furious with her because she has not stopped her son's destructive behavior. Making matters worse, Sheila is expected to reimburse the bank for damage to their parking lot. It cost four hundred dollars to repair the marked concrete walls during Duncan's last "artistic" episode.

Sheila loves her son, and understands the complexity of the situation. Duncan's fantasy is to be noticed as a muralist.

"It doesn't make any sense to spray paint buildings and expect praise!" Sheila moans. "You're just shooting yourself in the foot!"

Sheila wonders what keeps Duncan from using his imagination and creativity in productive ways. The question resonates in her mind. Her thoughts accelerate forward. "That's it!" she says to herself. "I have an idea that will really help Duncan shine!"

The next day, Sheila approaches her supervisors at work. She hands them each a copy of her proposal. The proposal maps out a plan for the parking lot walls. It suggests replacing the drab, gray concrete walls with vivid representations of plants and animals. Duncan will execute the artwork. In this way, he expresses himself and atones for his former tagging.

After some coaxing, Sheila's proposal is accepted. She calls Duncan and explains it to him. He is ecstatic at the idea. "Thank you, Mom, I can't wait to start!"

### **6. Sam shouts at his brother because:**

- A.** people are offended with his imprint
- B.** he's worried about the cost of repairing the damage
- C.** he is upset with Duncan's illegal actions
- D.** Duncan listens but does not respond

- 7. When Sheila tells Duncan he is "shooting himself in the foot," she means that:**
- a He might physically get hurt while tagging
  - b Duncan's shoe has a hole and needs to be fixed
  - c his behavior is destructive to himself
  - d he is going to get paint on his feet
- 8. Sheila understands that Duncan:**
- A. wants to be seen as an artist
  - B. wants to be in trouble
  - C. listens but responds inappropriately
  - D. has nothing to do but tag buildings
- 9. Sheila's plan is especially clever because Duncan can:**
- A. create art on the walls he had previously tagged
  - B. reimburse the corporation with four hundred dollars
  - C. approach his mother's supervisors at work
  - D. continue to mark every region of their small town
- 10. The line, "Thank you, Mom, I can't wait to start!" tells us that Duncan:**
- A. plans to continue to tag
  - B. is ready to pay for property damages
  - C. realized his actions were illegal
  - D. appreciates his mom's idea

## Curious Chris

Chris is extraordinarily curious. As a toddler, he stumbled about his home, playing with knobs on electrical objects. During his pre-school years, Chris discovered screwdrivers. Using his favorite tool, he examined the inner workings of all the household gadgets. Chris investigated blenders, clocks, stereos and even computer equipment.

Chris's parents accepted his curious ways. They admitted, however, a concern for Chris's compulsive need to disassemble electronic objects. Hoping to redirect his interest, Chris's parents purchased building toys. Together, they erected plastic buildings and constructed log forts. They baked tiny, clay bricks and built walls. They even made a two-foot round dome from plastic straws.

Nothing, however, replaced Chris's joy of electrical gadgets.

One Saturday morning, Chris' parents slept in. When they finally awoke, there was a peculiar silence. No television or radio, only the faint sounds of Chris and his screwdrivers.

Chris had discovered a new gadget. It was the family's new microwave oven. While his parents slept, Chris had been busy. The oven's back panel was off. Bright colored wires were splaying out, like guts from an open fish. Small nuts and bolts were scattered at his feet.

Chris was delighted! His parents, however, were aghast. "What have you done?" they questioned. "This is our new microwave! How will we ever repair it?"

"That's a good question!" Chris said smugly. "Can I give it a go?"

That was the start of Chris' career. He currently works for a large corporation as an electrical engineer. Now he can freely indulge in his curiosities!

### **11. Chris pulls apart electrical gadgets because he:**

- A.** is curious about how they work
- B.** wants to surprise his family
- C.** knows he will be an engineer
- D.** hopes to worry his parents

**12. Chris' "compulsive need to disassemble objects" means he:**

- A. takes things apart so often
- B. is obsessed with electricity
- C. uses screwdrivers so much
- D. is good at constructing log forts

**13. By the end of the story, the reader realizes that Chris:**

- A. wants to repair the microwave
- B. is in trouble with his parents
- C. can repair anything
- D. grew up to apply his curiosity

**14. The author develops the theme by examples of Chris:**

- A. showing curiosity at different ages
- B. frustrating his parents
- C. ultimately achieving his career goal
- D. helping his parents put things together

**15. This story is mostly about how:**

- A. a boy's parents try to redirect his attention
- B. a young man took apart his family's appliances
- C. a curious boy grew up to be a successful man
- D. curiosity caused one boy lots of problems

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