2015

The CLUES Strategy: Improving Science Vocabulary Acquisition for Secondary English Language Learners with Reading Disabilities

Amanda Lynn Helman
Lehigh University

The CLUES Strategy: Improving Science Vocabulary Acquisition for Secondary English Language Learners with Reading Disabilities

By Amanda Helman

Dissertation Proposal

In

Special Education

Lehigh University

2015

COPYRIGHT PAGE

Approved and recommended for acceptance as a dissertation in partial fulfillment of the requirements of Doctor of Philosophy.

_____
Date

_____
Dissertation Chair
Lee Kern, Ph.D.
Professor of Special Education

_____
Accepted Date

Committee Members:

_____
Timothy Bonner, Ph.D.
TESOL Adjunct Professor at Lehigh

_____
Mary Beth Calhoon, Ph.D.
Associate Professor of Special Education

_____
Minyi Shih Dennis, Ph.D.
Assistant Professor of Special Education

Acknowledgements

It is important to finish what you start. I end this journey as a different person; more resilient, humble, and thankful. I recognize that this journey was not accomplished alone. I had the guidance of God, my mentors, friends, and family. It was a journey that taught me how to be resilient.. I learned to be thankful for the hardest valleys so that I could climb up the highest mountains. Thank you, God, for showing me that the joy of the Lord is my greatest strength.

I want to thank my wonderful and dedicated committee. Dr. Kern, thank you for your high expectations, encouragement, and your dedication to my work. You are such an inspiration to me as an educator. I am thankful that you have been part of this process from its inception. Thank you for your strong leadership and support. Dr. Calhoon, thank you for support and encouragement. Dr. Dennis, your continuous support, encouragement, constructive feedback, and mentorship has been invaluable. Dr. Bonner, thank you for all of your time, energy, and feedback to expand my paper in regards to English Language Learners. I am grateful for your enthusiasm and dedication to this project.

I also want to thank all of the instrumental professors, Drs. Bambara, Wood, and Wiseman, who have encouraged and supported me throughout the years. Thank you Emily, Dolly, Robin, Chris, Amanda, Shu-Chen, Jackie, Beth, Allyse, Victoria, and Louis for your love and support. I also want to thank Pastor Darian and Yolanda Colbert who taught me the importance of character leadership as well as my entire youth ministry leader team.

Finally, I want to thank my parents and my family for loving me through this journey. Mom, Dad, Melissa and Mark, thank you for your support. You were always there to tell me that I was loved no matter what I faced.

Table of Contents

Abstract

Current vocabulary research indicates that both contextual and morphemic analysis is effective in helping secondary students, with and without disabilities, and English Language Learners (ELLs) improve vocabulary acquisition. However, a dearth of vocabulary research has been conducted with secondary ELLs with Reading Disabilities (RD). This study investigated the effects of a combined contextual and morphemic analysis strategy, the CLUES Strategy, to help students predict and analyze unknown science vocabulary words. Four 9th- and 10th grade ELLs with RD in an urban high school participated in this study. A multiple-probe across-participants design was employed. Students were taught the CLUES strategy to improve their vocabulary acquisition. CLUES instruction consisted of 4 training lessons to introduce the terms to students (e.g., context, morphemes, prefixes, roots, and suffixes) and 10 CLUES Instructional lessons to teach 10 common science (e.g., biology and life science) roots. Dependent measures included CLUES Probes, Reading Comprehension-4 (Brown, Hammill, & Widerholt, 2008) Word Knowledge test, Word Part test, and Word Mapping/Strategy Use test. Students' ability to generalize the CLUES strategy without the use of the CLUES graphic organizer and their maintenance of the CLUES Strategy also was investigated. In addition, each participant's acceptability of the CLUES Strategy was assessed using an adapted version of the Child Intervention Rating Profile (CIRP; adapted from Witt & Elliott, 1985). The results of this study indicated that the students benefitted from the use of the CLUES Strategy and both contextual and morphemic strategies generalized to novel science word meanings. Each student maintained his or her ability to use this strategy over time. Students were generally satisfied with the CLUES Strategy, and recommended its use with other peers.

Chapter I

Statement of the Problem

Importance of Reading

Reading can be defined as an active, complex process that involves the understanding and interpreting of meaning from text for a variety of purposes and situations and continues to evolve throughout the reader's life span (National Assessment of Educational Progress [NAEP], 2012). One of the most pivotal factors associated with being able to compete in the global economy is the ability to read, write, think, and engage in complex communication (National Academics, 2005). If students are to leave high school prepared for college and career it seems evident that they need to be able to proficiently read and write (Miller, 2009). Beyond the need for students to skillfully read for a variety of academic and professional purposes, proficient reading impacts their ability to engage in activities that influence their general quality of life (Biancarosa & Snow, 2006). Hirsch (2006) accentuates the vital role that proficient reading plays in being able to participate in a democratic society: "Reading ability correlates with almost everything that a democratic education aims to provide, including the ability to be informed citizens who can actively participate in the self-government of a democracy" (p. 3).

The National Reading Panel (NRP) identified five reading components, phonemic awareness, phonological awareness, vocabulary, comprehension, and fluency, as specific reading skills that need to be instructed and developed for students to become skillful readers. Students become proficient readers as they engage in effective instruction across all five instructional components. The National Reading Panel (NRP, 2000) found that readers who mastered these five components had successful academic outcomes.

Although all of the reading components are important for successful reading, vocabulary is critical for students' academic success (Nagy & Scott, 2006). Students need to learn an exceedingly large amount of words in order to succeed academically (Stahl & Nagy, 2006). For example, research indicates that students will know approximately 50,000 new words by the end of high school (Anderson & Nagy, 1992; Anglin, et al., 1993; Hiebert & Cervetti, 2012; Snow & Kim, 2007; Stahl & Nagy, 2006). Therefore, students who acquire a greater amount of vocabulary words are able to read complex texts, which leads to positive academic and post-school outcomes.

Students who excel at reading have the ability to read a variety of books and figure out unknown words based on their existing vocabulary knowledge. The majority of the vocabulary acquisition and instruction research over the past few decades has focused on a "wide reading approach" to improve vocabulary growth (Wysocki & Jenkins, 1987; Swanborn & de Glopper, 1999). Wide reading requires that students read a variety of genres and encounter various new words. Such an approach allows students to encounter 15 to 55 unknown words in a typical 1000-word text (Nagy & Anderson, 1984). Research has found that secondary students acquire approximately 3,000 new words per year in their reading vocabularies using the wide reading approach (Anderson & Nagy; 1992; Anglin, Miller, & Wakefield, 1993; Beck & McKeown, 1991; Nagy & Herman, 1987). Thus, wide reading is the single most powerful approach to vocabulary growth for students (Stahl & Nagy, 2006).

Unfortunately, many students do not read well. In fact, results of national reports indicate that over eight million secondary students are reading below the proficient levels necessary for positive academic outcomes (Kamil, 2008). Stanovich (1986) coined the term "Matthew Effect" referring to the difference between good readers and poor readers. According

to this phenomenon, students who are behind their peers in reading tend to fall further behind as they continue through the grades due to their lack of background knowledge, decoding difficulties, and poor vocabulary skills. Therefore, it is more likely that poor readers will read fewer and easier books, further prohibiting vocabulary growth. Despite lack of consensus over how vast a student's vocabulary is supposed to be and what words are essential, Stahl and Nagy (2006) argued that the vocabulary gap between students with poor and rich vocabularies will continue to widen. Unfortunately, wide reading is challenging for poor readers since this method has resulted in the lack of significant gains in the area of fluency, comprehension, word recognition, or vocabulary outcomes (Chard et al., 2002; Chard, Ketterlin-Geller, Baker, Doabler, & Apichatabutra, 2009; National Institute of Child Health and Human Development, 2000; Wexler, Vaughn, Roberts, & Denton, 2009).

Particular groups of students have been more vulnerable to reading difficulties. Specifically, English Language Learners (ELLS) and students with Reading Disabilities (RD) are less likely to improve their reading skills when reading difficult texts (Roberts, Torgesen, Boardman & Scammacca, 2008; Torgesen et al., 2007). Further, the area of vocabulary is a particular challenge. For example, in 2009 the National Assessment of Educational Progress (NAEP) included a measure to assess students' vocabulary knowledge. Results showed that nationally, 12th grade ELLs and students with disabilities performed 50% lower than their general education peers on the vocabulary measures (NAEP, 2009). This indicates a great need to identify effective vocabulary interventions for students, particularly ELLs with RD.

Prevalence and Identification of ELLs with Reading Disabilities

ELLs are defined as individuals who are in the process of acquiring a second language in English (National Council of Teachers of English, 2008). It is estimated that that there are more

than 11 million English Language Learners (ELLs) in the United States, representing the most rapidly growing school-age population (National Center for Educational Statistics [NCES], 2012). Approximately 13.5% of K-12 ELLs have been identified with learning disabilities (LD; Shore & Sabantini, 2009; Zehler et al., 2003). Of the ELLs identified with LD nationally, approximately 56% of ELLs with LD are identified with RD (Klingner, Artiles, Mendez Barletta, 2006; McCardle, Mele-McCarthy, & Leos, 2005; United States Department of Education, 2002; Zehler et al., 2003). ELLs with RD are students who are acquiring a second language in English who also have deficits in reading comprehension, vocabulary, fluency, impaired speech and/or accuracy of word recognition, oral language deficits, phonological processing, and working memory impairments.

ELLs with LD have the lowest academic achievement outcomes compared to their general education peers and students with LD (August & Shanahan, 2006; 2010; NAEP, 2011; NCES, 2012). However, ELLs with RD are an under-researched subgroup of the U.S. population (McCardle, Mele-McCarthy, Cutting, Leos, & D'Emilio, 2005). In all of the literacy studies reviewed by the NRP (2000), only 17 studies addressed instruction for ELLs, and even fewer focused on secondary ELLs (Snow, Burns, and Griffin, 1998; Lesaux, Kieffer, Faller, & Kelley, 2010). None of the studies included ELLs with RD, further indicating a need for literacy interventions with this population.

Vocabulary Acquisition Challenges for ELLS

The vocabulary gap for ELLs, especially those with RD, is the biggest hindrance of their academic success (Carlo et al., 2004; Proctor et al., 2005). Recent studies have shown that although some ELLs' vocabulary growth rates are similar to and may even surpass those of general education students, they are typically 2 to 3 years behind their general education peers in

vocabulary knowledge. Thus, a large vocabulary gap remains for those ELLs with RD who are further behind in acquiring vocabulary (Mancilla-Martinez & Lesaux, 2011). In addition to vocabulary, ELLs with RD are weak in the areas of academic language and in the ability to make inferences and analyze text in English (Graves & August, 2012). Assisting ELLs with RD catch up and keep up with the steady vocabulary growth experienced by general education students over years of exposure to the English language is imperative (Kieffer, 2013).

One of the greatest challenges of vocabulary with which secondary ELLs with RD will struggle is reading content area textbooks that often rival the complexity of college-level textbooks. Many of the technical words students read in high school textbooks are not part of their current vocabulary. Their inability to fluidly read subject area concepts and complex vocabulary words results in the reduction of their word knowledge and capacity to read a broad range of academic texts (Barr, Eslami, & Josh, 2012).

Vocabulary Instruction for Secondary ELLs with RD

The paucity of vocabulary instruction research conducted with ELLs over the past few decades, coupled with the dearth of studies with secondary students with RD, is telling of the state of vocabulary research for ELLs with RD. There is little rigorous research to review with respect to interventions specifically targeted at ELLs with RD (August & Siegel, 2006; Slavin & Cheung, 2005). Currently, no extant literature reviews or national reports are available on what effective vocabulary instruction should be composed of for this particular population. Therefore, any current conceptual framework about effective vocabulary instruction for ELLs with RD is limited. Only recently has research on effective vocabulary instruction for ELLs emerged (Graves et al., 2012).

In recent years, researchers have advocated for additional research to identify evidence based vocabulary interventions, particularly for secondary ELLs with RD (Kieffer & Lesaux, 2008; Kieffer et al., 2010). In 2000, the NRP identified over 100,000 evidence-based reading studies that had implications for reading instruction for kindergarten through 12th grade students. The NRP identified a high correlation between vocabulary instruction and reading comprehension and recommended further investigations of vocabulary instruction for elementary, middle, and secondary students. Since the NRP (2000) report, fewer than 50 additional vocabulary intervention studies occurred with elementary and secondary students, and only six studies included ELLs (August et al., 2005; Carlo et al., 2004; Leo, 1991; Proctor et al., 2005; Kieffer & Lesaux, 2007; Kieffer & Lesaux, 2008; Lesaux et al., 2010; Kieffer & Box, 2012; Kieffer & Lesaux, 2012). Furthermore, only one study was conducted with secondary ELLs with RD (Helman, Calhoon, & Kern, 2015. Helman and colleagues found that strategy instruction improved science vocabulary acquisition of secondary high school ELLs with RD.

Types of Vocabulary Interventions

Vocabulary interventions conducted over the past few decades fit into two categories: *non-generative* and *generative***.** Non-generative vocabulary interventions teach students the meaning of a single word with the aid of a strategy and/or a device (Harris, Deshler, & Schumaker, 2011). Although non-generative strategies may be effective for learning the meaning of the targeted vocabulary word, students do not learn the meaning of several words due to learning that one word. Non-generative strategies alone may not be the most practical instruction for adolescents who have vocabulary deficits (Harris, 2007; Harris et al., 2011). Given that ELLs with RD need to learn thousands of words to decrease the gap between their

performance and their typically achieving peers, strategies that teach students one word at a time lack the power to build vocabulary at a sufficient rate (Nagy & Anderson, 1984).

In contrast, generative vocabulary interventions not only teach students the meaning of an unknown word, but also allow them to unlock the meaning of related new words. Specifically, generative approaches teach students how to use vocabulary knowledge that can transfer to the learning of new words (Nagy et al., 2006). For example, word-learning strategies include teaching context (e.g., words or phrases that help define an unknown word) and word-parts (e.g., prefixes, roots, suffixes) to help students become independent word learners. These strategies, known as *contextual analysis* and *morphemic analysis*, are effective generative strategies to support vocabulary acquisition for ELLs with RD (Blachowicz & Fisher, 2006; Harris, 2007; Kieffer et al., 2010). Baumann and Kame'enui (2003) captured the significance of the lack of attention to generative strategies to vocabulary acquisition in the following observation:

> "In spite of the conventional wisdom that instruction in morphemic analysis is an appropriate transferable and generalizable vocabulary strategy, research on the efficacy of such instruction is fairly limited" (p. 623).

Morphemic Analysis and Contextual Analysis Strategies

Morphemic analysis involves deriving the meaning of a word by combining the meaning of the word parts (morphemes; Nagy & Scott, 2000). The word parts include prefixes, suffixes, and roots. Specifically, morphemic analysis can described in the following process: (a) breaking words into their morphemic parts, (b) connecting meaning to those parts, and (c) identifying a connection between and combining the meaning of the word parts to determine the definition of the whole word (Nation, 1990). Some authors have suggested that learning the meaning of ancient Greek and Latin roots is critical because approximately half of the English words are

derived from Greek and Latin roots with as much of 65% of these words being academic vocabulary (Stahl & Nagy, 2000).

Contextual analysis is another generative strategy that involves teaching students how to identify important information found in texts (e.g., antonyms, synonyms, adjectives, contrasts, examples) and helps them infer meanings of unknown words (Fukkink & De Glopper, 1998). Further, Kuhn and Stahl (1998) conducted a meta-analysis of 14 studies in order to determine the effectiveness of semantic contextual cues. They found clear evidence that students taught to use external semantic contexts became better at defining unknown word meanings compared to no-instruction controls.

A handful of vocabulary intervention studies have used contextual analysis and morphemic analysis strategies independently to help general education students, ELLs, students with RD, and ELLs with RD acquire vocabulary with promising results (Bauman et al., 2003; Carlo et al., 2004; Katz & Carlisle, 2009; Wysocki & Jenkins, 1987). Only one study integrated the use of contextual analysis and morphemic analysis throughout instruction to improve science vocabulary acquisition for ELLs with RD (Helman, Calhoon, & Kern, 2015). To expand the literature on vocabulary interventions for secondary ELLS with RD, Helman et al. conducted a study investigating the effects of using integrated contextual analysis and morphemic analysis strategies, the CLUE WORD Strategy (CWS), to improve students' ability to acquire science vocabulary. Results were notable since the three participants improved their ability to identify word parts, write word part meanings, and science content words after receiving a short duration of individualized instruction (e.g., 3-6 lessons).

Based upon the promising preliminary results, Helman et al. (2015) made recommendations for future research, including how to address limitations. First, they found that

ELLs with RD had difficulty memorizing the CWS steps, attributed to the length of each phrase (e.g., wording) and the number of steps. Second, all three students made minimal gains on two of the measures, the Word Knowledge test and Word Part test, ascribed to lengthy tests that included all of the taught words during intervention and novel words. The researchers recommended including only taught words and some novel science words on post-assessments to prevent potential test anxiety and fatigue.

In summary, the current study replicates Helman and colleagues' study investigating the effectiveness of generative strategies for secondary ELLs with RD. Considering the dearth of vocabulary studies for this population of students, it is imperative to investigate the integration of contextual and morphemic analysis strategies to improve vocabulary acquisition for secondary ELLs with RD. Preliminary results from Helman et al. (2015) indicate that ELLs with RD used the generative strategies to define unknown science words. This indicates students acquired the strategy following intervention. Therefore, it would behoove researchers to investigate the effectiveness of these strategies to diminish the vocabulary gap for ELLs with RD.

Purpose

The first purpose of this study was to extend Helman et al. (2015) by: (a) condensing the CLUEWORD steps; (b) adapting the scoring criteria for the strategy use; (c) adapting the Word Knowledge test (WKT), Word Part test (WPT), and Word Mapping/Strategy Use Test (WM/SUT) measures; (d), adapting the scoring criteria for the test measures; (e) modifying the amount of training lessons; (f) adapting the amount of instructional lessons; (g) adding a generalization probe measure; and (h) modifying the maintenance timeline. The effectiveness of a revised version of the previously developed vocabulary instruction strategy, now called the CLUES Strategy, on the acquisition of science word meanings with high school ELLS with RD

was assessed. The CLUES steps included all of the same necessary strategies to integrate contextual analysis and morphemic analysis in a more concise manner. A secondary purpose was to investigate whether students maintained the skills 2 weeks and one month post-intervention. A third purpose of this study was to investigate whether students would generalize the CLUES strategy to novel science words. A fourth purpose was to assess whether the students would find the intervention acceptable.

Research Questions

Research Question 1: Will the CLUES Strategy result in an increase in ELLs with RD's accuracy of writing word parts, word part meanings, and whole science word meanings?

It was hypothesized that the CLUES Strategy would result in improved accuracy of writing word parts, defining word parts, and predicting science word meanings among ELLs with RD.

Research Question 2: Will the Clues Strategy result in an increase the accuracy of their writing the CLUES steps among ELLs with RD?

It was hypothesized that the CLUES Strategy would result in an increase in CLUES steps accurately written by ELLs with RD.

Research Question 3: Will the CLUES Strategy result in an increase in the number of science words ELLs with RD can define from pre- to post-test?

It was hypothesized that the CLUES Strategy would result in an increase in the number of science words ELLs with RD could define from pre- to post-test.

Research Question 4: Will ELLs with RD maintain their use of CLUES use two weeks and one month post-intervention?

It was hypothesized that ELLs with RD would maintain their CLUES use both 2 weeks and one month following the CLUES intervention.

Research Question 5: Will ELLS with RD generalize the CLUES strategy to sentences from science text without using a graphic organizer?

It was hypothesized that ELLs with RD would generalize their ability to use the CLUES with regular science text without the use of a graphic organizer.

Research Question 6: Are ELLs with RD who receive the CLUES Strategy satisfied with the intervention?

It was hypothesized that ELLs with RD would find the CLUES instruction acceptable and would be satisfied with the intervention.

Chapter 2

Literature Review

In the past several decades, the importance of vocabulary has been emphasized in academic settings, mainly because reading comprehension is dependent on vocabulary growth (Graves et al, 2012; National Assessment of Educational Progress, 2009; RAND, 2002; Snow and Kim, 2007; Stahl & Nagy, 2006). The National Reading Panel report (2000) identified vocabulary as one of the five factors central to reading proficiency. Historically, educational researchers have studied a variety of dimensions of vocabulary found to be important for vocabulary acquisition and mastery. These include vocabulary size, vocabulary knowledge across students of different age spans, various vocabulary approaches, and different types of instructional conditions and instructional delivery systems. First, students who enter school with a limited vocabulary size (e.g., knowledge of words) will grow more discrepant over time from their peers who have rich vocabulary knowledge. Thus, students who have a larger vocabulary size tend have better comprehension outcomes because they have acquired both basic and complex vocabulary words. Second, research suggests that vocabulary knowledge follows a developmental trajectory (Biemiller, 2001). Vocabulary knowledge is the understanding of how a word not only implies a definition, but also how that word fits into the world (Stahl, 2005). Third, the use of a variety of effective vocabulary approaches helps students gain a deep understanding of the word's meaning through a variety of techniques (i.e., reviewing examples and non-examples of the word's meaning, breaking the word into its word parts, inferring the word's meaning from context) so students can use those words across academic settings. Fourth, many students benefit from engaging, rich, explicit and systematic vocabulary instruction in order to acquire and master the meaning of basic and complex word meanings (Nagy & Scott, 2000; Biemiller, 2008). Finally, the selection of appropriate instructional delivery systems (e.g.,

those that demonstrate explicit steps and strategies, model multiple examples, provide ample and extensive opportunities for practice and review) will enhance core vocabulary instruction for all students, particularly for students who have not acquired adequate vocabulary. Therefore, the importance of understanding these five vocabulary dimensions can provide direction for improving vocabulary acquisition and mastery for all students.

In this chapter, I first define the population of interest, including students with Learning Disabilities (LD), Reading Disabilities (RD), English Language Learners (ELLs), and ELLs with RD, focusing on their specific needs in the area of vocabulary acquisition. Second, I describe the differences between skilled vocabulary learners and students with vocabulary deficits. Third, I review the literature on challenging content texts. Fourth, I review the literature on effective vocabulary practices for general education students that were recommended for ELLs with RD, primarily focusing on non-generative strategies, designed to teach students the meaning of individual words. In comparison, the fifth section will review generative strategies, designed to teach students strategies for using key word elements (e.g., prefixes, suffixes, roots) to help them derive the meaning of unfamiliar words. The concluding sixth section reviews the research literature on integrating effective vocabulary approaches.

Defining English Language Learners with Reading Disabilities

There are varying viewpoints of what characteristics define ELLs with RD, with much of the controversy due to assessment issues (Chu & Flores, 2011). The reason for the high prevalence of ELLs with RD in the public schools is unclear because there is neither a method for accurate identification nor a consistent definition across states (McCardle, Keller-Allen, & Shuy, 2008). Specifically, since ELLs and ELLs with RD share similar reading characteristics, if inappropriate assessments are used, the resulting scores may be inaccurate (Ortiz, Wilkinson,

Robertson-Courtney, & Kushner, 2006). In fact, ELLs with RD may be under-or overrepresented if they are not properly assessed (Hallahan et al., 2005). Problems with standardized assessments include content bias (e.g., unfair test items) and linguistic bias (e.g., complex directions and multisyllabic vocabulary; Shore & Sanbanti, 2009). Therefore, ELLs may not understand assessment questions due to linguistic complexity (Chu & Flores, 2011). The controversy surrounding assessment and accurate identification is one reason reading research for ELLs with RD has remained limited. In spite of assessment limitations, the terms LD, RD, ELL, and ELLs with RD were defined in the next section along with description of the similarities and differences between general education students and second language learners' (ELLs) reading skills. Finally, the characteristics differentiating ELLs and ELLs with RD will also be described.

Current definition of Learning Disabilities. According to the Individuals with Disabilities Education Act (IDEIA, 2004), Learning Disabilities (LD) is defined as a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia and does not include learning problems that are not primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, or economic disadvantage, or cultural or linguistic difference (IDEIA, 2004 CFR 300.8 (c)(10)).

Issues with identifying students with LD have been an increasing concern over the past decade (Fletcher, Coulter, Reschly, & Vaughn, 2004). A broad definition of LD refers to a variety of disorders that affect the acquisition, retention, understanding, organization, or use of

verbal and/or nonverbal information. The 2004 definition, although still maintaining the core assumption of an underlying, intrinsic psychological processing disorder, differs from previous definitions by reducing the reliance on discrepancy and exclusionary identification methods in favor of a more criterion-based emphasis on a failure to achieve.

Defining characteristics of students with RD. The term LD and RD are not interchangeable since not all students identified with LD have difficulty with reading (Taylor, 2007). However, approximately 90% of students with LD have a disability in reading (Bender, 2004). Students with RD may have key component deficits in phonological awareness, phonological processing, rapid automatic naming, reading recognition, speed and/or accuracy of word recognition, vocabulary, language comprehension, and oral-language (i.e., difficulties in perception, retention, retrieval, analysis, and production of spoken words; Fowler & Scarborough, 1999; Taylor, 2007). When individuals do not attain component proficiency following appropriate instruction and interventions, it is evidence of RD (Shore & Sabantini, 2009).

Defining characteristics of ELLs. ELLs are defined as individuals whose primary language is not English and who are in the process of acquiring English (National Council of Teachers of English, 2008). Adolescent ELLs are a diverse group of learners in terms of their educational backgrounds, native language literacy, and socioeconomic status. These students vary in their response to literacy strategies (Short & Fitsimmons, 2007).

ELLS have challenges with both academic and oral language since they are acquiring English (Chu & Flores, 2011). Oral language proficiency is one's ability to communicate orally in a target language, most often measured as speaking and listening abilities and categorized as low, intermediate, or advanced (Cummins, 1979). Academic language proficiency refers to the

language functions used by teachers and students for the purposes of acquiring new knowledge and skills. Academic language may be global and commonly used across a variety of content areas (Chamot & O'Malley, 1994).

Some studies have indicated students can acquire oral communication skills more quickly than they can acquire academic language (Gottardo, 2002; Respredo & Gray, 2007). It can take approximately 5 to 7 years for ELLs to become proficient in academic language (Cummins 1979, 1981; Thomas & Collier, 2003). However, recent research indicates that the rate of acquisition of academic language is related to appropriately delivered, developed, and differentiated instructional support (Calderon & Minaya-Rowe, 2011; Echevarria, Vogt, & Short, 2004).

One important issue influencing the normal acquisition of the English language is how the ELLs' first, or native, language positively or negatively transfers to English. When the cross transfer is negative, it is often referred to as cross-linguistic interference. Negative cross transfer happens when individuals use their native language to make decisions about the second language, leading to errors due to the different language structures (Shore and Sabatini, 2009). Fortunately, this information can be useful to distinguish students who are in the process of normal language development in the second language from those who may be experiencing reading difficulties.

Factors that Affect ELL's Reading Acquisition.. One major finding across languages has been that literacy skills often transfer from one language to another (Respredo & Gray, 2007). Research across investigations in various languages (e.g., Italian, French, Persian, Spanish, Turkish) suggests that good readers (comprehenders) in one language tend to be good readers in a second language (Durgunoglu, 2002). According to Cummins (1979), children with

strong language and literacy skills in their first language are more likely to develop strong language and literacy skills in their second language. Further, some languages, such as English and Spanish, share similar orthographies and have many similarities in their phoneme-grapheme correspondences. Consequently, a reader's knowledge of the alphabet in Spanish is likely to transfer in English. However, a child who has difficulty learning to read in Spanish is also more likely to have difficulty learning to read in English (August & Shanahan, 2006; 2010; Gorman, 2009). Research has shown that English second-language oral proficiency, native-language reading, and English-second language reading appear to be positively related (Fitzgerald, 1995; Gottardo, 2002; Lindsey, Mani, & Bailey, 2003). However, although information regarding the student's first language proficiency may be suggestive of difficulties in the second language, it may not be completely predictive of RD (Shore & Sanbantini, 2009).

Studies have indicated that a strong correlation between decoding in first and second languages exists (Durgunoglu, 2002, Geva & Wang, 2001). Another findings across languages is that individuals with poor phonological-processing skills tend to be poor readers (Geva, Yaghoub-Zadeh, & Schuster, 2000). This poor level of reading may manifest as errors in decoding and word recognition in languages with inconsistent spelling-to-sound correspondence, like English, or simply slower but accurate word reading in transparent languages, like Spanish (Wimmer et al., 2000). Another important research finding is that ELLs often attain levels of performance equal to those of general education students in word-level skills (e.g., decoding, word recognition, spelling) (August, Carlo, Dressler, & Snow, 2005; August & Shanahan, 2006; 2010). However, this is not the case for text-level skills and reading comprehension (August & Shanahan, 2010). One reason for the disparity between word and text-level skills is the English vocabulary of ELLs (Perez, 1981).

Cross-cultural linguistic studies have also demonstrated that for ELLs, phonological awareness correlates with second language reading outcomes (Dickinson, McCabe, Clark-Chiarelli, & Wolf, 2004; Gottardo, Collins, Baciu, & Gebotys, 2008; Lindsey, Manis, & Bailey, 2003). Phonological awareness is the perception of speech sounds distinct from their meanings, including the ability to detect rhymes (e.g., bat, cat), syllables within words, as well as individual sounds (i.e., phonemes). In addition, phonological awareness is a significant predictor of word recognition and spelling within and across languages (Durgunoglu, 2002). Phonemic awareness is necessary for development of proficient decoding and is a predictor of reading outcomes (Lesaux & Siegel, 2003).

Recent studies have reported that ELLs' performance is significantly below the average achievement of general education students on vocabulary and other oral language proficiency outcomes such as listening comprehension, memory for sentences, and verbal analogies (Carlson & Francis, 2007; Gonzalez et al, 2011; Mancilla-Martinez & Lesaux, 2011; Proctor et al, 2005; San Franciso et al, 2006; Vaughn, et al. 2000). Recently, a study on oral language suggested a development lag in ELLs' patterns of growth, from the preschool years through early adolescence in oral language, relative to national norms (Mancilla-Martinez & Lesaux, 2011).

Challenges identifying ELLs with RD. The challenge of identifying ELLs with RD has been a topic of increasing concern, partly due to the rapid growth of the number of ELLs in the United States as well as the limited literature on specific characteristics of ELLs with RD (Shore & Sabantini, 2009). As mentioned, there is variation in the practice of identifying students with RD nationally. For ELLs, differing orthographic, cultural, social, and linguistic systems of their native language further complicates the process of identifying ELLs with RD (Fowler & Scarborough, 1999). However, regardless of native language, and cultural, social, and linguistic

contexts, some ELLs who experience difficulties learning to read do not respond to specific instructional interventions (Fowler & Scarborough, 1999).

Defining characteristics of ELLs with RD. For purposes of this paper, ELLs with RD are defined as students acquiring a second language in English who are identified with a learning disability in reading with deficits in oral language, phonological processing, working memory, and vocabulary. Since few descriptive studies have delineated the characteristics of ELLs with RD, the next section will provide a framework that distinguishes ELLs and ELLs with RD, and differentiates a student with RD from one with normal language and literacy acquisition, with the caveat being additional need for more research in this area.

Several factors may identify ELLs with RD, such as difficulties with word reading, phonological processing, phonemic awareness, rapid naming, oral language, working memory and vocabulary (Durungoglu, 2002; Gorman, 2009; Gottardo, 2002; Lesaux & Siegel, 2003; Ordonez, Carlo, Snow, McLaughlin, 2002; Siegel, 2009; Swanson, Saez, & Lentz, 2004; Shore & Sabantini, 2009; Swanson, Orosco, & Lussier, 2012). However, the four strongest predictors that distinguish ELLs and ELLs with RD are oral language, phonological processing, working memory, and vocabulary (Gorman, 2009; Shore and Sabantini, 2009; Lesaux & Siegel, 2003; Swanson et al., 2004; Swanson et al., 2012).

Oral language. The ability to understand oral language is an important aspect of reading and is an important indicator of reading proficiency (Durungoglu, 2002; Ordonez et al., 2002; Shore & Sabantini, 2009). For example, Durungoglu (2002) reported that for ELLs, lower linguistic proficiency, especially in vocabulary knowledge, slows the development of phonological awareness. Research on the use of oral vocabulary in learners' first and second

languages supports the conclusion that oral vocabulary in the first and second language helps account for variance in RD (Gottardo, 2002, Shore & Sabantini, 2009).

Phonological processing. Research has identified phonological processing as the primary neurological underpinning of RD across languages and grade levels, with the secondary being letter identification with elementary children (Gorman, 2009; Gottardo et al., 2002; Lesaux & Siegel, 2003; Stanovich & Siegel, 1996; Swanson et al., 2012). Phonological processing is an auditory processing skill. A student with phonological processing needs may have difficulty in one of several detection discrimination tasks involving speech sounds in words (Shore and Sabantini, 2009).

Phonological processing, working memory, and rapid naming tasks that are designed to tap into specific underlying processes also appear to be indicative of RD across both alphabetic and non-alphabetic languages (Leong, Tse, Loh, Hau, 2008; Lesaux & Siegel, 2003; Lesaux & Siegel, 2007). For example, Manis, Lindsey, and Bailey (2004) investigated the effects of early instruction and achievement in Spanish on achievement in English reading with kindergarten ELLs. The study employed tests designed to measure the same skills in the first and second language. Manis et al. found that cognitive factors, such as phonemic awareness and rapid automatized naming (RAN), were significant factors leading to the prediction of ELLs with RD. The authors also found that kindergartners' first language phonemic awareness and RAN predicted English letter-word identification in the second grade. Finally, Abu-Rabia and Siegel (2002) found that phonological awareness, working memory, and vocabulary were the most significant predictors of ELLs with RD.

Other studies that have measured reading skills in kindergarten showed phonological processing skills to be the single best predictor of ELLs' word reading and reading

comprehension skills in later grades followed by letter identification (Gorman, 2009; Swanson et al., 2004; Swanson et al., 2012). For second-grade ELLs, phonological processing and word reading were particularly robust cross linguistic indicators of RD (Chiappe, Siegel, & Wade-Wooley,2002; Durgunoglu, 2002; Gersten & Baker, 2000; Gottardo, 2002). Finally, Lesaux and Siegel (2003) found that word reading, phonological processing, and oral cloze tasks differentiated average ELL readers from those ELLs with RD.

Working memory. Recent studies have linked working memory to ELLs with RD and ELLs who are at-risk for RD (Pimperton & Nation, 2010; Swanson et al., 2004; Swanson et al., 2012). Working memory refers to the cognitive processes involved in the temporary storage of information as an individual is simultaneously processing incoming information or is retrieving information from long-term storage (Baddeley, 1983; 1986; Just & Carpenter; 1992; Turner & Engle, 1989). Working memory was measured using tasks that require individuals to hold a small amount of material in their mind for a short time, although simultaneously carrying out further operations. One important feature of working memory is that it has limited capacity (Chiappe, Hasher, & Siegel, 2000). Working memory involves transient memory and predicts comprehension (Swanson, 1983, 1989, 1993, 1999). For example, Swanson, Orosco, and Lussier (2012) explored the cognitive basis of RD in 393 ELLs with and without RD (Grades 1, 2, and 3). Students were administered a battery of cognitive, vocabulary, and reading measures in both Spanish and English. Four important findings emerged from the assessments. First, both groups shared common problems in English phonological processing and naming speed, as well as on language general measures of working memory and ratings of classroom attention. Second, both groups shared similar cognitive difficulties, but Spanish phonological processing differentiated the two groups. Third, differences were found in classroom inattention, English

naming speed, and phonological processing. The results supported the notion that first language phonological processing as well as general working memory system underlies second-language acquisition and RD in ELLs, particularly for Spanish speaking ELLs.

Vocabulary. Studies have indicated that ELLs who score lower on vocabulary measures in their first or native language tend to have lower scores on vocabulary measures in a second language (August & Shanahan, 2006; 2010; Perez, 1981; Vaughn-Shavuo, 1990). Recent studies have shown that although some ELLs' vocabulary growth rates are similar to and may even surpass those of general education students, they are typically 2 to 3 years behind general education peers in vocabulary knowledge, and a large vocabulary gap remains, especially for those ELLs with RD who are further behind in acquiring vocabulary (Mancilla-Martinez & Lesaux, 2011).

In summary, several predictors that may help distinguish ELLs from ELLs with RD, including cross-linguistic factors, such as phonological processing and working memory deficits. Despite the promising research findings on similarities and differences with general education students and ELL's reading skills that may help researchers and practitioners identify ELLs with RD appropriately, there is still much research needed. In addition, ELLs with RD are currently performing far below their peers in many academic areas and most research attributes this to the vocabulary gap (Graves et al, 2012). Therefore, it is critical to identify effective vocabulary instruction to help this under-researched population succeed.

Characteristics of Students with Good and Poor Vocabulary Skills

Cognitive studies have indicated that students who have a large vocabulary have greater comprehension and excel academically (Swanson, Orosco, & Lussier, 2012; Swanson, Saez, & Gerber, 2004). Studies that have investigated the characteristics of students with exemplary

vocabulary have the ability to: (a) parse the meaning of unknown words during incidental reading; (b) use working memory; (b) utilize prior knowledge and background knowledge to understand concepts; (c) employ structural analysis (e.g., prefixes, roots, suffixes); and (d) apply knowledge of known vocabulary words to figure out additional words (Graves et al., 2012; Lesaux & Kieffer, 2008; Nagy, Stahl, & Berninger, 2006; Swanson et al., 1999; Vaughn et al., 2007). Students with more expert vocabulary are able to use metacognitive strategies, cognitive strategies, memory and activation strategies to analyze text (Nation, 1990; Swanson, Mink, & Bocian, 1999). Metacognitive strategies consist of selective attention and monitoring thinking although reading (Gu & Johnson, 1996; Schmitt, 1997). Cognitive strategies entail using appropriate guessing strategies that draw upon background knowledge and use of linguistic cues, such as grammatical structures of a sentence to guess the meaning of unknown words. Memory strategies are classified as rehearsal and encoding strategies. Rehearsal strategies include repetition of words and use of word lists to help students remember words. Encoding strategies encompass strategies such as association, imagery, visual, auditory, semantic, and contextual encoding as well as word structure analysis. Activation strategies assist learners to use newly learned words in new contexts. Learners with stronger vocabularies use these strategies to improve comprehension.

Vocabulary Deficits in Students with RD

The ultimate outcome of great vocabulary knowledge in students is improved comprehension (Blachowitz & Fisher, 2000; Blachowitz & Ogle, 2008; Graves, August, & Mancilla-Martinez, 2012; Stahl & Nagy, 2000; Nagy & Stahl, 2006). Unfortunately, students with vocabulary deficits are poor readers, often with a reading level too low to profit from independent reading of challenging "grade-level textbooks" (Chall & Conard, 1991; Blachowitz

& Ogle, 2008). Although avid readers can increase vocabulary by encountering unfamiliar words during incidental reading (Sternberg, 1987), this is problematic for students with RD since the probability of learning any word during a first encounter is low, especially given challenging texts. Put simply, students with RD lack the vocabulary necessary to understand grade-level texts, even if they can identify the printed words (Biemiller, 1999). Additionally, students with RD often have had minimal to no training in deriving meanings for unknown words using context (Fukkink & de Glopper, 1998; Kuhn & Stahl, 1998). Further, word learning difficulties for students with RD are also attributed to semantic and phonological deficits (McGregor et al., 2002; Nash & Donaldson, 2005) and limited working memory capacity (Swanson et al., 2012).

Studies have demonstrated a link between phonological memory, the component of working memory responsible for keeping phonological information active for brief periods, and vocabulary skill (Baddeley, Gathercole, & Papagno, 1998; Gupta & Tisdale, 2009). Poor phonological short-term memory skills, as evidenced by non-word repetition tasks, may adversely affect students' ability to establish discriminable and durable representations of the phonological form of new words in long-term memory. As a result, it may be more difficult for students to build a semantic representation for a new word, due to the lack of a secure phonological representation used for memory mapping. For example, Nash and Donaldson (2005) found that students with vocabulary deficits showed less knowledge of novel words.

Students with deficits in vocabulary need more time to learn strategies to help them acquire words in order to reduce the vocabulary gap (Lockavitch, 2010). Unfortunately, studies have shown that students typically receive little vocabulary instruction in their classrooms (Blachowitz, 2008). Earlier studies on the amount of time vocabulary instruction occurs have found that teachers spent an average of only 1.67 min on vocabulary during each reading lesson

(Rosser & Juel, 1982). Recent studies have found that time devoted to vocabulary instruction has not increased, with one study showing that less than 12 min was devoted, on average, to vocabulary instruction throughout the week (Graves et al., 2012; Graves, 2006). This may explain why students with RD continue to have gaps in their vocabulary. Moreover, students with RD need considerable repetition in order to acquire vocabulary words (Chall & Conrad, 1991). Word meanings that are identified in repeated encounters in rich and oral contexts provide students with experiences and clues to the word's meaning that builds over time and will help shape their understanding of the unknown word (Stahl & Nagy, 2006).

Another obstacle that students with RD face is lack of explicit vocabulary instruction in various cognitive and metacognitive strategies to help them determine word meanings (Jitendra et al., 2004). Since students are not equipped with effective word learning strategies, students with RD often have fragmented and less complete knowledge of words, particularly a more narrow understanding of word features (Swanson et al., 1999). Lack of strategies to improve word knowledge appears to be one of the most critical obstacles to enhanced vocabulary development for students with RD (Stahl & Nagy, 2006).

Vocabulary Deficits in ELLs

ELLs have vocabulary deficits for several reasons. First, incidental word learning is challenging for ELLs because they are embarking on the task of understanding new words in a second language and have difficulty disambiguating the meaning of unfamiliar words (Carlo et al., 2004; August & Gray, 2010). Their reading deficits are further confounded because a higher proportion of the words in the text are unknown. ELLs who are acquiring English vocabulary often know fewer words compared to their general education peers, and are falling far behind the approximately 50,000 words required for success in high school (Biancarosa & Snow, 2006;

Hirsh, 2003; Nagy & Stahl, 1984). Thus, for ELLs, the vocabulary-learning task is enormous (Graves et al, 2012). As ELLs navigate through challenging content area text, they may have both challenges learning new vocabulary and difficulties understanding new concepts (Armbruster & Gudbrandsen, 1986).

In addition, ELLs may have varied vocabulary knowledge due to oral language proficiency skills (Gorman, 2009; August & Graves, 2012). Research indicates that ELLs with RD performed below average on vocabulary and other oral language proficiency outcomes, such as listening comprehension, memory for sentences, and verbal analogies (Mancilla-Martinez, & Lesaux, 2011; Proctor et al., 2005; San Francisco, Mo, Carlo, August, & Snow, 2006; Vaughn et al., 2006). Considering these challenges, ELLs often experience little success acquiring vocabulary at a rate that will catch them up with their general education peers (Blachowitz, 2008; Nagy & Scott, 2006). Therefore, secondary ELLs face significant challenges acquiring vocabulary of complex content area texts used in most high school classrooms (Harmon et al., 2005).

In order for ELLs to navigate challenging content area text, they need to be taught specific and explicit metacognitive, cognitive, and memory strategies (Gu; 2005; Gu & Johnson, 1996). Preliminary research has demonstrated a meaningful relationship between vocabulary learning strategies and academic outcomes through the establishment of similar strategies that are effective for different learners (Gu & Johnson, 1996; Moir & Nation, 2002). At the same time, this warrants additional research to validate these interventions with this population (Carlo et al., 2004; Proctor et al., 2005; August & Shanahan, 2006; 2010).

Vocabulary Deficits in ELLs with RD

ELLs with RD may be the subpopulation that has the most significant vocabulary deficits due to several factors, including phonological memory, oral language, working memory, and their current language proficiency (Gorman, 2009; Swanson et al., 2012). Phonological memory is an important component of second-language vocabulary acquisition (Thorn & Gathercole, 1999; Lipka & Siegel, 2007; Stanovich & Siegel, 1996). Deficits in the phonological system are attributed to poor vocabulary performance in ELLs with RD (Gonzalez & Valle, 2000). This assumption is based on research indicating that students with relatively poor phonological memory are less successful in learning the sound structure of new words (Chiappe, Siegel, & Wade-Woolley, 2002). Thus, students with more severe phonological processing deficits related to the phonological system may be unable to store unfamiliar phonological forms of information to allow more permanent memory presentations to be formed (Baddeley et al., 1998). Additionally, in a comparison of vocabulary acquisition, ELLs with RD were identified with more significant deficits than ELLs without RD in working memory and the ability to process information accurately (Swanson, 2012; Swanson, 2004).

ELLs with RD also need explicit vocabulary strategy instruction that includes multiple opportunities to reinforce word knowledge (Gorman, 2009). Research has found that multiple opportunities to read words in varied contexts helps students understand that words can have more than one meaning (Nagy & Scott, 2000). To provide students the opportunity to encounter words multiple times, increased instruction time for vocabulary is needed (Carlo et al., 2004). However, as previously mentioned, most students are not receiving an adequate amount of vocabulary instruction. In addition, minimal vocabulary intervention research has determined the specific metacognitive and cognitive strategies that are beneficial to use with ELLs with RD (Kieffer et al., 2010). Currently, researchers have suggested that ELLs with RD would benefit

from vocabulary strategies that are effective for ELLs and general education students (Graves et al., 2012). However, validation of these strategies is pertinent for this subpopulation (Vaughn et al., 2007; Swanson et al., 2012).

ELLs with RD may have substantial complexity in acquiring a greater amount of vocabulary words. This is due to their current reading deficits and need to acquire English language proficiency (Swanson et al., 2012). In addition, since there is limited time devoted to effective vocabulary instruction, these students will have even more complication acquiring words. One more difficulty that ELLs with RD face is comprehending content area information based on the complex lexicon found in secondary academic text. Due to their vocabulary deficits, ELLs with RD will have further adversity in navigating content area text that are challenging for many secondary students with and without RD, especially if they are not equipped with specific strategies (Harmon et al., 2005).

Challenges of Content Area Text

Content area texts require students to decode and understand multisyllabic words, connect prior knowledge with new ideas, summarize, and organize information in a genre where the content, vocabulary, and syntax are unfamiliar. Not only do content area texts generally differ from narrative text, but also each content area (e.g., science, social studies, mathematics) has its own set of vocabulary and common text structures (Heller & Greenleaf, 2007). In short, students are accountable for learning new information from content area texts that increase in reading level difficulty, vocabulary, content, and organization. The increased difficulty of school texts may be one explanation for the fourth grade slump, a time when the vocabulary gap between skilled and less skilled learners accelerates (Chall et al., 1990). Therefore, secondary students need effective vocabulary strategies, coupled with multiple exposures to content area

text. However, students receive limited exposure to content texts during their primary and intermediate school years (Duke, 2000; 2010; Englert, 2011).

Current vocabulary instruction for middle and high school students demands the provision of essential strategies to support vocabulary growth across academic content areas (e.g., science, mathematics, and social studies; Harmon, Hedrick, Wood, 2005). For instance, at times students can read one science passage that is easy to understand although another science passage on the same page may contain a plethora of technical words. To help struggling students develop vocabulary knowledge and navigate challenging text, Harmon et al. provided the following best practice recommendations: (a) read trade books related to the content area topics; (b) explicitly teach technical vocabulary; (c) employ contextual analysis strategies; (d) use self-selected vocabulary; (e) utilize visual aids; (f) provide several opportunities for exposure to key vocabulary; (g) use structural analysis; and (i) provide trainings in effective vocabulary instruction.

As the number of unfamiliar words increases in content area text, the nature of the words also changes (Baumann, 2011). Content area vocabulary, often referred to as academic vocabulary, is highly specialized and cognitively challenging, requiring students to use critical reading skills and sophisticated decoding skills to access information (Harmon et al., 2005). Academic words carry much of the content load, may have multiple meanings, and often students may be wholly unfamiliar. For example, in a typical 100-word narrative reading passage, students can encounter ten unknown words and still adequately comprehend the passage. However, unknown words in content area texts are generally concept words (e.g., biology, leukocyte, mitosis, chlorophyll), so if students are only able to comprehend approximately 90% of the text, their understanding is compromised.

As students' content knowledge improves so does their ability to comprehend texts (Schatschneider et al., 2004). Students' knowledge of an academic area, such as science, also may reflect their current vocabulary knowledge. For example, if students have background knowledge of science concepts through reading or other experiences, they can build upon their current science knowledge to help them further understand new and related concepts. Therefore, vocabulary knowledge may be the link that connects reading comprehension and learning from content area texts.

Vocabulary in science text. Knowledge of science words is an important part of being an educated citizen in the informational and technological world (Lee, 2005). The science and science education community have advocated for greater participation in science-related fields (Harmon, Hedrick, & Wood, 2005; National Research Council, 1995). Despite the urgent need for students of all backgrounds to partake in more science courses to advance the technology, science instruction does not get the attention that it deserves (August & Hakuta, 1997). This often results in students not obtaining the necessary background knowledge to help them develop their understanding of science concepts in the areas of biology, life sciences, and chemistry. Unfortunately, as Harmon et al. contend, science textbooks include words that are challenging for secondary students due to the scientific multi-morphemic terminology used to explain new concepts, coupled with the bombardment of unfamiliar concepts (Harmon et al, 2005) and vocabulary that is conceptually dense (Blachowitz & Fisher, 2000). Considering that students must understand approximately 90% to 95% of the words in a text to adequately comprehend (Nagy & Scott, 2000), difficulty in comprehension of science texts can be attributed, in part, to the high density of unfamiliar vocabulary (Baumann et al, 2003). Therefore, it is especially important for all secondary students, but especially for ELLs with RD, to acquire strategies to

help them in content areas such as science (Lee, 2005). Ideally, science instruction should provide a meaningful context for English language and literacy development with a particular focus on specific vocabulary concepts that will further enhance their vocabulary knowledge.

Review of the Effective Vocabulary Instruction Literature

The remainder of this chapter is a review of effective vocabulary instruction followed by research on two types of vocabulary strategies. First, a summary of a seminal meta-analysis is provided (Stahl & Fairbanks, 1986) and then a summary of the four recent major reviews of vocabulary intervention studies with general education students is provided (Baumann & Kame'enui, 2003; Blachowitz & Fisher, 2000; Hairell, 2011; Nagy & Scott, 2000). Second, three vocabulary literature reviews, that include students with RD, are discussed (Bryant et al., 2003; Elleman, Lindo, Morphy, & Compton, 2009; Jitendra et al., 2004). Third, the vocabulary literature that includes ELLs is summarized (August & Shanahan, 2006; 2010; Baker et al, 1995; Baker et al., 1998).

Vocabulary Instruction for General Education Students

A pivotal meta-analysis on vocabulary acquisition for general education students, conducted by Stahl and Fairbanks (1986), continues to be a cornerstone for current work on vocabulary instruction in the area vocabulary acquisition. A synopsis of this study provides a framework for better understanding of the five reviews on vocabulary acquisition. Stahl and Fairbank's (1986) meta-analysis examined the components of effective vocabulary instruction and investigated the effects of vocabulary instruction on text comprehension. The analysis included 24 studies conducted in 1983 to 1984. Each vocabulary instructional program was evaluated based on: (a) the degree to which the method emphasized the word's definition or its context, (b) the depth of processing (the number of exposures of words), and (c) the degree that

mnemonic devices were used. In addition, setting factors considered the amount of time allocated to instruction and whether instruction was conducted individually or in groups.

The major findings of the meta-analysis include the following: (a) vocabulary intervention had a small but significant effect on reading comprehension of passages not designed to contain the words taught; (b) "mixed" instructional methods (i.e., providing both definitional and contextual information during instruction) were more effective than those providing definitional only methods; (c) associative methods (i.e., associations between the word and its definition) produced better effects than comprehension methods (i.e., finding antonyms, synonyms, or clarifying words using the definitional information) or generation methods (i.e., producing novel responses to the word); (d) the use of keyword mnemonic devices produced average effect sizes on both contextual and definitional vocabulary measures; (e) the effects for group and individual instruction were very similar; and (f) longer duration of vocabulary instruction yielded greater gains in word knowledge. Results also indicated a mean effect size of .97 for vocabulary instruction on comprehension of passages that included the instructed words. A smaller effect size of .30 was identified for standardized measures of comprehension. Both effect sizes were significantly different than zero. Second, combined definitional and contextual instruction was identified as the most effective vocabulary instruction. This method of instruction allowed students to engage in deeper processing of the words due to multiple exposures to the words.

Vocabulary instruction for typical general education students has primarily focused on populations in third through ninth grades, with few studies conducted with secondary students. Nagy and Scott (2000) reviewed research studies that investigated vocabulary acquisition processes, or how children learn the meaning of new words and add them to their vocabularies.

The authors argued that in order to understand the learning processes for vocabulary growth, five complexities of word knowledge (i.e., incrementality, polysemy, multidimensionality, interrelatedness, multidimensionality, heterogeneity) must be recognized, beyond simply defining a word. The first aspect "incrementality" means that learning words takes place in several, generally guided or scaffolded, steps ranging from not knowing a word to recognizing it in context, to stating the word in a sentence. Incrementality research has studied the number of encounters a student has with a word before using it independently and competently. In fact, studies have found that vocabulary growth for students may occur after as few as four or as many as 40 encounters (Blachowitz & Fisher, 2006; Baumann & Kame'enui, 2003; Beck, McKeown, & Kucan, 2002; Blachowitz & Fisher, 2000; Nagy & Scott, 2000; Stahl & Fairbanks, 1986).

Second, the aspect of polysemy means that words have more than one meaning, and those meanings can be unrelated (e.g., stuffing as a verb or noun). The third aspect of the vocabulary learning process is multidimensionality, meaning that word knowledge consists of multiple dimensions, such as collocational (i.e., what other words does this word occur with?), stylistic register, and conceptual meanings. These multiple dimensions place different levels of processing demands on students (e.g., knowing the definition of a word and using it accurately in a sentence) and therefore require different instructional considerations. The fourth aspect, interrelatedness, means that words are connected; therefore, it is best to instruct words in related clusters. Thus, it is important to construct learning using familiar words and concepts. For example, research suggests that students will acquire the meanings of freezing more readily if they have already learned the words cold, hot, and warm.

Finally, the fifth aspect is heterogeneity: that each word may require different types of learning. For example, understanding the functions of basic words, such as *if* or *the,* is different

from learning complex terms such as *ethromycin, biology, or protozoa*. In addition, Nagy and Scott (2000) commented on metalinguistic demands of word learning, such as (e.g., word parts). Specifically, the authors contended that morphology should play a central role in vocabulary acquisition since nearly 60% of all new words students encounter are suitable for analysis into word parts that can provide substantial help in defining them.

To extend the literature on vocabulary learning processes reviewed by Nagy and Scott (2000), Blachowicz and Fisher (2000) reviewed effective vocabulary instruction. The authors concluded that four main principles should guide effective vocabulary instruction. Specifically, students should: (a) engage in active vocabulary activities (e.g., mapping strategies), (b) personalize word learning (e.g., learn how to generate mnemonic devices that have personal meaning), (c) access a range of reading materials in their instructional setting, and (d) use varied sources of information to learn words through multiple exposures (e.g., use and manipulate words in a variety of contexts through repetition). Blachowitz and Fisher also addressed vocabulary acquisition for students who struggle with learning, including ELLs. Instruction for these students should: (a) provide multiple ways for students to encounter new words. (b) provide clear auditory and/or visual imagery to facilitate memory, (c) make strong memory connections between the forms and meanings of new words, and (d) use the new words or word parts in multiple contexts. All of these components are associated with improved vocabulary acquisition leading to greater reading comprehension for secondary students (Kieffer & Lesaux, 2012).

Baumann and Kame'enui (2003) conducted a review primarily focused on evaluating research on reading vocabulary instruction and its relationship to text comprehension. Baumann and Kame'enui concluded the following: (a) general education students learn approximately

3,000 new words per academic year and they will know the meaning of approximately 40,000 words at the end of high school, (b) students encounter up to 10,000 different unknown words yearly, (c) students will learn as many as 1,500 words per year through incidental word learning if they read 25 min per day, and (d) the relationship between vocabulary knowledge and comprehension is very strong. Baumann and Kame'enui made several recommendations regarding vocabulary instruction: (a) teaching vocabulary that is explicit, engaging, and systematic will improve comprehension; (b) definition-only instruction is not likely to result in gains in comprehension; (c) secondary vocabulary instruction is not taught frequently or intensively; (d) keyword mnemonic approaches have been shown to be effective for learning specific word meanings; (e) semantic-related approaches (e.g., semantic mapping, semantic feature analysis) have been found to be effective for teaching new concepts and labels for them; (f) context clues can be effective for teaching students to infer the meaning of specific words if explicitly taught; (g) definitional information combined with contextual clues is a better method for defining word meanings than isolated contextual clues; and (h) both contextual analysis and morphemic analysis can be effective means for students to learn words independently.

Hairell et al. (2011) conducted a synthesis that examined 24 vocabulary intervention studies and their impact on approximately 5,347 (one sample size was not reported) second through eighth grade students' vocabulary knowledge and acquisition. This synthesis utilized the inclusion criteria from the NRP (2000) study since one goal of the study was to report empirical evidence of vocabulary strategy effectiveness since the NRP was published. The authors concluded that there were several effective strategies (e.g., contextual analysis, explicit instruction, multiple exposure, morphemic analysis, graphic organizers) for increasing vocabulary knowledge that are consistent with previous research. Most importantly, large effect

sizes indicated that students receiving intensive teacher-led vocabulary instruction with a mix of delivery features (e.g., multiple exposures, explicit instruction, supervised practice) and a mix of vocabulary learning strategies (e.g., contextual and morphemic analysis, graphic organizers) outperformed those who did not have these common vocabulary instructional elements, consistent with previous literature. The authors concluded that research informing vocabulary instructional practice in content areas (e.g., science, social studies, mathematics), focus on the intensity (e.g., time and duration) of vocabulary instruction, and that maintenance of skills is a gap in the current vocabulary literature. Similar to the NRP (2000) report, Hairell (2011) and Baumann and Kame'enui (2003) identified the importance of interventions that explicitly teaching vocabulary for improved reading outcomes. Finally, Hairell and the NRP (2000) reviews both recommended the use of contextual analysis and morphemic analysis strategies since these interventions helped students acquire vocabulary and improve reading comprehension.

Vocabulary Instruction for Students with RD

Research on vocabulary acquisition and instruction has comprised students with RD in early elementary grades through grade 12. However, few of the studies included with secondary students.

In an early literature review of the effects of vocabulary interventions for students with RD, Bryant et al. (2003) examined six intervention studies conducted from 1978 to 2003. Four categories of vocabulary interventions emerged based on the review of the studies, including computer-assisted instruction, fluency-building practices, mnemonic strategy instruction, and concept enhancement instruction. Of the six studies, three focused on mnemonic strategy instruction. All six interventions focused on non-generative techniques for learning vocabulary

words. The instructional time ranged from 10-50 min lessons across 1 to as many as 15 days, and a range of 10 to 50 words were taught in each study. The results suggested that the use of targeted vocabulary interventions for students with RD produced more generalization and were more effective than the use of traditional interventions (e.g., dictionary usage, definition-only). None of the studies included generative word learning strategies, such as contextual analysis and morphemic analysis. Further, in the majority of studies instruction took place for a short duration of time.

In another review of the vocabulary interventions conducted with students with RD, Jitendra et al. (2004) identified 19 studies spanning the years 1978 to 2002. The following intervention studies were reviewed: mnemonic approaches, cognitive strategy instruction, direct instruction, constant time delay, activity-based methods, and computer-assisted instruction. The studies were evaluated with respect to intervention duration (intensity) and instructional approach employed. The authors reported that the instruction ranged from 1 to 11 sessions, and from 2 to 50 min sessions, spanning approximately 6 weeks. Additionally, a large majority of the vocabulary approaches incorporated direct and explicit instruction. Some of the studies did not report the number of target words; however, most of the interventions included a range of 10 to 50 words. The authors found that students with RD can learn word meanings if they are taught using a variety of methods, including mnemonic and conceptual approaches. Similar to the studies in Bryant et al. review, the investigations reviewed by Jitendra and colleagues did not include interventions using generative vocabulary strategies.

In a recent literature review that extended Stahl and Fairbank's (1986) meta-analysis, Elleman, Lindo, Morphy, and Compton (2009) conducted a meta-analysis of 37 vocabulary intervention studies that included 3,063 pre-K to grade 12 general education students. Effect size

calculations included studies published between 1950 -2006. Unlike Stahl and Fairbank's (1986) meta-analysis, Elleman and colleagues incorporated a moderated analysis that included students with RD and those with varying abilities. Most of the vocabulary studies, conducted in 10 or fewer hours, included both standardized and customized vocabulary measures. Results showed largest effects (e.g., -0.11 to 2.28) for customized measures compared to those obtained from standardized measures, consistent with previous research. Further, standardized vocabulary measures indicated some improvement in vocabulary knowledge.

When considering student characteristics, grade level correlated positively with effect size and reading status was significantly correlated. In addition, students with RD benefitted more from vocabulary instruction on comprehension outcomes than students who were not at risk for RD. The effect of grade level was not significant; however, and half of the vocabulary intervention studies were conducted with students in Grades 3-5. When considering only customized measures and controlling for method variables, students at risk for RD (d = 1.23) benefitted over than three times more than students without RD (d = 0.39) on comprehension measures. However, students at risk and not at risk for RD both made comparable gains on vocabulary measures across reading ability. The authors discussed that custom measures could detect vocabulary growth but lack evidence for their reliability and validity.

The results from Bryant et al (2003), Jitendra et al. (2004), and Elleman et al. (2009) support the positive benefits of non-generative instructional approaches for vocabulary learning for students with RD. However, vocabulary instruction in mnemonic approaches, conceptual methods, and traditional approaches (e.g., dictionary usage, synonyms) focuses on a limited set of targeted words. These approaches do not allow students to generate knowledge about using words they may not recognize. Since the Elleman et al. (2009) literature review, only two

published studies have been conducted with students with RD (Fishley, Konrad, & Hessler, 2012; Harris, Schumacher, & Deshler, 2011), and both focused on word-learning strategies, reviewed in the morphemic analysis section of this chapter.

Baker and colleagues (1995) conducted a research synthesis to identify critical areas for daily vocabulary instruction. In their examination of 16 primary and seven secondary studies that include ELLs, students with RD, culturally diverse students, and high reading performers, Baker and colleagues identified five themes that addressed: (a) vocabulary size differences between students, (b) theoretical framework accounting for the vocabulary differences, (c) methods to improve the vocabularies of students with diverse learning needs, and (d) the relationship between vocabulary knowledge and reading achievement. Six major convergence areas were that: (a) vocabulary differences between students are extensive; (b) students need to be taught with a variety of strategies to learn word meanings; (c) instructional procedures to teach word knowledge must match the goals for depth of word knowledge; (d) critical factors of generalized linguistic deficiencies, memory deficits, and poor word learning strategies contribute to individual differences in student growth; (e) students should be taught both intentionally and incidentally; and (f) students need to develop strong beginning reading skills in order to engage successfully in the volume of reading required for them to learn large numbers of word meanings through connected text. Baker et al. acknowledged that there is not one single best method of vocabulary instruction identified within the literature.

Based on the recommendations in their earlier synthesis, Baker, Simmons, and Kame-enui (1998) identified five areas of importance that should frame comprehensive vocabulary programs for diverse learners, including ELLs. Specifically, they described the following five principles of instructional design to help students become independent word learners: (a)

conspicuous strategies, (b) strategic integration, (c) mediated scaffolding, (d) priming background knowledge, and (e) judicious review. Further, the authors identified vocabulary instructional approaches that apply the principles of instructional design to ensure students have several word learning opportunities. Baker et al. noted that, considering the complexity of vocabulary knowledge, flexibility must exist between instructional goals and techniques. Both Baker et al. (1995) and Baker et al. (1998) acknowledged the need for effective vocabulary interventions for diverse learners such as ELLS and those with disabilities. Further, these authors recognized the need to use explicit strategy instructional components with diverse students.

Vocabulary Instruction Research for ELLs

Research on vocabulary acquisition and instruction for ELLs has been conducted with students in the early elementary grades through grade 12. Two reviews identified instruction for diverse students, including ELLs. In 2006 and 2010, Shanahan, August, and colleagues provided an overview of literacy for ELL students, including an analysis of the vocabulary instruction. Several studies happened in resource rooms or other settings outside of the general education classroom. Additional studies comprised of ELLs and students with RD appeared in the literature since 2004 but were not included in the August et al. and Shanahan et al. reviews.

In a recent review of ELLs' literacy research, the National Literacy Panel on Language-Minority Children and Youth (August & Shanahan, 2006) reported the findings from a comprehensive review of the state of literacy outcomes for ELLs and Language-Minority youth, ages 3-18. An additional purpose of the report was to provide research-based information for schools on how to best facilitate English learning. Only three studies investigated vocabulary with ELLs, and those were conducted with elementary students in first through fifth grades. No

studies were identified that were conducted with secondary ELL students or ELLs with RD. The three studies yielded findings consistent with those of vocabulary studies of native speakers (Vaughn-Shavuo, 1990; Perez, 1981; Carlo et al., 2004).

In 2010, August and Shanahan updated the 2006 review on literacy outcomes for ELLs. The authors identified 20 additional experimental and quasi-experimental publications that appeared in peer-reviewed journals that measured six types of vocabulary outcomes. Three experimental studies were conducted with secondary ELLs (Lesaux & Kieffer, 2012; Proctor, Dalton, Uccelli, Biancarosa, Mo, Snow, & Neugebauer, 2011; Vaughn, Martinez, Linan-Thompson, Reutebach, Carlson, & Francis, 2009). A fourth study conducted with ELLs with RD was recently published (Helman et al., 2015). However, three of the studies were conducted with sixth and seventh grade ELLs. Similar to previous reviews, the same principles of systematic and explicit phonological-based interventions used with general education students also appear to benefit ELLs' literacy development.

In summary, most effective vocabulary instruction research has been conducted with general education students, and many vocabulary instruction methods have been found to be effective with students with RD and ELLs. However, ELLs and students with RD need very explicit, systematic instruction to teach them strategies that assist them in learning vocabulary. Most of the vocabulary instruction research has been conducted with elementary students, and there is a need for vocabulary intervention investigations with secondary students. Currently, only one known study investigated vocabulary acquisition with secondary ELLs with RD (Helman, Calhoon, & Kern, 2015).

Non-Generative and Generative Vocabulary Strategies

Non-generative vocabulary strategies. Non-generative vocabulary strategies help students write and memorize one definition of the word. However, non-generative strategies do not help students become independent word learners by teaching strategies to analyze words and word parts in order to learn more words, especially during incidental reading of content area texts. Non-generative strategies include: (a) definition approach strategy, (b) keyword mnemonic instruction, (c), semantic feature analysis, and (d) semantic mapping.

***Definition approach strategy*.** Definition instruction consists of students writing down definitions from the dictionary and/or learning one meaning of the target word. Students are taught the definition for each target word by stating its definition several times. A large number of studies have investigated the use of the definition method with general education students and students with RD (Barrett and Graves, 1981; Beck et al., 1982; McKeown et al., 1983, 1985; Leong et al., 1990). Although research has found that direct instruction of words can be generally beneficial for general education students (Nagy & Anderson, 1984; Smith, 1941), students with RD have difficulty memorizing the word and generalizing what they learned about the word (Nash and Snowling, 2006). Further, teaching students every word individually is impossible, because the amount of instructional time needed to teach thousands of words would exceed the academic calendar. Additionally, since many novel words are complex and have more than one meaning, students with RD, may not benefit from using the definition approach strategy exclusively (Beck & McKeown, 2002; Nagy & Stahl, 2000; Nagy & Stahl, 2006; Graves, 2006)

***Keyword method*.** The keyword method (Atkinson, 1975) involves forming a linkage between a to-be-learned vocabulary word (i.e., keyword) and a familiar English word that sounds similar to the keyword (Pressley, Levin, & Miller, 1981). Research over the past two decades

has indicated that the keyword method can substantially improve memory for new vocabulary and other content area information with general education students and students with RD (Mastroprieri, Spencer, Scruggs, & Talbott, 2000). The keyword method typically involves mnemonics, or the use of pictures to help a student link new words with previously taught words (Terrill, Scruggs, & Mastroprieri, 2004). Although evidence suggests the strategy is effective and versatile (Levin, 1983; Miller, Berry, & Pressley, 1982; Pressley, Levin, & Miller, 1981), one limitation is that although students associate words, they do not always remember the whole definition. Second, the keyword method does not help students learn or generate several new words as a result of learning the one word (Harris et al., 2011). Therefore, this strategy will not be as beneficial for students who have a significantly smaller vocabulary compared to their typical peers.

Semantic feature analysis. Semantic feature analysis focuses on the ways to categorize words based on characteristics of likeness (e.g., how words are the same and different) and relates meanings to prior knowledge (Pearson & Johnson, 1978). Specifically, semantic feature analysis is a strategy predicated on the hypothesis that learning and memory are based on linking new pieces of information to previously known categories of information (Jitendra et al., 2004). The general instructional sequence of semantic feature analysis is to select a topic, list some words related to the topic on the grid, and list features shared by some of the words in each column. After discussing the features of the words, pluses and minuses are placed in the grid to indicate whether each word listed in the column shares each of the features listed along the top. One critical component of semantic feature analysis is the relation of vocabulary to major concepts, resulting in increased word knowledge and improved reading comprehension (Anders, Bos, & Filip, 1984). In addition, semantic feature analysis techniques were effectively used to

improve vocabulary with general education students, students with RD, and have been recommended for use with ELLs (Anders, Bos, & Filip, 1984; Bos, Filip, & Jaffe, 1985; Ebbers & Denton, 2008; Pearson & Johnson, 1978). Although there is evidence for using semantic feature analysis to improve student's vocabulary, especially their understanding of the linkage between words, semantic feature analysis does not help students analyze novel words or equip students to become independent word learners. In addition, although this strategy helps students identify similarities and differences between words or words within a group, generalization has not been demonstrated (Harris et al., 2011).

Semantic mapping. Semantic mapping is a strategy that uses categorical structuring of information in a graphic form and is an individualized content approach in that it helps students relate new words to their own experiences and prior knowledge (Pearson & Johnson, 1978; Johnson and Pearson, 1984; Johnson, Pittelman, & Heimlich, 1986). Semantic mapping provides information about what the student knows and reveals anchor points for new concepts to be related to the vocabulary word. The general instructional sequence is: (a) selecting a word, (b) writing the word on the board, (c) asking the class to think of words related to the target word, and (d) numbering the categories that the students name. Students discuss the words they brainstorm during the semantic mapping process. The procedure of mapping a topic provides students with a method to activate and enhance their knowledge base regarding content topics (Johnson et al., 1986). The use of semantic mapping strategies have been evaluated with general education students and students with RD (Johnson & Pearson, 1984; Pearson and Johnson, 1978; Pearson & Spiro, 1982; Sinatra, Stahl-Gemake, & Berg, 1984) and have been suggested for use with ELLs (Ebbers & Denton, 2008).). Similar to the other non-generative strategies, semantic

mapping helps students categorize the words, but may not be helpful in assisting the reader to identify words in print that have similar meanings (Harris et al., 2011).

Although non-generative strategies are effective in helping students learn the meaning of targeted vocabulary words, students only learn one word at a time, rather than learning strategies to help them access the meaning of several word meanings. For example, students may use a memory device for remembering the meaning of the word, but this association does not generalize to learning the meaning of several new words. In contrast, generative strategies not only teach students the meaning of a given word, but also allow them to unlock the meaning of new related words. Generative approaches provide the kind of vocabulary instruction that ELLs with RD need to learn the meaning of thousands of words (Ebbers & Denton, 2008; Graves, Kieffer & Lesaux, 2008; Kieffer & Lesaux, 2010).

Generative vocabulary strategies. Generative vocabulary strategies help students become independent word learners by teaching them how to use structural analysis, or strategies for analyzing word parts. Independent word learning strategies also teach students how to use context or identify clues around an unknown word that will help them define the word. Two word-learning strategies reviewed are: (a) contextual analysis, and (b) morphemic analysis.

***Contextual analysis strategies*.** Contextual analysis has the largest empirical base of all vocabulary strategies and is defined as the use of clues within the context of the text to derive word meanings (Baumann, Edwards, Boland, Olejnik, & Kame'enui, 2003; Baumann & Kame'enui, 2003; Edwards, Font, Baumann, & Boland, 2003; Fukkink & de Glopper, 1998; Harmon et al., 2005; Kuhn & Stahl, 1998; Nash & Snowling, 2006; Stahl & Fairbanks, 1986; Swanborn & de Glopper, 1999, 2002). Contextual analysis can occur incidentally or can be explicitly taught. However, research has shown that students, particularly those with RD, have

better vocabulary outcomes with explicit instruction (Carlo et al., 2004; Ebbers & Denton, 2008; Scott & Nagy, 2000; Kieffer & Lesaux, 2008). Explicit instruction involves instructing students to use semantic clues from context to identify synonyms, antonyms, syntax, and definitional examples that surround the unknown word (Fukkink & de Glopper, 1998).

Research has shown that deriving word meaning from written context is a very important source of vocabulary expansion for students at all ages (Fukkink, Blok, & de Glopper, 2001). Historically, various instructional techniques and strategies were investigated to help students determine word meaning from written context (Peterson, 1943), including clue instruction followed by context clue classifications (Artley, 1943). This type of instruction helps students learn to recognize and use clue types (e.g., synonym and antonym clues). Several decades later, research in contextual clues emerged in the form of cloze tests as an instructional strategy. Students were provided texts that contained blank spaces with specific words omitted, drawing students' attention to the context. In the 1980's, contextual clue strategies were not researched as frequently due to a growing awareness that contextual clues within sentences either supported students in deriving unknown word meanings or were not helpful depending on the complexity of the surrounding words (Carnine, Kame'enui, & Coyle, 1984). Therefore, researchers began to provide a general strategic approach that taught students to search for clues in the context, think of a meaning for unfamiliar words, and check to see if the answer made sense.

In the late 1990's and early 2000s, only a few reviews assessed the instructional effects of the skill of determining word meaning from written context (Fukkink & De Glopper, 1998; Kuhn & Stahl, 1998). In 2000, the NRP (2000) identified the importance of contextual analysis, but also asserted that research in the types of contextual analysis strategies that are most effective are

in a "state of infancy" (p.29). The panel specifically mentioned the importance of contextual analysis since students learn words incidentally through reading.

Studies that have investigated the role that contextual analysis plays in word learning have mainly focused on incidental word learning from written context where students read a short passage and have to define the word orally (Fukkink, 2001; 2005). Some studies have mentioned that teaching contextual analysis should be used with caution since there are different types of contexts and some contexts may be more challenging than others (McKeown, 1985). However, many researchers have argued that if contextual analysis strategies are explicitly taught to students using appropriate contexts, they were able to generalize what they have learned (Stahl & Fairbanks, 1986; Stahl & Nagy, 2006). Studies have found that explicit instruction of word meanings in context is more effective than instruction of word meanings without context (Stahl & Fairbanks, 1986; Nash & Snowling, 2006).

A large body of research supports teaching students to derive the meanings (or partial meanings) of new vocabulary items from written context (Carnine, Kame'enui, & Coyle, 1984; Jenkins, Matlock, & Slocum; McKeown, 1985; Nagy, Herman, & Anderson, 1987; Swanborn & de Glopper, 1999; Nagy & Scott, 2000). Although derivation of word meanings from context is considered an important means of vocabulary extension, there is little evidence about how elementary, intermediate, and secondary students learn to use the given text to find important information about a word's meaning. Additionally, it is unclear how they identify the relevant contextual clues to accurately infer the partial or whole meaning of new words to confirm the meanings of unfamiliar words. In past studies, students were 'taught' the strategy of inference from context by providing a simple rule or explanation of why context is useful, followed by practice in reading texts and defining words (Carnine et al., 1984). Other instructional programs

provided further details about the types of contextual clues that are available, such as definition, synonym, or antonym clues (Baumann, Font, Edwards, & Boland, 2002). Some programs taught different stages in the meaning derivation process, (e.g., substitution of a target word with a synonym, checking that the context supports the substitution and revising the idea if necessary (Jenkins et al, 1989). A meta-analysis of these different interventions found that simple rule instruction regarding context was more effective compared to more detailed context instruction (Fukkink & de Glopper, 1998).

The ability to learn word meanings from written context can be mediated by three classes of factors: word factors, contextual factors, and individual differences in learners (Fukkink & de Glopper, 2002; Fukkink, 2005; Nash & Snowling, 2006). Word factors include individual words that vary widely in their semantic (e.g., concreteness) and syntax (e.g. part of speech) properties, and some of these factors are likely to affect learning. Word factors may continue to be relevant for learning from written contexts. Text factors include the features of the context that involves the placement of the word. The type of context can range from being supportive, in varying degrees, to being misleading (Beck et al, 1983; Beck, Kucan, & McKeown, 2002). The third mediating factor is individual differences. Reading ability has been shown to be a contributing factor in learning from context (Cain, Oakhill, & Lemmon, 2004; Jenkins et al., 1984; McKeown, 1985). Students with poorer reading skills need explicit instruction in contextual analysis strategy instruction in comparison to their general education peers.

Review of the contextual analysis literature. An in-depth search of the research literature over the past 50 years was conducted to determine the existing knowledge base on descriptive and experimental vocabulary studies that included contextual analysis strategies. The following web-based databases were searched: Education Resources Information Center (ERIC),

PsycINFO, JStor, Council for Exceptional Children (CEC), EBSCOHOST, using these key words: *contextual analysis, context, contextual clues, contextual cues, vocabulary learning, incidental word learning, word learning strategies, generative vocabulary strategies, secondary students, ELLs, ELLs with RD, students with RD, students with learning disabilities, vocabulary instruction, vocabulary acquisition.*. The descriptive studies that were selected for review met the following criteria: (a) the study included students who were in grades K through 12, (b) the study examined the effects of contextual analysis interventions on students' word learning and/or vocabulary performance, and (c) the study used an experimental design or quasi-experimental design with experimental control or alternative treatment condition.

In one of the most well-known meta-analyses, Kuhn and Stahl (1998) examined the literature on using contextual analysis strategies to help students derive word meanings. Kuhn and Stahl (1998) examined 14 studies to improve words students were learning from context, through instruction on using context clues, or instruction on a more general process of learning words from context. The authors grouped the results of each study by type of measure and examined commonalities among studies. Ten of the 13 studies included a control group and measured children's ability to derive word meanings from context.

Findings across these 10 studies showed that students explicitly taught to use context to derive word meanings generally do better on measures that assess that skill. In the studies that included experimental and control groups, the students in both conditions did not differ significantly on the outcome measure, suggesting that practice in deriving words, rather than the strategies, may make a difference in vocabulary development. However, results should be interpreted cautiously due to the paucity of research evidence that uses explicit instruction to teach contextual analysis. In addition, research that assessed the effects of explicitly teaching

students to use context is in its infancy (NRP, 2000; Kieffer & Lesaux, 2012). Kuhn and Stahl asserted contextual analysis is a general strategy aimed at helping students contend with unfamiliar words in a wide variety of texts. Studies show that students use context strategies to learn words incidentally during daily reading of expository text in intermediate and secondary grades. However, research conducted with students with RD (although limited) has demonstrated the need for more explicit strategy instruction, without which they will learn far fewer words incidentally compared to their peers (Bauman et al., 2003; Nagy & Scott, 2006).

In a meta-analysis of 20 experiments that investigated word learning during reading, Swanborn and de Glopper (1999) found that students incidentally learned approximately 15% of words that they encountered. Participants were 2,130 students assigned to experimental and control groups. To account for possible differences in outcomes, studies were coded in four categories: study conditions, subject factors, assessment factors, and material-related factors. Study conditions were composed of pretest sensitization, time interval between pretesting and reading, and time interval between reading and posttest. An exploratory multi-level analysis to identify the source of variability in the results suggested that several factors affect the probability of learning an unknown word although reading: pretest sensitization, students' grade level, students' level of reading ability, the sensitivity of assessment methods to partial knowledge, and the amount of text surrounding the target words.

Results indicated that incidental word learning during natural reading takes place and explained a large part of the variation in outcomes between studies. The mean effect size of logit (p) = -1.70, derived from probability estimates, indicated that students learn around 15% of the unknown words they encounter. A combined model examining predictors showed that students' grade level and partial word knowledge predicted 66% of variance in the effect size.

Unfortunately, most of the published studies in both reviews included students in elementary school. Further, students with reading difficulties read fewer words incidentally compared to their peers without reading difficulties, indicating that students with reading difficulties need more specific vocabulary interventions to improve their outcomes.

Based on the literature, incidental vocabulary strategies to learn vocabulary are more effective for general education students than for students with RD because poor readers continue to struggle with complex texts and read less although better readers read more and have strategies to figure out unknown word meanings. Therefore, students with RD, particularly ELLs with RD, need explicit and systematic instruction in contextual analysis strategies to improve their vocabulary acquisition (Ebbers & Denton, 2008; Scott & Nagy, 2006; Kieffer & Lesaux, 2012). A generative vocabulary strategy, such as contextual analysis, can help identify contextual clues surrounding unknown vocabulary to help them figure out word meaning. Thus, teaching students contextual analysis skills helps them derive word meanings from text.

Contextual Analysis Experimental Studies

Over the past two decades, three experimental studies have demonstrated the effectiveness of using contextual analysis with students. Most of the studies found that students were able to define unknown words when contextual clues were closer to the word rather than far away from the unknown word in a sentence or short passage. In an experimental study on the effects of context, Swanborn and De Glopper (1999) examined how reading texts for different purposes affected incidental word learning for 223 sixth grade students from nine elementary schools. Students were randomly assigned to one of four conditions where students read for different purposes. In the first condition, students were asked to do free reading, students in the second condition were asked to learn as much of the topic of the text as possible, students in the

third condition were asked to read for text comprehension, and the fourth group served as a control and read text with no specific reading purpose. The control group did not encounter the target words during the reading tasks to control for existing knowledge of the target words. The experimental group members had use of an informative text to provide a synonym, to give a correct definition, or to use the target word in a meaningful sentence if they could not define the target word. Fifteen target words were presented in isolation, with two blank lines for each word where the student could write the definition. Each of the participants' answers on the definition task received a score ranging from 0 to 3 to allow for partial word knowledge. The students were labeled as low-ability, average ability, and high-ability readers according to their scores on a standardized reading comprehension test. These categories were used to examine the interaction of reading ability, reading purpose, and incidental word learning from context.

Results indicated that proportions of words learned incidentally ranged from .06 for free reading to .08 when reading for text comprehension to .10 when reading to learn about the topic. Reading ability was a significant factor in all conditions, as low-ability readers defined three of every100 unknown words, average ability readers defined up to 15 of every 100 unknown words, although high-ability readers defined up to 27 of every 100 unknown words when reading for text comprehension.

Nash and Snowling (2006) investigated the effects of using two different methods, the definition method and contextual analysis, to improve vocabulary knowledge and reading comprehension. Twenty-four children (aged 7-8) with poor vocabulary knowledge participated in the study. Students were ranked for ability and gender, and then were assigned to the definition group or to the context group. Twelve students were taught new vocabulary items using definitions; the other 12 students were taught a strategy for deriving meanings from written

context. Two words were taught per lesson, one noun and one verb, for a total of 24 words. The order of the noun and verb was reversed in every other lesson. Each program involved two 30-min sessions a week for duration of 6 weeks.

In the definition group, simplified dictionary definitions were taught. In the context group, students were given a short passage containing a few sentences created for each word. Each passage contained four or five descriptive cues to the word's meaning and key to the word's concept. The position of the word in the passage varied (e.g., first word in the sentence, in the middle of the sentence, at the end of the sentence). The procedures were that the whole group read the word aloud, each student read it individually, and then the group read it again. The experimenter circled the new word with a red pen on a large tablet then read the word aloud a fourth time and reminded the children that they were looking for clue words that would help them work out the meaning of the new word. The group read all of the clue words aloud that were found.

Results indicated that when tested immediately after teaching, the two groups demonstrated equivalent increases in vocabulary knowledge of the taught words, but three months following intervention the context group demonstrated significantly better expressive vocabulary knowledge, particularly with nouns. On the transfer test, the context group was able to express significantly more derived meanings at post-test. The results suggested that the context method was a more effective intervention than the definition method. Further, contextual analysis was effective in increasing vocabulary knowledge and improving reading comprehension in the students with poor vocabulary knowledge. One potential limitation was that the experimenter taught both programs and there could be potential experimenter bias. In

addition, there was an absence of an untreated control group and a small sample size limited statistical power.

In a recent experimental study examining contextual analysis strategies, Cain (2007) investigated whether explanation facilitates children's ability to derive the meanings of words from external clues in written contexts. Forty-five children (ages 7-8 years) were participants. Children were grouped in triples with reading ability scores matched as closely as possible. Each member of a triple was assigned to a different treatment condition including the feedback-only condition (FO), the feedback and explanation of his/her own reasoning (FOR) condition, or the feedback plus explanation of experimenter's reasoning (FER) condition. Sixteen stories, each with a novel word, were adapted from a set of materials developed from two previous studies and contained contextual clues to help students infer the definition of the target word. Each child was presented with the same stories in each session in a fixed order. At the beginning of the first session, the experimenter read aloud the instructions. At the end of each story, children were asked to explain the meaning of the novel word (e.g., 'what do you think bop means?').

Children in the FO group were given feedback on their response (whether it was correct or incorrect) but were not asked to explain their interpretation of the novel word. Children in the FOR group were asked to explain their interpretation of the novel word before receiving feedback on their response. The children in the FER group were given feedback on their response first. Whether or not their initial response was correct, they were asked to explain the experimenter's reasoning. Students earned one point if the definition was partially correct (e.g., "a fence") and two points if the definition was wholly correct (e.g., 'a gap in the '*fence*''). Other definitions were classified as story related (e.g., "another bull in the field"), a similar sounding word (e.g., 'boat' or 'rope'), or a definition that was not related to the story content and was not a

similar sounding word (e.g., “saddle”) not defined, (e.g., “don’t know”). The explanations provided by the FOR and FER groups during Sessions 1-3 were categorized regardless of whether the actual response was correct.

Results indicated that the children with the greatest gains used the explanation technique in their own (usually incorrect) definition or the experimenter’s definition, although all three groups of students generally improved in their quality of their word definitions. Groups who provided explanations were more accurate in their use of story content to generate word definitions. Qualitative analysis of the word definitions revealed that all groups were more likely to consider the text as a source of information to derive word meanings by the end of the intervention phase. Additionally, analysis of the explanations revealed that groups who explained their own definition appeared to have greater insight into the derivation of the word meanings compared to the group in that the experimenter explained the answer. The Cain (2007) study also suggested that practice and/or feedback could facilitate skilled use of context for students.

In summary, contextual analysis strategies have been used effectively with general education students, students with RD, and ELLs. However, students who are less skilled in overall reading benefit from explicit and systematic contextual analysis strategy instruction. Although ELLs are behind typical peers due acquiring the English language and vocabulary, ELLs with RD also have major deficits in phonological processing, word recognition, working memory, and comprehension (Shore & Sabantini, 2009). Thus, the vocabulary gap for ELLs with RD is greater than for ELLs due to these deficits. In order to minimize the vocabulary gap, explicit and systematic vocabulary instruction in contextual analysis strategies will help these students acquire words at a greater rate is needed (Fitzgerald, 1995; Kieffer & Lesaux, 2012).

Research has found that contextual analysis strategies are beneficial for ELLs (Carlo et al., 2004; Proctor et al., 2005; August & Shanahan, 2013) and this strategy is recommended with ELLs with RD. Unfortunately, few studies included secondary students, students with RD, and ELLs. Although contextual analysis is promising for ELLs, further investigations of contextual analysis vocabulary strategies with secondary ELLs with RD are necessary. In addition, several researchers have suggested combining contextual analysis strategies and morphemic analysis strategies to help students become word learners who can effectively analyze and partially or wholly define unknown words. The combined use of contextual analysis and morphemic analysis strategies needs further investigation.

Morphemic analysis. A second type of generative strategy, stemming from morphology, is morphemic analysis. Morphology is the conventional system in which the smallest units of meaning, called morphemes (bases, prefixes, and suffixes), combine to form complex words. For example, the word *immortal* has three morphemes, represented *orally*, */im/ + /mort/* + /əl/. Morphological knowledge has the potential to affect literacy skills in at least three ways, through word recognition, comprehension, and motivation (Bowers et al., 2010).

According to Spencer (2001), there are two main types of morphological operations: inflectional and derivational. Inflectional morphology is described as one free morpheme and one suffix denoting the conjugation of the base (e.g., students, reading). Inflectional morphology involves adding suffixes to change the base word's class, number, gender, person, or tense. For example, the base word cat can be made plural by adding –s, making it cats, the base word skip becomes skips, skipped, or skipping by adding –s, -ed, or –ing. The basic meaning of the word has not been changed. Derivational morphology is the system by that affixes change the part of speech or meaning of a word (e.g., adding the suffix-*ical* to the noun *category* to change it into

the adjective *categorical*). Derivational morphological knowledge is very powerful for adolescent students' reading comprehension (Kieffer & Box, 2013).

Derivational morphology words have at least one root (free or bound) and one or more affixes (prefix and/or suffix) that can change the meaning and/or part of speech of the word (e.g., disability, fluently). Words composed of derivational prefixes and suffixes are challenging for all populations of students, including students with and without disabilities and those acquiring a second language acquisition. This is partly due to the great number of words that occur with low frequency (Reed, 2008).

One major aspect of morphology is morphemic analysis. The NRP (2000) specifically noted the importance of teaching morphemic awareness (i.e., knowledge of prefixes, root words, suffixes) to assist students deriving the meanings of new words. Morphemic analysis is the process of decomposing, or breaking a complex word into its meaningful parts, or morphemes. Words can contain two, three, or more morphemes that are formed by combining free and bound morphemes. Bound morphemes are morphemes that cannot stand alone as an English word (Ebbers, 2011). For example, the Latin root *spect*, that means *to see*, is a bound morpheme because it needs to be bound by an affix (e.g., prefix and/or suffix) to form a word, such as the prefix *'in'* that forms the word *inspect.*

Free morphemes do not need a prefix or suffix attached to form an English word (Ebbers & Denton, 2008). For example, the word *biosphere* contains the base word *sphere*. The base word *sphere* can stand alone without the prefix *bio*. Learning ancient Greek and Latin roots is critical because approximately half of academic vocabulary is derived from these languages (Nation, 1990). Further, in the area of science, up to 30 words may be formed from a single prefix (e.g., hydro) (Graves, 2006; Nation; 1990; Stahl & Nagy, 2006; White, Power, & White,

1989). By revealing morphemic families of words, students can process language more efficiently (Carlisle & Katz, 2006). In fact, when students receive adequate explicit instruction in Latin roots, they will continue to increase their knowledge of words significantly between grade seven and college (Nagy & Scott, 1990).

Three recent literature reviews investigated the effectiveness of morphemic awareness interventions on reading, phonological awareness, reading comprehension, spelling, and vocabulary (Bowers, Kirby, & Deacon, 2010; Goodwin & Ahn, 2010; Reed, 2008). In the only quantitative synthesis, Reed (2008) investigated morphemic intervention studies conducted in English between 1986 and 2006 with students from kindergarten through 12th grade. A small sample of seven studies met the specified inclusion criteria. The seven studies included three that focused on word identification, three that focused on vocabulary, and one that investigated spelling. Reed reported a wide range of effect sizes and concluded that stronger effects were associated with instruction that focused on root (base) words compared to affixes (prefixes, suffixes) alone. Three studies specifically included low achieving readers (Abbott & Berninger, 1999; Vadasy, Sanders, & Payton, 2006). Reed reported that they showed medium effect sizes for improving reading and reading-related outcomes. These effects were larger than those for students in the other intervention studies. Reed suggested that these results indicate that learners with reading challenges need explicit instruction in morphemic awareness and learn better in small group settings. Reed also recommended that morphemic vocabulary instruction should include explicit systematic instruction of word roots.

Recently, Bowers, Kirby, and Deacon (2010) expanded on the literacy outcomes investigated in Reed (2008) and conducted a review of the literature to investigate the effects of explicit morphological instruction. They coded for the following factors: (a) reading, spelling,

vocabulary, and morphological skills; (b) less able readers versus undifferentiated samples; (c) younger versus older students; and (d) combinations of instruction with other literacy skills or explicit morphological instruction in isolation. This meta-analysis included 22 peer-reviewed studies with 2,652 participants in preschool through Grade 8. Studies reported literacy outcome measures, used with either an experimental control or comparison group with pre- and post-test measures, assessed instruction that focused on morphology at least one third of the time, and investigated instruction of morphemic elements (e.g., prefixes, suffixes, bases or roots, compounds, derivations, and inflections). Further, the authors included studies that were conducted in English and other languages (e.g., Danish, Dutch, and Norwegian).

Bowers et al. (2010) found that only eight out of the 22 studies included root instruction in comparison to the 14 studies that included affix (prefix, suffix) instruction. Effect sizes were small but favored students with reading challenges. Results suggested that: (a) morphemic instruction benefits learners, particularly learners with reading difficulties; (b) it is effective for younger and older students; and (c) morphemic analysis is more effective when combined with other literacy strategies. These findings were consistent with Reed's (2008) conclusions that morphological instruction had higher effect sizes for the group of less skilled readers. The limitation of both of these reviews is the small sample size across age and ability levels. In addition, most of the studies reported findings by whole classes rather than small groups, necessitating caution in the conclusions drawn about ability effects.

Goodwin and Ahn (2010) conducted a review of descriptive studies and intervention studies published in 1953-2009 that examined the effectiveness of morphemic analysis intervention on literacy achievement, with an emphasis on struggling learners, including students with reading disabilities, students who were at risk for reading disabilities, struggling readers,

and ELLs. The authors identified 17 independent studies and computed the overall mean effect size of morphemic intervention on literacy achievement. They further compared effect sizes across several areas of literacy outcomes including reading comprehension, decoding, fluency, morphological awareness, phonological awareness, phonological recoding, spelling, and vocabulary.

Of the 17 studies, only three focused on using morphological instruction to improve vocabulary outcomes (Tomesten & Arnouste, 1998; Harris, 2011; Katz & Carlisle, 2009). Morphological instruction showed a significant improvement on literacy achievement (d =0.33). The difference between overall mean change for treatment and control groups ranged from 0.24 to 0.49, demonstrating that the groups receiving morphemic instruction showed significantly larger improvements on reading outcomes (between a quarter of a standard deviation unit to a half of a standard deviation unit larger) compared to control groups. Results suggested that morphemic intervention can successfully improve reading, spelling, and vocabulary outcomes for struggling readers, students with speech and language disabilities, low achievers in reading, students performing below proficiency on standardized state tests, ELLs, and students at high risk for RD. These findings indicated that morphemic instruction should be included in remedial instruction for struggling learners, although it is not currently a major component of instruction for these students (Abbott & Berninger, 1999). Finally, morphemic analysis interventions improved vocabulary, that shows that direct instruction in units of meaning and words structure can help students determine the meaning of unfamiliar words.

Experimental Studies Using Morphemic Analysis

An in-depth search of the research literature was conducted to determine the existing knowledge base on descriptive and experimental vocabulary studies that have investigated

morphological analysis interventions with students. The following web-based databases were searched: Educational Resources Information Center (ERIC), PsychNET, Education Research Complete, JSTOR, WhatWorksClearinghouse using these key words: *adolescence, secondary students, high school students, learning disabilities, reading disabilities, students with disabilities, ELLs, ELLs with reading disabilities, ELLs with disabilities, second language vocabulary acquisition, morphemic word learning strategies, vocabulary instruction, vocabulary acquisition, vocabulary learning, morphological analysis, morphemic analysis, and, morphology*. This section of the review included some descriptive articles as well as intervention studies that met four criteria: (a) the student participants in K through 12, (b) the study examined the effects of morphemic analysis interventions on student vocabulary performance, (c) the study used experimental or quasi-experimental designs that included experimental control, and (d) the study was published between 1955 to 2013.

Four studies met the criteria for inclusion in the review, all implemented with students in grades 3 through 9. Three of these studies focused on the instruction of ancient Greek and Latin word roots (Otterman, 1955; Harris et al, 2011, Fishley, Condrad, Hessler, & Keesey) and one study focused on instruction of derivational and inflectional morphological parts (Long & Rule, 2004).

In one of the earliest studies of morphology, Otterman (1955) used a non-randomized control group design to test the effects of teaching prefixes and ancient Greek and Latin word roots to 440 students in 20 seventh-grade classes. Intact classes were selected based on the teachers' willingness to instruct two different classes of students, one experimental and one control group. Within each group, students were categorized as being either in a high or a low "mental age" group. Students in both groups were provided 30 lessons of instruction on 250

vocabulary words over a 6-week period. However, the experimental group received 10-min lessons daily of additional instruction in one prefix or one word root following their usual English class.

Results showed that only students in the high mental age group made significant gains on an assessment that measured interpretation of new words. Furthermore, students in the experimental group performed better compared to the students in the control group in their ability to recall learned prefix and word root meanings on a test provided 6 weeks following instruction. No differences were found between the groups on general knowledge on a standardized vocabulary test. The interpretations of this study should be made with caution because the experimental group received an additional 300 min of instruction compared to the control group, and no further statistics or quantitative data were provided.

In a more recent study, Long and Rule (2004) focused on ancient Greek and Latin root word families with 12 third graders assigned to one of two instructional conditions. A counterbalanced design was employed so that the students experienced both conditions in different orders. In one condition, the students received an intervention using 'object boxes' and word cards. The object boxes contained three-dimensional objects that illustrated the meaning of the words (e.g., provided pictures to give a visual depiction of the word), and the word cards gave the definition and part of speech for each word. During instruction, students learned that a root word family involves a root *ped*, its meaning *foot*, and words are derived from that root (e.g., *pedicure, biped, peddler*). In the other condition, the students wrote the meaning of the words on a worksheet with use of the dictionary. Pretest and posttest measures consisted of six words for each of the targeted word families. Students gained approximately 20 percentage points on the tests administered after each condition. Results showed that students' scores were

higher in the object box and word card condition compared to the worksheet condition, but statistically significant gains were not achieved due to the small sample of participants.

Harris, Schumaker, and Deshler (2011) conducted a study that examined the use of a graphic organizer to assist in analyzing morphemes with multisyllabic words with 239 ninth grade students, with and without RD. The participants were assigned to either a morphemic analysis condition or a vocabulary LINCing (e.g., List the parts, Identify a Reminding Word, Note a LINCing Story, Create a LINCing Picture, Self-Test) condition. Both groups received ten 45-min lessons that occurred in three phases. The three phases included an orientation to each strategy, the first vocabulary list, and then the second vocabulary list. Students were taught 20 academic vocabulary words during the intervention. The morphemic analysis group was taught a mnemonic strategy for identifying and defining word parts with use of a graphic organizer. Instruction was provided with use of a word mapping organizer. The teacher modeled and described the strategy to be used, the word mapping organizer was completed with the students, and the strategy was practiced using novel words. The vocabulary LINCing group was taught to write definitions, make connections between words, and create stories including the unknown word using graphic organizers.

Both groups made significant gains compared to a control group on the Word Knowledge test. Additionally, the morphemic analysis group made significant gains compared to the LINCing Vocabulary and control groups on a morphemic analysis test (i.e., writing word parts, writing word part meanings, predicting word meanings). One limitation of the study was the small number of students with disabilities in each group, hindering an understanding of the intervention's effectiveness for different types of students. In addition, no standardized tool was used to measure vocabulary knowledge and reading comprehension.

Using a single subject multiple probe across morpheme decks design, Fishley, Konrad, Hessler, and Keesey (2012) investigated the effectiveness of an intervention package called GO FASTER (Graphic Organizers Flashcards Added up and Self-graphed to Track progress, Errors Reviewed) with three female 10th, 11th, and 12th grade students (ages 15, 16, and 18). The authors investigated the ability of students with RD's to correctly state morpheme definitions in 30 s. Forty-five unknown morphemes were identified for each student and printed on flashcards. During baseline, students participated in their regular English classes where vocabulary instruction consisted of students looking up dictionary definitions and discussing words.

In each of the first three intervention sessions, the interventionist introduced five morphemes although the student recorded the target morpheme, its definition, two sample words containing the morpheme, definitions for the sample words, and a sentence that included the sample words on a graphic organizer. Following the completion of the graphic organizer, students read aloud the morpheme, its definition, both sample words, and the sample sentence. The interventionist then removed the organizer, pointed to the flashcard, and asked the student for the definition. The researcher then placed all five flashcards from the intervention session in front of the student in random order and asked the student to state the definition of each morpheme. Each instructional session ended with two 30-s presentations of all 45 flashcards. Maintenance data were collected similar to baseline. Students completed a pre-post generalization probe, consisting of 45 untaught words, each containing a morpheme targeted during intervention. Following a prompt to write, students spelled each word and then state its definition.

Results showed that within three to four instructional sessions, the students successfully defined morphemes at a predetermined fluency rate and generalized these definitions to untaught

words. Limitations of the study included the generalization measure of whole-word spelling that is not a likely outcome of generalization of the intervention. Second, the authors used an intervention package that included many elements; therefore, it is not possible to identify the specific components that contributed to the change in students' behavior.

Experimental Studies on Combined Contextual Analysis and Morphemic Analysis

Some experimental and single subject design studies, have combined contextual analysis (e.g., word clues) and morphemic analysis (analyze words parts (e.g., prefix, roots, suffixes) to help 4^{th}-10^{th} grade students generate the meaning of whole words (Bauman et al., 2002; Bauman et al., 2003; Carlo et al., 2004; Helman et al., (2015); Wysocki & Jenkins, 1987). A small number of studies were conducted with typically achieving students, students with LD, and ELLs. Only one study was conducted with ELL students with RD (Helman et al., 2015).

In one of the most widely cited morphological intervention studies, Wysocki and Jenkins (1987) investigated the effects of instruction of derivational suffixes using both contextual analysis and morphemic analysis strategies with 131 fourth, sixth, and eighth grade participants who served as their own controls. Using two sets of morphologically related words, students were taught one set during six 15-20 min sessions by training in the meaning of six target words that contained suffixes. Subsequently, the students were tested on the meaning of the target words plus the meaning of transfer words that contained the same root but had a different suffix. Transfer words were presented with two contexts on the test: one context involved sentences that provided clues so that the meaning of the words could be inferred. The other context involved sentences where the context did not provide any clue to the meaning of the word. Students were also tested on words that were not taught. Results indicated that students' success in deriving the meaning of unfamiliar words was affected by prior knowledge of words and by the strength of

the surrounding sentence context. Sixth and eighth grade students were more skilled than fourth-grade students were in using both context clues and morphemic clues. Students did not combine both contextual and morphemic clues to yield higher vocabulary scores than were obtained with either source alone. Since the intervention did not include a comparison condition, was of a brief duration (e.g., 15 to 20 min each over a course of 2 weeks), and only introduced students to six morphemically complex words, the results should be interpreted with caution. One important implication of the Wysocki and Jenkins (1987) study was that secondary students need explicit instruction in both contextual analysis and morphemic analysis when approaching an unknown word.

Using a quasi-experimental design, Baumann et al. (2002) explored instruction in morphemic analysis and contextual analysis. Five fifth grade classes, with 88 heterogeneously grouped students, were assigned to one of four instructional groups: morpheme-only, context-only, combined morpheme and context, or an instructed control group. Students were taught words in twelve 50-min lessons by the experimenters. The morpheme-only group was taught eight prefix families, the context-only group received lessons on nine categories of semantic context clues, and the morphemic-context groups received lessons on prefixes and nine context lessons. The instructed control group read, discussed, and responded to young-adult trade books. Students were tested on their ability to recall the meanings of the words that had been used to teach morphemic and contextual analysis skills, on the lesson words, and on their ability to infer the meanings of taught words that contained taught morphemic elements or were embedded within text that included context clues. Results indicated an immediate effect of morphemic and contextual analysis instruction and showed that knowledge for lesson words and novel words maintained over time. Finally, students in both the contextual analysis and morphemic analysis

groups were equally good at inferring word meanings when the morphemic and contextual analysis instruction occurred in combination as when the instruction was provided separately. Bauman et al. (2002) concluded that vocabulary instruction that incorporates morphemic analysis and contextual analysis can positively influence independent vocabulary word learning.

In a second study incorporating contextual analysis and morphemic analysis, Baumann et al. (2003) employed a quasi-experimental design with 157 fifth grade students in eight social studies classes. The investigators studied the students' ability to derive word meaning following instruction on a combination of morphemic and contextual analysis (MC) on social studies textbook vocabulary (TV) instruction. Students in both the MC and the TV groups were taught 25 lessons from the fifth-grade social studies curriculum that lasted approximately 45 min. The lessons for the groups differed in that the MC group received specific morphemic analysis instruction, were introduced to prefixes, and were taught to apply specific rules that integrated contextual and morphemic cues. Specifically, the students in the MC group were taught three vocabulary procedures to define an unknown word: a) students read sentences that contained the target word to identify contextual clues to support the word meaning; b) students separated a word into root word, prefix, and/or suffix to help derive its meaning; and c) students read and reread the word phrases that surrounded a word to determine its meaning.

The TV instruction differed from MC instruction in that students were directly taught content-central vocabulary selected from the textbook rather than being taught the two independent word learning strategies (e.g., contextual and morphemic analysis). The TV group used their textbook glossary and a published dictionary to find word meanings. Data were analyzed using a univariate ANCOVA model with the Degrees of Word Meaning researcher-constructed pretest serving as the covariate for all vocabulary and comprehension posttests and

content serving as the covariate for the two social studies posttests. Furthermore, data were also analyzed using a hierarchical linear model to test possible interaction effects between the student pretest scores, the instructional treatment, and classroom mean achievement scores.

No differences were found among the groups on the pretests. On the textbook vocabulary test, the TV group earned significantly higher scores compared the MC group. There were no statistically significant differences between the groups with regard to inferring a word's meaning. MC students were more successful at inferring the meanings of morphologically and contextually analyzed words on a delayed test two weeks after learning the words, but not on an immediate test. Still, results indicated a strong immediate effect of morphemic instruction on students' ability to decipher the meanings of transfer words that were not taught, with a less robust effect of context instruction on students' ability to infer the meanings of transfer words in context. One major limitation was that the two groups received instruction in two different sets of words, thus it is difficult to determine whether the morphemic analysis instruction or characteristics of the word sets produced the differences.

In one notable study investigating the effectiveness of using combined contextual and morphemic analysis strategies, Carlo et al. (2004) investigated ways to improve fifth grade ELL and non-ELL peers' academic vocabulary (N =254). The treatment group (ELL and non-ELL peers) received 30-45 min of explicit instruction on inferring the meaning of unknown words with using contextual analysis (two sessions per week) using morphemic analysis (two sessions per week) over a 15-week period. Students were taught context clue types during contextual analysis instruction (e.g., synonyms, antonyms, definitional examples) and cloze task procedures. During morphemic analysis instruction, students were taught word parts (e.g., prefixes, roots, suffixes) using word-building activities (e.g., word sorts, cards with word parts) to analyze

unknown words. Results indicated that ELLs scored lower on all pre- and post-test measures compared to their general education peers, yet intervention effects were large for these students. In addition, the intervention group demonstrated greater gains on depth of vocabulary knowledge; knowledge of taught words; understanding of multiple meanings; and on reading comprehension based on the measures of morphology, polysemy (more than one meaning for a word), reading comprehension, and word mastery. This was attributed to teaching procedures that included explicit instruction with context and morphemic analysis strategies.

In a smaller study, Katz and Carlisle (2009) examined contextual and morphemic analysis strategy instruction using a close reading program with three students with RD in 4th grade using single subject design. Students were taught morphemic analysis strategies during the first 8 weeks of instruction and were taught contextual analysis strategies during the last 4 weeks of instruction. During the first module of morphemic analysis lessons, students were taught etymology of easily definable prefixes and suffixes as well as etymology (e.g., ancient Greek and Latin roots) and dictionary use. The students also engaged in speed drills (e.g., underlining the prefixes and suffixes on words), word sorts (sorting words into categories based on structure and meaning), and word building (constructing complex words from prefixes, suffixes, and base words). During these lessons, students learned how to identify clues in passages that could help them analyze words in text. Students highlighted synonyms and definitions, antonyms and contrasts, and examples. Students were taught a systematic procedure called SLAP (Say the unknown word to yourself, Look for passage clues to the meaning of the word, Ask yourself what the word might mean, Put the definition in the passage to see if it makes sense) to use context to read and derive meaning from unfamiliar words. Students were assessed on standardized tests of reading and language skills.

Results indicated that the students made gains in their ability to define novel words and read them more efficiently using contextual analysis and morphemic analysis strategies. In addition, students typically were better able to read morphemically complex words on reading measures. However, Katz and Carlisle (2009) recommended further investigation of the effectiveness of integrated contextual and morphemic analysis instruction across other content areas. Together, these studies show the effectiveness of combined contextual and morphemic strategies to improve vocabulary and reading comprehension outcomes among ELLs and students with RD.

In the first vocabulary intervention study conducted with secondary ELLs with RD to date, Helman and colleagues (2015) employed a multiple baseline design across three 9th and 10th grade ELLs with RD. Specifically, Helman et al. investigated the effects of teaching an integrated contextual analysis and morphemic analysis strategy called the CLUEWORD strategy (CWS). All three ELLs with RD had a Level 3 or 4 English proficiency level score, and were reading at a fourth grade level. The investigator taught scripted pre-training and training lessons that included teacher-led practice, guided practice, and independent practice components. Students were individually taught six pre-training lessons in morphemic analysis and contextual analysis, at least three types of rules about context and morphemes, and were oriented to the CWS strategy steps and graphic organizer. Following the pre-training lessons, students were individually taught CWS (range 3-6) lessons, with instruction provided three times weekly. Lessons focused on teaching common Greek and Latin science roots from the biology and life science curriculum to help the students derive meanings for unknown words.

During each CWS instruction, students were taught a specific Greek and Latin root using the CLUE WORD mnemonic composed of the following eight steps: (a) Check the sentence; (b)

Look for clues that surround the unknown word; (c) Understand it! Re-read the sentence; (d) Explore it! Write the unknown word; (e) Write it! Write the word parts; (f) Organize it! Guess and write the meaning of the word parts; (g) Re-think it! Define and write the predicted word meaning; and (h) Double check. See if you are correct! Students used their newly learned skills to analyze and define three science words that contained the ancient Greek or Latin root taught during each lesson. Each unknown biology word that contained an ancient Greek and Latin root was in a sentence with 15- 20 syllables, had definitional context clues, and included the definitions of any prefixes or suffixes in the unknown word. During teacher-led practice, the teacher demonstrated how to use the CWS steps to analyze and define an unknown word. Students completed a CWS graphic organizer during the teacher-led, guided-practice, and then independently practiced parts. Students completed a CWS probe prior to receiving the new lesson every other day. Pre-post measures included three researcher-created CWS probes and one standardized measure (Test of Reading Comprehension, 4th edition).

Results indicated that all three participants were better able to analyze and define science words by the end of the intervention compared to pretest, with all students scoring at least 60% or higher on their final CWS probe. Additionally, all three students maintained their ability to use the CWS to analyze unknown science words two months following the intervention. Finally, all three participants made small gains from pre-posttest on the Word Knowledge measure, Word Part Test, and the Word Mapping/Strategy Use Test. Students had the highest gains on the Word Mapping/Strategy Use Test pre-posttest, showing that they could accurately use the CWS strategy to analyze and define words. Limitations of the study included possible threats to internal validity because the Word Knowledge Test and Word Part Test included all of the possible science words taught and not taught. Also, the length of the assessment may have led to

test anxiety and fatigue resulting in minimal gains. In addition, two of the participants had difficulty remembering all of the CWS steps, possibly attributed to the eight CWS steps being too many, with wording too lengthy for the students to memorize. Thus, further investigation of this potentially effective intervention is pertinent to address the above limitations.

Summary

Validating effective vocabulary interventions for ELLs with RD is relatively new. ELLs with RD are a sub-population who is acquiring English as a second language and who also has difficulty with reading processes. ELLs with RD are tremendously behind in the number of vocabulary words they need to know in order to succeed academically (Kieffer & Box, 2013). When comparing generative and non-generative strategies, although non-generative strategies are effective in teaching students isolated words, these types of strategies are not as effective in helping students learn related relevant words (Harris et al., 2011). Effective instruction for ELLs with RD must increase their vocabulary acquisition in a small duration of time. Therefore, generative strategies, such as contextual analysis and morphemic analysis, are recommended (Kieffer & Lesaux, 2012). Generative strategies teach students how to use contextual clues (e.g., identify clues around an unknown word) and morphemic analysis (e.g., prefix, root, suffix word parts) to learn word parts meanings so that they can identify these meanings in many words. Based on recent vocabulary studies, generative strategies have led to improved vocabulary acquisition and comprehension with secondary students, including ELLs with RD (Bauman et al., 2003; Fishley et al., 2012; Harris et al., 2011; Helman et al., in press; Katz & Carlisle, 2009). Despite the promising results, additional investigations should determine the effects of using generative vocabulary intervention strategies with ELLs with RD. To date, only one study has investigated the effects of using generative strategies, contextual analysis and morphemic

analysis, with secondary ELLs with RD, with promising preliminary results (Helman et al., 2015). The purpose of this investigation is to test the effectiveness of a revised version of the previously developed vocabulary instruction strategy, CLUES, on the acquisition of science vocabulary with secondary ELLs with RD. Students' ability to maintain and generalize their skills following the intervention was investigated. Finally, students' acceptability of CLUES was assessed.

Chapter 3

Method

Participants and Setting

Participants for the current study were drawn from Freedom High School in Bethlehem Area School District (BASD). Freedom High School serves approximately 1,846 ninth through twelfth grade students and is racially and ethnically diverse, with a population of 28% Hispanic students, 56% White students, 11% Black students, and 4% Asian students. The percentage of students eligible to receive free and reduced lunch is 38.

The English Speakers of Other Languages (ESOL) teachers at Freedom High School were asked to refer students meeting the following criteria: (a) attending 9th or 10th grade; (b) functioning on Level 3 or 4 language proficiency levels based on the World-Class Instructional Design and Assessment Consortium's English Language Proficiency Standards (WIDA ELP Standards, 2007); (c) identified as an ELL based on the school district's language assessment; (d) labeled with a learning disability in reading (RD) as documented by school records; and (e) scoring at fourth grade reading level or higher based on the school district's most current standardized reading assessment.

The Pennsylvania English Language Proficiency Standards outline five phases of language development that describe the progression of English language acquisition. The standards address specific contexts for language acquisition (e.g., social and instructional settings, academic language in content areas). The five English language proficiency standards center on the language needed by preschool through 12th grade ELLs to succeed both socially and academically in education settings. In addition, the five standards all include the following four language domains: listening (process, understand, interpret, and evaluate spoken language in a variety of situations), speaking (engage in oral communication in a variety of settings for

multiple audiences and purposes), reading (e.g., process, interpret, and evaluate written language, symbols, and text with understanding and fluency), and writing (engage in written communications in a variety of forms for an array of purpose and audiences. WIDA Consortium's English Language Proficiency Standards (2007) address the need for students to become fully proficient in both social and academic English. The WIDA performance indicators represent social, instructional, and academic languages and are used by 21 states, including Pennsylvania. WIDA has identified six performance definitions that provide criteria for each of the six levels of English language proficiency in the areas of linguistic complexity, vocabulary usage, and language control. For purposes of this study, participants were identified at a 3 or 4 language proficiency level. Students identified on the Level 3 (Developing) language proficiency have the following language characteristics: (a) they use general and some specific language of content areas; (b) they expand sentences in oral interaction and written paragraphs; (c) they use oral and written language with phonological, syntactic, or semantic errors that may impede their communication, but they retain much of its meaning when presented both orally and written with graphic or interactive support. Students identified with a level 4 language proficiency can use more specific and technical language of the content areas: (a) they use a variety of sentence lengths with varied linguistic complexity in oral discussions; (b) they use oral or written language with minimal phonological, syntactic; or (c) they make semantic errors that do not impede the overall meaning of their communication nor do they need graphic or interactive support.

Parental informed consent, in both English and the native language, was obtained prior to reviewing student records or assessing students. The instructor, without the need of an interpreter, contacted the parents to provide an overview of the study and answer questions.

Finally, the parents provided consent for their child's participation, including audio/and or videotaping, which was used to ensure reliability of the measures.

The project procedures were explained to each student (e.g., purposes and benefits for their participation in the project, amount of time involved). Subsequently, all six students signed a written assent form indicating their agreement to participate in the study. In addition, the students signed a written assent form to be video and/or audiotaped during assessment and lesson administration.

Four 10th grade students were included in this study. The instructor reviewed student cumulative school records to confirm that the student was identified as ELL with RD in reading decoding and comprehension based on district assessments. In addition, the investigator reviewed the student's recent standardized reading assessment to determine basic reading comprehension and decoding ability. Students meeting criteria for potential participation were further screened using the Test of Reading Comprehension (TORC-4; Brown, Hammill, & Wiederholt, 2009). TORC-4 was included to control for basic reading comprehension skills and decoding ability. Four out of the six students met the criteria of reading at a 4th grade level or higher across all five subtests. Table 1 displays the demographic data, academic functioning in reading and screening information. Based on Lexile scores on the Scholastic Reading Inventory (SRI) district reading assessment, Tamara was reading at a beginning fifth grade level, Narcisa was reading at a beginning fourth grade level, Victor was reading at a fourth grade level, and Sarita was reading at a beginning fourth grade level. All four students were included in general education classrooms for math and science electives but received literacy instruction in the ESOL classroom. Tamara, Narcisa, Victor, and Sarita were enrolled in biology classes in the first half of the year, which did not influence the results since the study was conducted in spring.

The study was conducted during an 80 min block when students attended ESOL class for literacy instruction. All students received a set of four training lessons, 4 days per week, 25 min in duration, over a one-week period. Following training lessons, each student received 10 CLUES instructional lessons, 40 min in duration, provided four times per week. All instruction and assessments took place in a large conference classroom that contained a large blackboard, two white boards, and stadium seating.

Materials

Each student received a vocabulary binder that contained the following sections: (a) CLUES graphic organizer sheets (three for each lesson), (b) a sheet containing the list of CLUES steps, (c) answer key sheets, (d) guided note sheets for the pre-training lessons, and (e) blank note sheets. The three CLUES graphic organizer sheets had different formats for teacher-led instruction (see Appendix A), guided practice (see Appendix B), or independent practice (see Appendix C). The CLUES graphic organizer for teacher-led instruction contained directions, a sentence with the targeted science word, the CLUES steps, and a graphic organizer web for students to write the word parts, word meanings, and science word meanings. In addition, boxes on the graphic organizer included labels with the word parts (e.g., prefixes, roots, suffixes) and arrows that guided students to write each word part and word meaning for the targeted word. A CLUES graphic organizer, for guided practice, contained the same content as the teacher-directed organizer, except the boxes did not have labels with the word parts and did not include arrows. A CLUES graphic organizer, for independent practice, contained the same content as the guided practice organizer, except the CLUES steps did not appear on the sheet. Additional space was available for students to write the steps. A sheet with the five CLUES steps was in the binder for students to reference if necessary. Answer key sheets corresponded to teacher-led,

guided, and independent practice. The answer key sheets contained the information omitted from the organizer sheets (see Appendix D).

Guided note sheets (see Appendix E) contained boxes for students and were used during the training lessons for the following purposes: (a) writing definitions (e.g., context, morpheme, prefix, root, suffix); (b) writing contextual analysis, morphemic analysis, and word part rules; (c) writing examples that were reviewed during the lesson; and (d) independently practicing additional examples. In addition, the sheet contained lines for the student to write down notes. Finally, two large laminated posters of the organizer sheets assisted in the facilitation of the modeling of the CLUES strategy to define science words during teacher-led instruction.

Vocabulary Selection and Sentence Development

Target ancient Greek and Latin roots and science words. Science words with common Greek and Latin roots were used during CLUES instruction and for assessment (see Appendix F). Helman et al. (2015) used the same sets of science words in an earlier study. Originally, Helman et al. selected 50 roots from biology and life science curriculum sources (Campbell, Williamson, Heyden, 2003; Hasseler, 2005; Williams, 2005). Five target biology and life science words were identified for each root. Every target word had at least one high-frequency Greek or Latin root and a prefix and/or suffix. Each word part (morphemes) contained a maximum of six letters and three syllables. The science words were matched across lists by the number of word parts they contained. Three science words containing the same Greek or Latin root were used for each CLUES instructional lesson and a fourth word was prepared in case a booster session is needed. A fifth science word was prepared for assessment purposes on the intervention probes. Science words used for both CLUES baseline probes and maintenance

probes were novel (e.g., contained unknown prefixes, roots, and suffixes) and were randomly drawn from the initial pool of 50 roots.

Sentence construction. Sentences constructed for Helman et al. (2015) were used during instruction and assessment. Sentences contained key phrases that provided clues to help students define the unknown science word (see Appendix F; Beck, McKeown, & Kucan, 2002). Target science words were placed at the beginning, middle, or at the end of the sentences for variation. The length of each sentence (15 to 20 syllables) was held constant across experimental phases.

A panel of experts, consisting of three professors with expertise in ELL, English, reading instruction, RD, and/or science, as well as a researcher in the areas of Linguistics and ELL acquisition, reviewed the words and the constructed sentences in the initial Helman et al. (2015) study. The instructor subsequently met with each expert individually and, based on feedback, refined each constructed sentence until it contained key phrases that helped students define the science word, varied word placement (i.e., beginning, middle, and end of sentences), and contained a maximum of 15-20 syllables.

Dependent Measures

CLUES probes. During baseline, intervention, and maintenance phases, trained graduate students administered the CLUES probe (see Appendix G), the primary dependent measure. The CLUES probe was adapted from Helman et al. (in review) by reducing the original eight CWS steps to five steps since students had difficulty acquiring the steps. The CLUES probe consisted of one sentence with an unknown science vocabulary word and a CLUES graphic organizer. Students wrote the science word parts, defined the science word parts, and wrote the definition of the science word on the CLUES organizer. In addition, students wrote the

five strategy steps (CLUES) on the blank lines provided on the probe. Maintenance probes did not contain any words used during instruction. Data were collected on each student's: (a) correctly written word parts, word part meanings, and science word meanings (strategy use) and (b) correctly written CLUES steps on the CWS baseline, intervention, and maintenance probes (strategy knowledge).

Students could obtain 8-11 points total on the CLUES probe, depending on the number of word parts. Students could earn one point for each word part written in the correct box, for a total of two possible points for words with two parts (e.g., prefix-root; root-suffix) and three possible points for a word with three parts (e.g., prefix-root-suffix). In addition, students could obtain up to three total points for writing the correct word part meanings, up to four points for writing down the correct word meaning, and one point for checking the dictionary and/or vocabulary binder and writing down the correct definition.

Trained graduate students scored probes using a checklist in the following manner. Students could earn three or four points for writing the definition but omitting detail (e.g., did not include the definition of the prefix, suffix, or root), one point for writing part of the definition, but less than half (e.g., one of the key phrases and word part definitions were omitted), and zero points for writing nothing or an incorrect definition based on the scoring checklist (see Appendix H). The number of points earned were converted to percentage correct by dividing the number of points earned by the number possible (8 or 11) and multiplying by 100.

In addition, students' strategy use was assessed (see Appendix I). A student could earn up to 15 points for correctly writing strategy steps (five strategy steps, three maximum points for each). Specifically, students could earn three points for writing the complete strategy step (e.g., "Connect to the context"), two points for writing at least half of the strategy step but omitting

detail, (e.g., “Connect Context”), one point for writing part of the strategy step, but less than half (e.g., “Connect”), and zero points for writing nothing or writing an incorrect answer. Points were converted to a percentage score by totaling the number of points earned, dividing by 15 and multiplying by 100. Two graduate students scored each CLUES probe using an answer key sheet and a checklist to identify the points students received for: (a) correctly written word parts, word part meanings, and science word meanings and (b) correctly written strategy steps. To assess inter-scorer agreement, two graduate students independently scored the CLUES probes using an answer key sheet. A percentage score was calculated for the instruction by dividing the number of item agreements by the number of item agreements plus disagreements and multiplying by 100. CLUES probe inter-scorer agreement was 97% (range=93%-100%) across all assessment, instruction, and scoring conditions.

Generalization probes. Trained graduate students administered two different generalization probes following the administration of the CLUES intervention probe and before the CLUES instruction once a week during baseline, once a week during intervention and one time during maintenance (see Appendix J). The generalization measure was added to extend the findings from Helman et al. (2015) since generalization was not assessed in that study. Further, students had difficulty writing the meaning of the morphemes (e.g., prefixes, roots, and suffixes) in isolation or without the visual aid of the organizer, suggesting that students may have difficulty generalizing the CWS steps across content areas. There were two types of generalization probe measures: controlled and uncontrolled. The controlled and uncontrolled generalization probes did not contain any words used during instruction and did not include a visual aid or require students to write the strategy steps. There was only one difference between the controlled syllable generalization probe and uncontrolled generalization probe. The number

of syllables in the sentence on the controlled generalization probe was held constant between 15-20 syllables. The uncontrolled syllable generalization probe contained a sentence selected from a fourth grade science text, so the number of syllables was not held constant. On both generalization probes, two sections were presented below the sentence. In the first section, students used their knowledge of the CLUES steps to write and define the word parts in the unknown science word. Students used the sentence context to define the unknown science word. Two graduate students scored each CLUES generalization probe using an answer key sheet and a checklist to identify the points students received for correctly written word parts, word part meanings, and science word meanings.

Students could obtain 6-8 total points on the generalization probes depending on the number of word parts. Students could earn one point for each word part written correctly, for a total of two possible points for words with two parts (e.g., prefix-root; root-suffix) and three possible points for a word with three parts (e.g., prefix-root-suffix). In addition, students could obtain up to three total points for writing the correct word part meanings. Furthermore, students received two points for writing down the definition of the unknown science word based on the sentence context. To assess inter-scorer agreement, two graduate students independently scored the generalization probes using an answer key sheet. A percentage score was calculated for the instruction by dividing the number of item agreements by the number of item agreements plus disagreements and multiplying by 100. Inter-scorer agreement for the CLUES generalization probes was 100%.

Test of Reading Comprehension, 4th Edition (TORC-4; Brown, Hammill, & Widerholt, 2008). Students were administered the TORC-4 just prior to and immediately following intervention to evaluate intervention effects on reading proficiency. The TORC-4 is

an untimed standardized assessment containing five subtests that assess contextual fluency, relational vocabulary (i.e., word identification and contextual meaning), paragraph construction (i.e., the ability to understand semantics, or context, well enough to organize sentences into a coherent paragraph), sentence completion (i.e., read a sentence and select from a list a pair of words that best completes it), text comprehension (i.e., read short passages and then answer five multiple-choice questions about each passage), and contextual fluency (read passages and draw a line between recognizable words within a 3 min time limit). Most reliability coefficients for the TORC-4 subtests meet the rigorous standard of .90. The overall reliability coefficient is reported at .89 (Brown, Hammill, & Wiederholt, 1995). A variety of validation procedures and correlational studies confirmed the structure of the test. The validity of the TORC-4 was investigated for three types of validity: (a) content-description validity, (b) criterion-prediction validity, and (c) construct-identification validity (Brown et al., 2009). Content-description validity theory and point-biserial correlations were .80. Criterion validity evidence with the WISC-IV was .86. Construct-identification validity was reported at .73 when compared with other tests.

For purposes of this study, raw scores were converted to grade equivalent and scaled scores. The cognitive clusters intended to predict achievement correlated well with associated achievement cluster scores. The grade equivalent scores are reported since the selection criterion was performance at the fourth grade level across all five subtests. To assess inter-scorer agreement, two graduate students independently scored the TORC subtests by using the answer key provided in the manual. A percentage score was calculated for each assessment by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100.

Word Knowledge Test (WKT; adapted from Harris et al., 2011; Helman et al., 2015). The WKT assessed students' ability to write the definition of science words. Helman et al. (2015) modified the WKT from Harris (2007) to only include 72 science words only, 18 of which were taught during intervention and 48 novel words to assess generalization. Additionally, students were required to define word parts they recognized (see Appendix K). However, Helman et al. found that students did not have significant gains on this measure since it was composed of more novel words than words taught. Therefore, the modification of the WKT includes the 40 science words used during instruction to assess student's maintenance.

The WKT assessed students' prior knowledge of the 30 science words taught during CWS instruction, including 10 words to assess generalization at pre-test and post-test. Therefore, additional roots on the test were necessary to determine if any student had prior knowledge of the selected root words and science words. If students recognized the selected root words or science word a different root or science word would be used. None of the WKT forms was adapted because students did not recognize the selected root parts or science words. Two graduate students administered equivalent forms of the WKT, Form A and Form B, at pre- and post-test to prevent practice effects. The forms differed only in the order of the science words presented.

Three points were earned for each word: one point for writing the correct word parts, one point for writing the correct word part definitions, and one point for writing the correct science definition. Students could earn up to 120 possible points. Percentage correct for the WKT was calculated by dividing the total number of points earned by 120 and multiplying by 100. To assess inter-scorer agreement, two graduate students independently scored the WKT using an answer key sheet. A percentage score was calculated for the instruction by dividing the number

of item agreements by the number of item agreements plus disagreements and multiplying by 100.

Word Part Test (WPT; adapted from Harris et al. 2011; Helman et al., in 2015). The WPT in the Helman et al. (2015) study was adapted from Harris (2011) so that it contained science morphemes (see Appendix L). WPT test modifications occurred since Helman and colleagues found that students did not make substantial gains on the WPT, possibly due to test anxiety and fatigue. Therefore, the number of novel word parts was decreased. Two graduate students administered the WPT at pre-test and post-test to assess the students' knowledge of the prefixes, roots, and suffixes that were taught during instruction. Two equivalent forms of the WPT, Form A and Form B, were administered at pre- and post-test to prevent practice effects. The forms differed only in the order of the science word parts presented. Different unknown prefix, root, and suffix word parts were included on each form of the test for generalization.

The WPT was composed of three sections that contained 57 science morphemes (47 taught, 10 novel). If the students correctly wrote down any of the roots selected for use during instruction, the instructor replaced one of the additional roots for CLUES instruction. Students wrote the definition of each prefix, root, and suffix in the first, second, and third sections, respectively. Students received one point for each correctly defined root, prefix, or suffix for a possible total of 57 points. Percentage correct was calculated by dividing the total number of points earned by 57 and multiplying by 100. Two graduate students individually scored the WPT using an answer key to evaluate inter-scorer agreement. A percentage score was calculated for the assessment by dividing the number of agreements (on roots, prefixes, and suffixes) by the number of agreements plus disagreements and multiplying by 100.

Word Mapping/Strategy Use Test (WM/SUT; adapted from Harris et al., 2011; Helman et al., 2015). WM/SUT assessed the effects of intervention on student's use of the CLUES strategy steps, correctly written science definitions, and correctly written context and morpheme rules at pre-test and post-test (see Appendix M). Modifications to the WM/SUT, developed by Harris, included the addition of questions such as, "What are two morpheme rules?" (e.g., every word contains at least one morpheme, morphemes can have at least one prefix and/or suffix). In addition, the WM/SUT pre- and post-tests contained four unknown science words that were matched for the number of syllables. The WM/SUT was further modified from the Helman et al. (2015) study to include two science words with graphic organizers rather than four science words. In the Helman et al. study, students wrote out the list of CLUES steps four times, which may not have reflected gains due to test anxiety and/or fatigue.

The WM/SUT consists of nine items. The first two items contained single sentences with one unknown science word in each. Students were required to: (a) recognize the science word and read the sentence, (b) identify a key phrase around the science word to help define the science word, (c) re-read the sentence, (d) identify key phrases around the science word to help define the morphemes, (e) write the science word in the first box, (f) identify the morphemes in the science word, (g) write the meaning of each morpheme, and (h) write the meaning of each word. The first two items included two CLUES graphic organizer for the student to complete. The final seven items included questions that required students to write the definitions of context, morpheme, root, prefix, and suffix, write the rules associated with each definition (e.g., context, morpheme, root, prefix, and suffix), and list the CLUES steps. Trained graduate students administered two equivalent forms of the WPT, Form A and Form B, at pre- and post-

test to prevent practice effects. The forms differed in the order of the definitions and rules presented.

A total score of 82 points could be earned on the WM/SUT. The first two items were scored based upon the percentage of correctly written strategy steps (30 possible points) and word parts and meanings (22 possible points) with a possible total of 52 points for the first section. Students could earn 11 points each on Items 1 and 2. Graduate students scored items 3-9 based upon the percentage of correctly written definitions (e.g., context, morpheme, prefix, root, and suffix) and the correctly written rules for morphemes, context, prefixes, roots, and suffixes (15 possible points). Item 9 was scored based upon the percentage of correctly written strategy steps (15 possible points) with a possible total score of 30 points on the second section of the WM/SUT. Percentage correct was calculated by dividing the total number of points earned by 82 and multiplying by 100. Inter-scorer agreement was assessed by having two graduate students independently score the WM/SUT forms using an answer key. Agreement was calculated by dividing agreements on each item by agreements plus disagreements and multiplying by 100. A percentage score was calculated for the assessment by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100.

Child Intervention Rating Profile (CIRP; adapted from Witt & Elliott, 1985). Trained graduate students administered the adapted CIRP (Appendix N) individually to each student post-intervention to assess acceptability of the CLUES intervention. Questions were slightly adapted in the Helman et al. (2015) to reflect the CLUES procedures. For example, modified statements included asking the student to rate the fairness of the intervention and to ask whether the students felt the CLUES strategy was a fair tool to help them figure out unknown science word meanings. The CIRP is an empirically validated tool with seven items used to

assess acceptability (e.g., fairness, expected effectiveness, and possible negative consequences associated with participation) based on the student's perspective. Students rate each of the seven items on a six-point Likert-type scale ranging from 1 (do not agree) to 6 (agree). The total CIRP score ranges from 7 to 42, with the higher scores indicating higher acceptability. Internal consistency reliability is .89 (Witt & Elliott, 1985). An additional space for students to write comments about the intervention was included to provide additional information about how, why, or when students have used the CLUES strategy in other settings and any suggestions to improve the CLUES instruction. A percentage score was calculated for the total test scored by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100.

Treatment Fidelity

Treatment fidelity checklists. Treatment fidelity was assessed during the administration of all tests and during the implementation of both the training lessons and CLUES instruction.

Treatment fidelity of training lessons. A fidelity checklist assessed implementation of the instruction during the four training lessons (see Appendix O). The checklist consisted of 16 items. The researcher created training lesson checklist represented all of the critical parts of the training lesson. Items included the teacher beginning the lesson with the CLUES review, cueing students to define words (e.g., context, morpheme, prefix, root, suffix) and prompting students to state the rules about each previously learned words (e.g., context) and the rules students were taught about those words (e.g., What are two rules about morphemes?). Items on the checklist also assessed the format of the lesson, such as review of previously learned words, introduction of new information, demonstration of examples and non-examples, and review of the newly learned information. An example of an item assessing teacher implementation of the CLUES

instruction on the training lesson is, "The instructor stated the rules, (e.g., context, morphemes)." Observers coded fidelity of CLUES training lessons using audio/videotapes during 100% of the CLUES instructional sessions. One point was assigned for each correctly implemented step. Percentage correct implementation was calculated by dividing steps implemented correctly by total number of steps, as assessed by the primary observer. A second observer (i.e., student) assessed the treatment fidelity IOA data were collected during 30% of sessions, distributed across conditions. Mean IOA for CLUES training lesson implementation was 97% (range=93%-100%).

Treatment fidelity of CLUES instruction. The researcher created fidelity checklist assessed instructor implementation of the CLUES strategy (see Appendix P). The fidelity checklist represents all of the 20 critical instructional parts of the CLUES strategy instruction (e.g., prompting students to respond, asking students to repeat the CLUES steps, following the lesson format). Specifically, the items included review of the information learned in each lesson (e.g., defining context, morpheme, prefix, root, suffix terms) and all of the Greek and Latin roots that were taught. In addition, the checklist included specific teacher behavior, such as cueing the student to use the steps of the strategy or stating each CLUES step aloud throughout instruction. The items also included the format of the lesson to make sure the teacher began with teacher led practice, guided practice, and ended with independent practice. The CLUES instruction fidelity checklist included items such as, "The instructor stated and implemented the five CLUES steps." Two trained graduate students assessed the treatment fidelity of CLUES implementation using video/audiotapes or direct observation during 100% of CLUES instructional sessions. One point was assigned for each correctly implemented step. Percentage correct implementation was calculated by dividing steps implemented correctly by total number of steps, as assessed by the

primary observer. IOA data were collected during 30% of sessions. A percentage score for IOA was calculated for the instruction by dividing the number of agreements on steps implemented correctly by the number of agreements plus disagreements and multiplying by 100. Mean IOA of CLUES intervention lesson implementation was 93% (range=90%-100%).

Test Administration. Fidelity checklists assessed test administration of the CLUES probes and all assessments (see Appendix Q, R, and S, T, U). Graduate students assessed the fidelity of test administration using video/audiotapes or direct observation during 100% of test administration sessions. A percentage of assessments with which each assessment was administered accurately was calculated by dividing the number of steps implemented correctly by the total number of steps. The collection of IOA data occurred during 40% of test administrations. A percentage score was calculated for the instruction by dividing the number of agreements on steps implemented correctly by the number of agreements plus disagreements and multiplying by 100.

Inter-scorer reliability. Inter-scorer reliability was determined by having two graduate students, blind to the purpose of the study, independently score 100% of all tests, distributed evenly across conditions and participants. The two scorers used the scoring checklists created by the instructor. Scored tests were compared item-by-item to determine the number of agreements and disagreements. To calculate percentage agreement, the number of agreements were divided by the number of agreements plus disagreements and multiplied by 100%.

Inter-scorer agreement for TORC-4 assessments was 98% (range = 95%-100%), WKT inter-scorer agreement was 97% (range = 94%-100%), WPT inter-scorer agreement was 100%. Mean inter-scorer agreement on the WM/SUT was 97% (range = 94%-100%). Inter-scorer agreement data for the total test score on the CIRP was 100%.

Calibration. Calibration was planned if the treatment fidelity or inter-scorer reliability was below 80% for two consecutive sessions, with the primary instructor and the trained graduate students reviewing the procedures and definitions as well as practicing recording again until he/she reached 100% agreement. None of the trained graduates scored below 80% for two consecutive sessions; therefore, calibration was not necessary.

Experimental Design

A multiple probe across participants design (Tawney & Gast, 1984) was employed to evaluate intervention effects. Continuous data were collected on the percentage of correctly written word parts, word part meanings, science word meanings and correct strategy steps during the intervention phase. During baseline, trained graduate students individually administered a minimum of five CLUES probes to each student. After the fifth probe, the participant with the most stable baseline data was selected to begin the CLUES intervention while the other students received intermittent CLUES baseline probes. The second participant with stable baseline data was selected to begin intervention once the first participant responded to intervention, as measured by an upward and stable trend across a minimum of five data points. Sequential exposure to the intervention occurred for the remaining participants in the manner described.

Procedures

General. Participants received a small incentive (e.g., candy, pencil, eraser) once weekly based on attendance and session completion to increase their desire to continue participation in the study. Students received a ticket at the end of every completed session. The instructor drew a ticket at the end of the study for each student to receive a larger reward of his/her choice (i.e., gift certificate).

Training. Graduate students (master's and doctoral level) collected fidelity data during the implementation of the training lessons, CLUES instructional lessons, test administration sessions, and scoring of the assessments. The instructor trained graduate students by reviewing the fidelity sheet then having them watch a videotaped lesson demonstration and complete the fidelity checklist simultaneously with the instructor. Graduate students completed the treatment fidelity checklist with 100% accuracy. If the graduate student did not meet the 100% criterion, additional lesson demonstrations were planned with the instructor until he/she met 100% criterion. All graduate students met 100% criterion and no additional lesson demonstrations were needed. Procedural fidelity for CLUES instructional lessons was 100%.

Graduate students (master's and doctoral level) also received training on how to administer all of the tests (e.g., TORC-4, WPT, WKT, WM/SUT, and CLUES probes). The instructor met with the graduate students and reviewed the test administration protocols for the standardized TORC-4 and testing protocols created for the researcher-created tests (see Appendixes Q, R, S, T, and U). Graduate students administered each of the assessments to the instructor. The instructor assessed graduate students' ability to follow testing directions on all assessments and identify basal and ceiling levels for the TORC-4 using checklists that contained the specific testing procedures. Criterion for competency was established at 100%. Booster training sessions were planned for graduate students who did not meet 100% in training for any assessment. Simultaneously, a graduate assistant conducted IOA.

After graduate students received training for administering assessments, they received training on how to score each measure (e.g., TORC-4, WPT, WKT, WM/SUT, CLUES probes). First, the instructor provided the graduate students with examples of completed assessments and reviewed how to score each test. For the TORC-4, the instructor provided directions on how the

graduate students used the TORC-4 examiner manual to score tests. Graduate students scored raw score data for each assessment. If accuracy was less than 100% for any of the assessments scored, the instructor conducted retraining by having the graduate student score additional assessments until he/she met 100% criterion. The instructor provided a booster session two times to two graduate students who scored below 100% for assessment administration. A second observer who was a graduate assistant assessed IOA for each scored assessment. IOA was calculated by dividing the number of agreements on each administration step by the number of agreements plus disagreements. IOA was 98% (range=90%-100%).

Assessment administration. Prior to and just following intervention, one of two trained graduate students administered assessments (WKT, WPT, WM/SUT, and TORC-4) individually to each participant over a period of 2 days. Following the completion of the CLUES intervention, two graduate students administered the adapted CIRP.

Baseline procedures. During baseline, the students received typical vocabulary instruction that was provided as part of their regular reading instruction. Trained graduate students or the instructor administered a CLUES baseline probe sheet to students that included a sentence with one unknown science word (see Appendix G). The examiner instructed the participant to do his/her best and gave him/her unlimited time to complete the probe. After the fifth probe, the participant with the most stable baseline data was selected to begin the CLUES intervention while the other students received intermittent CLUES baseline probes.

Intervention procedures. The CLUES intervention (originally the CLUE WORD strategy), developed by the instructor, served as the independent variable. CLUES combines morphemic analysis strategies developed by Harris et al. (2011) and the vocabulary rule (e.g., read the sentence, look for context clues, re-read the sentence for clues) developed by Baumann

et al. (2003). The CLUES strategy is a set of cognitive steps students used to derive meanings of unknown science words from instructional context. The strategy involves the following steps: (a) connect to the context, (b) label two contextual clues, (c) use the clues to define and write the word parts, (d) explain the science word, and (e) see if you are correct (see Appendix V). The prompting of a CLUES organizer, a graphic device, assisted them through the CLUES steps.

Participants received four sessions per week of CLUES instruction from the primary instructor (first author) outside of their typical ESOL literacy instruction. Four scripted training lessons and 10 scripted CLUES instructional lessons guided instruction. The following format was used for each of the 30-min training lessons and the 45-min CLUES instructional lessons: (a) CLUES review, (b) teacher-led practice, (c) guided practice, and (d) independent practice. Before each lesson, the instructor provided a CLUES review (see Appendix P), asking students about terms previously learned during CLUES training lessons. The CLUES review, teacher-led practice, guided practice, and independent practice formats differed for the training lessons and CLUES instructional lessons.

Training lessons. Training lessons were reduced from six to four based on Helman et al. (2015) since students quickly acquired the terminology. The four training lessons included an explanation of the following terms: context, morpheme, prefix and suffix, and root (see Appendix W). The instructor displayed a blank laminated poster during each training session. Before each lesson, the instructor provided a CLUES review (see Appendix X) and asked students to state the terms previously learned during CLUES training lessons. The instructor provided immediate feedback to students if they stated an incorrect answer. For example, if the instructor says, "A morpheme is defined as…" a correct student answer would be "A morpheme is the smallest unit of meaning and also known as word parts (e.g., prefixes, roots, suffixes)." If

a student stated an incorrect answer such as "a word," the instructor used an error correction procedure that included the instructor stating the answer and having the student respond correctly three times.

Following CLUES review, teacher-led practice was given. During teacher-led practice, the instructor provided the student with the definition of the new term to be learned in the lesson (e.g., context; words or phrases that surround the unknown word), stated the rules associated with each term (e.g., context can be made up of one or two words or a whole phrase; context will usually give you clues about the unknown word), and modeled how to distinguish examples (e.g., reading the sentence and finding key words) from non-examples (e.g., finding words that are distractors and will not help define the unknown word). Students wrote down the definition of the term, rules about the term, and examples and non-examples on a guided note sheet. During guided practice, the instructor provided examples of the term, (e.g., students will have to identify context, key phrases, in the sentence on the poster). During independent practice, students completed four examples independently. For example, if the instructor taught the meaning of context and context rules, the students read and completed the four examples listed in the independent practice section of the guided note sheet. Students read a sentence with an unknown word. He/she then underlined key words or phrases that helped define the unknown word. At the end of the lesson, the instructor reviewed the concepts taught during the current and previous training lessons.

CLUES instructional lessons. CLUES instructional lessons included displaying the poster with the CLUES steps and explaining the strategy to the students (see Appendix Y). Lessons included review of the key terminology taught during the four pre-training lessons, examples and non-examples, interactive questioning procedures, and corrective feedback

strategies. Each 30-min CLUES instructional lesson included the following format: (a) teacher led practice, (b) guided practice, and (c) independent practice. Before each lesson, the instructor continued the CLUES review (see Appendix X). For example, if the instructor said, "The root 'nat' means...', students could have correctly answered by stating "birth." The instructor provided immediate feedback to students if they stated an incorrect answer. During teacher led practice, the instructor explicitly instructed students how to navigate the CLUES organizer and use the CLUES steps. Specifically, for steps 1 through 2, the instructor taught students how to re-read each sentence to identify key phrases around the unknown science word that provided clues to define the word. For example, they underlined the key phrases, defined the word part meanings (e.g., prefix, root, suffix), identified words that describe the science word (e.g., adjectives), or identified small phrases that provide important details to help define the word. After identifying the key phrases, the instructor modeled how to segment the science word to identify morphemes (e.g., prefixes, roots, and/or suffixes). The instructor demonstrated how to use the identified key phrases to derive the meaning of the word parts. Finally, the instructor modeled how to use the dictionary to look up the science word meaning. Students checked each answer key to monitor their ability to write the correct CLUES steps and define the word part meanings and word meanings. During guided practice, using another science word, the instructor scaffolded instruction to the students as they applied the process of using the CLUES steps to define word part meanings and the science word. Specifically, the instructor asked students questions such as, "After reading the sentence, what is a key phrase that would help us define the science word?", "What are the morphemes in the unknown science word?", or "What is the next strategy step to help us analyze the science word?" The instructor provided feedback during guided practice if students did not identify the correct morphemes, did not state the

CLUES steps correctly, did not define word part meanings correctly, or did not provide an adequate science word definition.

During guided practice, the instructor completed the CLUES organizer as the student wrote his/her answers on the CLUES guided practice sheet. During independent practice, the student independently used the CLUES steps to define word part meanings and define the science word. Students wrote the CLUES steps to remind them to identify key phrases that surround the word, define the word parts, and define the unknown science word. At the end of the lesson, the instructor reviewed the CLUES steps and each of the three graphic organizers that listed the newly learned science word meaning and its word part. Trained graduate students administered the CLUES probes that corresponded to the previous root lesson before each new CLUES instruction lesson four times weekly to assess students' ability to define morphemes and infer the definition of the science words that contain the previously taught Greek or Latin root.

Booster session. If a student did not acquire at least three CLUES steps or did not accurately write at least four of the word parts across a minimum of five data points a booster session was conducted. The booster session was planned during the CLUES intervention lesson after the first guided practice session. Specifically, students would receive an additional guided practice session. The instructor would use the guided practice CLUES organizer to scaffold the process of analyzing words. The student would use a guided practice note sheet to write down the science word parts, word part definitions, science word definitions, and the CLUES strategy steps. Furthermore, the instructor would provide feedback to students if they did not identify the correct morphemes, state the CLUES steps incorrectly, define word part meanings inaccurately, or define the science word inadequately. During the booster session, the instructor would complete the CLUES organizer as the student writes his/her answers on the CLUES guided

practice sheet. The instructor would conduct booster sessions until an upward trend was apparent in the student's data. None of the students needed a booster session during the intervention.

Generalization procedures. Trained graduate students administered two generalization CLUES probes to each participant once weekly during the baseline phase, once weekly during the intervention phase, and one time during the maintenance phase (see Appendix J). No review took place prior to administration. The fourth participant received a generalization probe 1 week and then 3 weeks following intervention due to the end of the school year. As during baseline and intervention phases, students received approximately 10 min to complete the probe.

Maintenance procedures. Maintenance CLUES probes were administered to each participant 2 weeks and 1 month following intervention (see Appendix Z). No review took place prior to administration. As during baseline and intervention phases, students received approximately 10 min to complete the probe.

Data Analysis

Data were collected on each student's: (a) correctly written word parts, word part meanings, and science word meanings and (b) correctly written CLUES steps on the CLUES baseline, generalization, intervention, and maintenance probes. The instructor used visual analysis to evaluate changes in trend, mean, level, and variability of the data. In addition, the percentage of non-overlapping data was calculated by counting the number of data points in the intervention phase that did not overlap with the highest data point in the baseline phase, dividing the total number of data points in the treatment phase, and multiplying by 100.

Pre-and post-test assessment data were compared for the following tests: (a) TORC-4; (b) WKT, (c) WPT, and (d) WM/SUT. The pre- and post-test raw scores of the five subtests within

the TORC-4 were converted to grade equivalent and scaled scores. Scaled scores and grade equivalent scores are reported to descriptively compare student pre- and posttest performances. Finally, the adapted CIRP mean scores for each participant are reported.

Chapter 4

Results

CLUES Strategy Probes

Baseline phase. Figure 1 shows each participant's percentage of correct strategy knowledge and strategy use steps. During baseline, the percentage of strategy use on the CLUES probe for Tamara, Narcisa, Victor, and Sarita was 0%. During baseline, the number of strategy knowledge steps for all participants was 0%. The data were stable for all four participants during the baseline phase with no variability.

Strategy use. After introduction of the CLUES intervention phase an immediate change in level of strategy use was apparent for all four participants. An immediate change in level and an upward accelerating trend can be seen in Tamara's CLUES strategy use data with a mean of 87.1% (range=63%-100%) and 100% non-overlapping data points.

For Narcisa, the introduction of the CLUES intervention resulted in an immediate change in level and an upward trend with a mean of 82.4% (range=40%-100%) and 100% non-overlapping data. Narcisa had a slight decreasing trend during sessions 4 and 5 but had a score of 100% for strategy use on session 6. After an absence following session 7, Narcisa's strategy use score decreased slightly and then increased to 100% mastery during session 9. A slight decreasing trend in the morpheme data was apparent during sessions 6, 7, and 8.

Victor's CLUES strategy use shows a change in level and an upward trend with a mean of 70.3% (range=13%-100%) and 100% non-overlapping data. Victor was absent between session 7 and 8. Victor's strategy use improved to 88% on session 9 and 10.

An immediate change in level can be seen in Sarita's CLUES strategy use with a mean of 90% (range=62%-100%) and 100% non-overlapping data. Despite some variability, Sarita's data remained greatly above baseline levels throughout all sessions. Sarita had frequent absences

between sessions 1 through 5 but her morpheme data remained above baseline level throughout the intervention.

Strategy knowledge. Following the introduction of the CLUES intervention phase, an immediate change in level of strategy knowledge was apparent for all four participants. An immediate change in level and upward trend can be seen in Tamara's CLUES strategy knowledge data with 88.3% (range=60%-100%) with 100% non-overlapping data. For Narcisa, introduction of the CLUES intervention resulted in an immediate change in level compared to baseline and an upward accelerating trend can be seen in his ability to correctly write strategy steps with a mean of 83.4% (range=73%-100%) with 100% non-overlapping data. Victor's CLUES strategy knowledge data shows a change in level and an upward trend with a mean of 88% (range=47%-100%) and 100% non-overlapping data. Victor's strategy knowledge data had very little variability was apparent between session 4 and 5 and between sessions 7 and 8. Following the introduction of the CLUES intervention phase an immediate change in level from baseline to intervention is apparent in Sarita's ability to correctly write strategy steps with a mean of 72.4% (range=62%-80%). Despite Sarita's frequent absences, her strategy use remained stable.

Generalization Probes

Controlled and uncontrolled syllable baseline probes. Figure 1 shows each participant's percentage of correctly written word part meanings and science words on the uncontrolled and controlled syllable generalization probes. During baseline, the mean percentage of correctly written word part meanings and science words on both the CLUES controlled syllable and uncontrolled generalization probes for Tamara, Narcisa, Victor, and Sarita was 0%.

Controlled and uncontrolled syllable intervention probes. During intervention, the mean percentage of correctly written word part meanings and science words on the CLUES controlled syllable generalization probes for Tamara was 15.3% (range=0%-46%) and the mean percentage for uncontrolled was 5.7% (range=0%-17%) over three sessions. For Narcisa, the mean percentage of correctly written word part meanings and science words on the controlled syllable probe was 49% (range=17%-67%), with a mean percentage of 23.3% (range=17%-36%) on the uncontrolled syllable probe over three sessions. The mean percentage of correctly written word part meanings and science words on the controlled syllable probe for Victor was 55.7% (range=33%-67%) with a mean percentage of 22% (range=0%-33%) on the uncontrolled syllable probe over three sessions. Finally, Sarita's mean percentage of correctly written word part meanings and science words on the controlled syllable probe was 18.3% (range=0%-38%) with a mean percentage of 1l% (range=0%-33%) on the uncontrolled syllable probe over three sessions.

A controlled generalization probe and uncontrolled generalization probe were administered to all four participants following the second maintenance probe. Tamara scored 17% for correctly writing and defining word part meanings and science words on the controlled generalization and scored of 0% on the uncontrolled generalization probe. Narcisa correctly wrote and defined word part meanings and science words with 83% accuracy on the controlled syllable generalization probe and scored 0% on the uncontrolled syllable probe. Victor correctly wrote and defined word part meanings and science words with 33% accuracy on the controlled probe and scored 33% on the uncontrolled probe. Finally, Sarita correctly wrote and defined word part meanings and science words with 50% accuracy on the controlled generalization probe and scored 0% on the uncontrolled probe.

Maintenance Probes

Strategy Use. Data for all four students indicated treatment gains for correctly writing and defining word parts and science words on the CLUES probe were maintained. All students' performance exceeded that of their baseline performance. However, all four students had lower strategy use scores compared to their performance during the intervention phase. Tamara's ability to correctly write and define word parts and science words decreased 2 weeks post-instruction to 37% and then increased to 63% at 1 month post-intervention. Narcisa's ability to correctly write and define word meanings and science words decreased 2 weeks post-instruction to 55% and further declined to 45% at 1 month post-intervention. Similarly, Victor's performance for correctly defining and writing word part meanings and science words decreased to 54% at 2 weeks post-intervention and then increased to 68% at 1 month post intervention. Sarita's ability to correctly write and define science word meanings and science words decreased to 73% 2 weeks post intervention and declined to 64% at 3 weeks post intervention.

Strategy Knowledge. Data for all four students indicated treatment gains for correctly writing strategy steps on the CLUES probe were maintained. All students' performance exceeded that of their baseline performance and was maintained compared to the strategy knowledge performance during the intervention phase. Tamara's performance for correctly written CLUES strategy steps maintained 2 weeks post-instruction at 100%, then slightly decreased to 93% at 1 month post-intervention. Similarly, Narcisa's ability to correctly write CLUES strategy steps was maintained 2 weeks post-instruction at 100% and slightly decreased to 93% at 1 month post intervention. For Victor, his performance to correctly write CLUES strategy steps slightly increased 2 weeks post-instruction to 100% and slightly decreased to 93%

1 month after intervention. Sarita's ability to correctly write CLUES strategy steps increased 2 weeks following instruction to 100% and was at 100% 3 weeks post intervention.

Pre-Post-tests

WKT. Results for the WKT for all four participants also reflected slight improvement (see Table 2). Tamara had a score of 0% on the WKT pre-test compared to a score of 22% on the WKT post-test. Narcisa's WKT pretest score was 0% compared to a score of 7% at post-test. Victor scored 0% on the WKT at pre-test compared to a score of 6% at post-test. Sarita's score on the WKT pretest was 0% and increased to a score of 16% at post-test.

WPT. All four participants showed improvements on the WPT. Tamara's had a score of 0% on the WPT pre-test compared to a score of 16% at post-test. Narcisa's pretest score on the WPT pre-test was 0% and slightly increased to a score of 12% at post-test. Victor's WPT pre-test score was 0% compared to a score of 4% at post-test. Sarita had a score of 0% at pre-test in comparison to a score of 16% at post-test.

WM/SUT. Results for the WM/SUT for all four participants on pre- and post-tests indicate improvement. Tamara's WM/SUT pre-test score was 0% compared to a score of 62% at post-test. Narcisa's WM/SUT pre-test score was 0% and increased to a score of 73% at post-test. Victor's WM/SUT pre-test score was 0% compared to an increased score of 72% at post-test. Finally, Sarita's WM/SUT pretest score was 0% and increased to a score of 71% at post-test.

TORC-4. TORC-4 screening and post-intervention data were analyzed for Tamara, Narcisa, Victor, and Sarita (see Table 3). At pretest, Tamara, Narcisa, Victor, and Sarita's grade equivalent scores on the Relational Vocabulary subtest were 5.5, 4.8, 4.1, and 6.4, respectively compared to their post-test scores of 3.2, 3.5, 3.2, and 2.9, respectively. On the Sentence Completion subtest, Tamara, Narcisa, Victor, and Sarita's grade equivalent scores were 5.0, 5.6 5.0, and 5.9, respectively at screening, compared to their post-test scores of 5.6, 4.5, 5.0, and 7.8,

respectively. In addition, Tamara, Narcisa, Victor, and Sarita scored 8.5, 9.2, 4.2, and 7.4, respectively on the Paragraph Construction subtest during pretest compared to their post-test scores of 4.9, 7.9, 5.9, and 1.7, respectively. Moreover, Tamara, Narcisa, Victor, and Sarita's grade equivalent scores on the Text Comprehension were 4.8, 5.4, 4.0, and 4.8, respectively at pretest compared to scores of 4.8, 6.1, 2.2, and 4.2, respectively at post-test. Finally, Tamara, Narcisa, Victor, and Sarita received grade equivalent scores of 5.1, 5.0, 4.1, and 4.9, respectively on the Contextual Fluency subtest compared to scores of 5.8, 5.8, 4.6, and 5.8 respectively at post-test.

Social Validity

Overall, students' satisfaction with the intervention was relatively high as reflected on the adapted CIRP. Tamara's satisfaction with the intervention was high with a post-intervention adapted CIRP mean score of 4.90 (range=4-6). She indicated that she felt that "the intervention was helpful" but suggested reducing "the amount of steps to find the meaning of the unknown word." Narcisa's satisfaction with the intervention was relatively high with a post-intervention adapted CIRP score of 5.71 (range=5-6). She indicated that she felt that "it was a very good strategy to help me learn words" but suggested that the use of flashcards be added to instruction to "help me remember the word part meanings and science word meanings." Victor's satisfaction with the intervention was relatively high with a post-intervention adapted CIRP score of 5.71 (range=4-6). He indicated that he felt that the intervention "helped me learn new words" but he suggested "not to write the CLUES steps multiple times" or during each instructional format. Finally, Sarita's satisfaction with the CLUES intervention was relatively high with a post-intervention adapted CIRP score of 5.57 (range=3-6). She thought the strategy "was easy to use" but suggested that the "instructional pace should be faster."

Chapter 5

Discussion

The purpose of the current study was to investigate the effects of teaching a vocabulary strategy that can be used for contextual analysis and morphemic analysis as applied to science words to a small sample of ELLs with RD. The findings and implications are discussed with respect to the research questions addressed in the study. Additionally, limitations and recommendations for future research are described.

Tamara, Narcisa, Victor, and Sarita all made significant gains in both strategy knowledge and strategy use compared to baseline. Additionally, all four students maintained their knowledge of the CLUES steps. Two of the students maintained their gains and generalized morpheme definitions 1 month following intervention. All four of the students scored higher on the generalization probe with controlled syllables compared to the probes with uncontrolled syllables. Finally, the CIRP results of all three participants indicated they found using the CLUES strategy acceptable.

This study both contributes to and extends the limited vocabulary literature for ELLs with RD by demonstrating that secondary ELLs with RD can integrate contextual and morphemic analysis to analyze science words. Students demonstrated this by using a sequence of steps to analyze and make predictions about unknown morphemes and science words. Further, this study used a variety of effective vocabulary approaches (i.e., reviewing examples and non-examples of the word's meaning, breaking words into parts, inferring the word's meaning from context) to help students gain a deep understanding of a word's meaning. Similar to previous literature, ELLs with RD benefitted from engaging, rich, explicit, and systematic vocabulary instruction to understand the meaning of complex words (Biemiller, 2008). These findings were similar to the

initial Helman et al. (2015) and other studies (Harris et al., 2011; Fisher et al., 2012; Kieffer et al. 2012) in which students benefitted from explicit contextual analysis and morphemic analysis instruction.

This study also represents a second effort in the vocabulary literature to study the effects of teaching the meaning of commonly used Greek and Latin science roots and most common prefixes and suffixes using explicit instruction for secondary ELLs with RD. Considering vocabulary is the greatest hindrance of ELLs with RD's academic success (Carlo et al., 2004; Proctor et al., 2005), emphasis on explicit vocabulary strategy instruction is critical. Similar to their peers without RD, ELLs with RD benefitted from explicit vocabulary instruction using generative strategies (Kieffer & Lesaux, 2012). Results of this study indicate that the CLUES intervention is a powerful tool with regard to generative vocabulary strategies that teach the meaning of word parts and how to predict the meaning of unknown science words. This is important because nearly 50% of the words students encounter in academic text are unknown to them, so their ability to predict unknown words is essential (Harris et al., 2011).

This is the first study conducted with secondary ELLs with RD that investigated whether students' ability to use CLUES to define word parts and science words would be different with controlled versus uncontrolled syllables from fourth grade science text. Specifically, generalization probes were used to analyze gains post-intervention and investigate transfer of the strategy skills without use of the organizer. Jitendra et al. (2004) noted that less than 30% of the vocabulary intervention studies included generalization and only 56% of the studies included maintenance assessments. Generalization of skills is challenging for students with RD (Jitendra et al., 2004). In this study, all four students generalized their knowledge of the CLUES strategy without a visual organizer. Although students had greater gains on the generalization probe with

controlled syllables, their performance was still below educational mastery of 80% or higher (Deshler et al., 2001). The results are similar to previous research that suggests that students need specific and explicit instruction in generalizing vocabulary strategies.

All students met the education mastery criterion of 80% or higher on their strategy use steps and their strategy knowledge before the last CLUES probe. This indicates that they used the meta-cognitive strategies learned during intervention to select the appropriate morpheme meanings using context. The students used the strategy steps to identify key phrases to define the word parts and the science word. They also used self-regulation skills to remember to re-read the sentence, check the context to define the morphemes, and define the morpheme. As students acquired the strategy steps, the self-checking may have improved their outcomes as students used comprehension monitoring strategies, including the use of a dictionary, to find and then define the science word.

Strategy Knowledge

It was hypothesized that the CLUES strategy would increase the accuracy of writing CLUES steps for ELLs with RD. This hypothesis was confirmed for all four participants. Specifically, all four participants immediately had a change in level from the last baseline probe and met the criterion of 80% or higher on at least one of the CLUES probes. One participant, Sarita, scored 100% mastery on the CLUES probe given 1 month post-intervention, indicating that she was able to recall all five steps accurately over time. In comparison to Helman et al. (2015), students wrote the CLUES steps with greater accuracy. This is most likely attributed to the reduction in the number of steps, because students had to recall and the concise wording of each step. This is consistent with the research that has shown students with RD typically hold

smaller amounts of information for a short amount of time and need more opportunities for practice compared to their typical peers (Pimperton & Nation, 2010).

Strategy Use

It was hypothesized that the CLUES Strategy would result in improved accuracy of writing word parts, word part meanings, and whole science word meanings. This hypothesis was confirmed for all four participants. Specifically, all four participants had an immediate increase in level and trend compared to the last baseline probe and met the criterion of 80% or higher on several probes. Although there was some variability in Narcisa's and Victor's data, their performance maintained well above baseline throughout the intervention sessions. Students used their knowledge of morphemes and context to help them accurately analyze and define word parts and science words better than in the initial Helman et al. (2015) study. One possible reason for the improved accuracy may be the additional lessons that were provided, the continuous review of the previously learned terms (e.g., context, morphemes, roots), and the review of the roots. As the research suggests, one important component of explicit instruction for students with RD is judicious review of information (Carnine et al., 1984).

Tamara, Narcisa, Victor, and Sarita were able to integrate two generative strategies, contextual analysis and morphemic analysis, to help them identify word part meanings and then define each word part. All four students were able to recall the taught root on all of the CLUES probes. The participants' accuracy with correctly writing the roots is attributed to the explicit instruction on roots they received throughout the lesson. Students were exposed to the definition of the root and then discussed that root during teacher-led, guided, and independent practice. Students also defined the taught word parts at the end of each lesson. Vocabulary research

indicates that students must have multiple exposures of words and word parts in order to retain meaning (Biemiller, 2008; Scott & Nagy, 2000).

All four students were better able to identify and define prefix word part meanings with greater accuracy compared to their ability to identify and define suffix word part meanings. Specifically, Tamara correctly identified prefixes on eight probes, Narcisa on seven probes, and Sarita and Victor on six probes. In comparison, Tamara correctly identified six suffixes on the CLUES probes, Narcisa and Victor correctly identified five suffixes on the CLUES probe, and Sarita correctly identified four suffixes on the CLUES probe. Research indicates that words composed of complex prefixes and suffixes are challenging for all students, particularly ELLs with reading difficulties (Kieffer & Box, 2013; Reed, 2008). Suffix word parts are difficult for students to recognize because the suffix is often abstract or impacts the grammar of the word (Wysocki & Jenkins, 1987). In comparison, prefixes are usually adjectives and are descriptive in nature. Nonetheless, research has demonstrated the importance of providing explicit and systematic instruction in high frequency word parts (e.g., prefixes, roots, suffixes) so that students can then better generalize those meanings when seen in other unknown words.

Maintenance of Strategy Knowledge

It was hypothesized that the participants would maintain their knowledge of the CLUES steps 2 weeks and 1 month post-intervention. This hypothesis was confirmed for all four participants. Although three of the four participants slightly decreased 1 month post-intervention, their scores still indicated that they remembered the steps without intervention. One participant, Sarita, remembered the steps with 100% mastery 2 weeks and 1 month post instruction. This was surprising because her ability to write the CLUES steps during instruction was below mastery across most of the CLUES probes. Sarita's decreased ability to accurately write the CLUES steps

may be attributed to delayed acquisition of the strategy. In comparison to the initial Helman et al. (2015) study, all four participants maintained their ability to write the CLUES steps with greater accuracy, possibly attributed to the longer duration of instruction and additional opportunities for using the strategies. Additionally, the number of strategy steps was condensed from 8 steps to 5 steps to help students more easily remember the strategy.

Maintenance of Strategy Use

It was hypothesized that the participants would maintain their use of the CLUES strategy to analyze and define word part meanings and science words 2 weeks and 1 month post intervention. This hypothesis was not confirmed. Although students maintained their ability to define and write word parts and science words with greater accuracy compared to baseline, all four of the participants had decreased accuracy compared to their last intervention probe. Two of the participants improved in their ability to define and write the word parts 1 month following instruction. However, the scores were lower compared to students' accuracy during intervention. Students' maintenance performance was compared to the participants in the Helman et al. (2015) study. During the maintenance phase of the original study, students had less accuracy in defining words and meanings then improved in their ability to write words two months following intervention. The participants in the present study showed the same loss of accuracy on the first maintenance probe then did not improve on the final maintenance probe. This may be attributed to students need for additional practice in order to generalize the skills.

Controlled and Uncontrolled Generalization Probes

It was hypothesized that the participants would generalize the CLUES strategy to define unknown science words from science text without the use of a graphic organizer. This hypothesis was not confirmed for all four participants. Specifically, all four participants generalized their

ability to use CLUES to define unknown science words in the sentences with a controlled number of syllables, and met educational mastery criterion of 80% or higher on the probe. However, all four participants had greater accuracy defining word parts and unknown science vocabulary on the probes with controlled number of syllables compared to the sentences with uncontrolled number of syllables selected from fourth grade science text. This is problematic for one main reason. If secondary students are having difficulty with content area text at a fourth grade level, what are the implications for younger students who have an even more limited vocabulary reading these content area texts?

It is concerning that secondary ELLs with RD had difficulty identifying adequate word part meanings and science word meanings from fourth grade text. This implies that secondary ELLs with RD, even when given materials at their appropriate instructional reading level, may still not be adequately prepared to analyze the academic vocabulary provided in the fourth grade text. This is consistent with the vocabulary literature in that students who are not equipped with specific strategies to help them navigate the text, especially vocabulary, will continue to have challenges comprehending the content (Harmon et al., 2005). One reason for students' difficulty adequately identifying word parts can be attributed to the need for additional practice learning the meanings of the word meanings, particularly having students learning the prefix and suffix word parts. In addition, students who are reading at a fourth grade level still have difficulty with phonological word recognition skills, one of the most common deficits associated with the identification of a learning disability. Furthermore, fourth grade is a time when the vocabulary gap between skilled and less skilled learners accelerates (Chall et al., 1990), a phenomenon that was magnified for these secondary students. The current study suggests the necessity of teaching explicit and systematic generalization skills to help students transfer their knowledge of the

CLUES strategy with use of regular text. In previous vocabulary intervention studies, minimal emphasis was given to teach students how to apply generalization strategies (Jitendra et al., 2004). Although students fared better in their ability to generalize CLUES on the controlled syllable probes, all four students received scores lower than 60% on the uncontrolled probes. One possible reason that students did not accurately identify the word parts, define the word parts, and define the science word could be attributed to the lack of explicit instruction on how to generalize the use of CLUES using typical science text and without the use of a graphic organizer.

This study also suggests that using known roots on the controlled and uncontrolled probes may have better measured students' ability to generalize their knowledge of CLUES on the probes. Students may have been more likely to identify appropriate word part meanings if they knew the meaning of the root morpheme. As a result, it would have helped students to break the science word into its correct word parts. For example, all four participants often incorrectly identified the morpheme by placing it on the incorrect line (e.g., writing 'chloro' on the root line instead of on the prefix line). In addition, students often wrote down an incorrect meaning for the word part meanings that were identified. Finally, some of the participants only wrote down the word part meanings as the definition instead of including additional clues from the text as they had practiced during instruction.

Maintenance of Controlled and Uncontrolled Generalization Probes

It was hypothesized that participants would generalize their use of the CLUES post-intervention. This hypothesis was not confirmed for all participants. Narcisa and Sarita both improved in their ability to generalize the CLUES when given controlled syllables on the maintenance probe. However, their accuracy was below educational mastery criterion (Deshler et

al., 2001). Although three of the participants performed better on the controlled syllable probes, Sarita performed similarly on both maintenance probes. Therefore, the results should be interpreted with caution.

WKT

Students made minimal gains on the WKT, a test used to measure students' ability to recognize and define word parts and science words (see Table 3), from pre-test to post-test. Several factors may have contributed to this lack of growth based on the results from this study and the initial Helman et al. (2015) study. One factor may be the test structure. The text directions, specifically the test examples, did not provide students an opportunity to practice how to identify a word part, write the word in a sentence, or define the word. Furthermore, test item structure was problematic since each word was presented without context, resulting in students only writing the meaning of the each morpheme in the word.

The lack of clarity as to how to complete the test items may have resulted in the small gains on the WKT in both the initial Helman et al. (2015) study and this investigation.

Students did not accurately define the word parts in isolation on the WKT. It seems that students had difficulty identifying and writing down definitions of morphemes when presented with the word in isolation without context of the whole word. Initially, Helman et al. (2015) suggested that the minimal gains on the WKT were attributed to a lengthy test. However, the issue may be both presenting students with all 40 science words to define, including defining the word parts and formulating a sentence that includes the word, and presentation of the word parts in isolation.

WPT

Students made minimal gains on the WPT, a test used to measure students' ability to write the meanings of morphemes, from pre-test to post-test. Results were similar to the Helman et al. (2015) study. The authors discussed the amount of morphemes listed on the test as a possible factor for minimal gains. Therefore, the WPT included morphemes taught during instruction and an additional 10 novel morphemes added to assess generalization. In both studies, students listed at least 90% of the instructed roots, suggesting that providing students explicit instruction and multiple exposures of these roots will lead to better retention. Students did not retain the prefixes and suffixes most likely due to minimal exposure of these morphemes during lessons. The students did not receive additional practice identifying the different morphemes. Perhaps review of the previously learned prefixes, roots, and suffixes before and after each lesson would be beneficial. Based on explicit and systematic instruction, students with RD retain information better when provided with review at the beginning and end of lessons (Baddeley, 1974; Swanson et al., 2004). Additionally, students had to recall the six terms taught, the rules about each term, and 10 roots previously taught. Students were able to recall the 10 items but not accurately recall each definition and the associated rules (e.g., context, morphemes). This could be attributed to providing too much information for students to recall. For example, condensing the number of words in the rules and definitions may help each student better store the information. Second, students did not correctly write any of the novel morphemes. This may be attributed to students having difficulty writing definitions of morphemes without any context.

WM/SUT

All of the participants made their greatest gains from pre-test to post- test on the WM/SUT, a measure to assess the effects of the intervention on student's use of the CLUES strategy steps, correctly written science definitions, and correctly written context and morpheme

rules. Students made greater gains in this study in comparison to the Helman et al. (2015) study. Helman et al. found that participants were not able to recall all of the CLUEWORD steps and did not correctly identify the meaning of the root morphemes. In this study, all four participants recalled the CLUES strategy to help them define unknown morphemes and science words using contextual and morphemic analysis strategies. Additionally, all four participants recalled the definition of roots and morphemes on the two questions that required students to use CLUES to figure out unknown science words in sentence context. However, similar to Helman et al., three of the four participants had difficulty recalling all four of the following definitions: context, morpheme, prefix, and suffix. The lack of recall may be attributed to students' need for additional review and practice defining these terms. As noted, research shows that ELLs with RD have challenges with working memory or their ability to temporarily store information while processing incoming information, preventing information from being stored in long-term memory (Swanson et al., 2012). Therefore, ELLS with RD in this study may have benefitted from additional review of the words with potential visual aids or organizers.

Based on the current literature for meeting educationally significant scores of 80%, all four participants scored below the criterion (Deshler et al., 2001). Although levels were below mastery, Narcisa, Victor, and Sarita scored above 70%, indicating that they acquired the strategy. The points that were deducted based on the recall of the definitions may have attributed to the low scores. Another possible factors for the lower score was that participants had to recall a minimum of two rules about using context, morphemes, prefixes, roots, and suffixes. Most of the students could not recollect the information. Students may benefit from additional review of the terms or by another way to show they know what context means (e.g., underlining context phrases or writing a sentence and circling the phrases around an unknown word). In general,

ELLs with RD may benefit from additional practice writing, stating, or visualizing the terms that were taught.

Test of Reading Comprehension

All four participants showed decreased performance across most subtests on the TORC-4, measuring reading proficiency. Interestingly, Victor's decreased results may be attributed to his lack of motivation to complete testing. Students completed the post-tests in the last few weeks of school, following other district-wide assessments. Another possible reason for decreased scores may be attributed to the short intervention time and the small number of science words taught. Also, research has shown that students have not performed well on global measures in comparison with specific measures created based on the intervention (Elleman et al., 2009). In this particular study, the participants may not have performed as well on the Relational Vocabulary portion of the subtests due to the discrepancy of the TORC-4 not being well matched to typical classroom instruction and the students' cultural background knowledge. Finally, the decrease in scores may be attributed to the participants' attempt to apply the CLUES strategy while reading sentences in the Relational Vocabulary subtest that did not hold syllables constant. Students were provided 15-20 syllables of instructional context during CLUES instruction to help them figure out whole science word meanings. Therefore, the context within the sentences may have been too complex for students to identify the word part meanings or accurately define the whole word.

Limitations

Several limitations of this study are noted**.** One possible threat to internal validity was instrumentation since the WKT, WPT, and WM/SUTT were not standardized measures. The WKT may provide limited information due to the possibly confusing test format. The TORC-4

may also not have been sensitive enough to measure gains from a small sample of vocabulary lessons. Although the number of lessons increased from the initial Helman et al. (2015) study, researchers suggested that vocabulary instruction should be given throughout a longer period of time and for a longer duration (e.g., more than 50 lessons; Elleman et al., 2009; Jitendra et al., 2004; Hairell, 2011). Further, testing bias may be another limitation because students were given pre-tests in February and then received the post-tests in May. There was a very short amount of time between tests, which is a possible threat to internal validity.

Another limitation of this study is that students did not maintain their scores of strategy use at a socially significant level (i.e., anything below 70% is considered below a "C" grade in today's schools) on the CLUES probes 2 weeks and 1 month following instruction compared to intervention.

A third limitation is possible experimenter bias as the investigator administered a few of the CLUES baseline probes and intervention probes. The limitation is somewhat mitigated, given the high fidelity of the procedural integrity data. Also, the possibility is reduced because the assessment administrations were audiotaped. Nonetheless, experimenter bias cannot be ruled out.

Implications for Research and Practice

There are several implications based on the results of this research**.** One implication is that practice is critical to vocabulary acquisition of science words as supported by previous literature (Jitendra et al., 2004; Pany et al., 1982). Practice is important because acquisition of science words may result in greater maintenance and generalization of the strategies. Further, it is important for ELLs with RD to acquire vocabulary so that they can comprehend complex text. Given the importance of practice, future vocabulary research should look at how classroom environments can maximize time to allow students to apply newly learned vocabulary.

A second implication is that CLUES strategy instruction may be beneficial for ELLs without RD and other groups of students. Most of the literature about ELLs pertains to general education students. Therefore, it is likely that the CLUES strategy would be useful for ELLs (including those with language backgrounds other than Spanish) learning generative word learning strategies. However, ELLS with RD may need additional practice and explicitness of instruction in comparison to other students due to their acquisition of both language and to address their reading deficits. Future studies should investigate how different groups of students respond to using CLUES strategy instruction to improve vocabulary acquisition across content areas.

Based on the extended findings of the CLUES, future research is necessary before this intervention can be considered fully effective. Additional studies should be conducted to extend the generality of the findings across larger populations and content areas using group designs. Although this intervention is a replication of Helman et al. (2015) with another small group of secondary ELLs with RD, supplementary studies across a larger number of this population are necessary to extend the generality of the findings. For example, one possible extension of this design would be to investigate the effects of having teachers use the CLUES strategy with a larger group of secondary ELLs with RD using a randomized controlled trial or quasi-experimental group (e.g., pre-test post-test) design. In this design, students would be randomly assigned into one of three groups: CLUES strategy instruction, morphemic analysis-only instruction, and the control group that would receive typical vocabulary instruction. In the morpheme analysis only group, students would receive a shorter mnemonic similar to the Harris et al. (2011) study to investigate the effectiveness of using morphemic analysis alone compared to using both contextual and analysis strategies (i.e., CLUES). Both interventions could then be

compared with the control group. Additionally, instructional components could be added to teach students to generalize CLUES without the use of graphic organizers and with the use of real science texts.

Another future direction is to investigate the effects of CLUES for the vocabulary acquisition of secondary ELLs with RD's in other content area such as mathematics, social studies, or English. It may be beneficial to conduct further single subject designs, with additional participants, in order to select the most common and appropriate mathematic, social studies, or English vocabulary for secondary students. This is consistent with suggestions by Hairell et al. (2011) that additional research informing vocabulary instructional practice in content areas is needed. Teachers could help in the process of selecting specific content (e.g., mathematics and social studies) and creating word lists. It may be helpful for students to learn select mathematic, social studies, or English morphemes (e.g., prefixes, roots, and suffixes) using discrete trial training prior to receiving the training lessons. For example, Fisher et al. (2012) taught four secondary students with RD a specific number of morphemes using a discrete trial training method. All four students successfully acquired 35 common word parts and word part definitions. This additional training may have increased students' ability to recall and to deeply understand the science words and helped them generalize their knowledge of the word parts in different content area text. It would be important to investigate whether students can identify the morphemes learned during the discrete trial training in the actual intervention lessons.

An additional future direction is to increase the number of lessons taught during intervention. Although this study provided 10 lessons, recent literature reviews indicate that 10-50 is a small number of lessons (Elleman, 2009; Hairell, 2011). Therefore, additional studies

may extend the number of CLUES intervention lessons across the academic year and track student progress using a longitudinal study design.

It would be important to incorporate explicit instruction of the CLUES strategy for generalization to regular science textbooks without use of the graphic organizer. Generalization is an essential skill for students with disabilities to learn and this type of instruction is lacking in the most recent vocabulary intervention literature (Jitendra et al., 2004).

It would also behoove future researchers to investigate the effects of adding background knowledge about each science word during CLUES instruction. Current and previous ELL research indicates that providing background knowledge for ELLs, particularly with vocabulary, will support their understanding of concepts being taught across academic contexts (Kieffer & Lesaux, 2011; Shanahan & August, 2006; 2010; Shanahan et al., 2014). Further, Blachowitz and Fisher (2000) recommended ELL students have multiple ways and opportunities to encounter new words paired with clear images (visual and/or auditory) to facilitate strong mental connections between the forms and meanings of words. For example, ELLs might benefit from the use of short technology clips that illustrate the meaning of the words students are learning (e.g., cytoplasm, leukocyte) and other content area words in mathematics (e.g., trigonometry) and social studies (e.g., revolution). ELLs with RD could be introduced to a short video clip at the beginning or end of the CLUES lessons to help them make connections to the text and expand what they already know about the science word.

Finally, psychometrics of the vocabulary measures should be explored in future studies. Specifically, the WPT, WKT, and WM/SUT tests should be further investigated to determine their psychometric properties, including reliability and validity, and then refined, if needed. Future researchers should examine the cultural validity of the vocabulary assessment measures.

Cultural validity of an assessment will minimize test bias that may lead to inaccurate test results for diverse student populations. Cultural sensitivity in assessment is complex because test constructors must be conscious of culturally specific behaviors or areas of development, such as ethnic identity, that have not been viewed as significant concerns in test theory (Padilla, 2001). Some factors that may impact the cultural validity of assessment measures include language, dialect, register of tests, social and cultural aspects of the language and testing context, and the classroom ecology surrounding the testing environment (Short & Sabantini, 2009).

One way to examine cultural differences in the vocabulary measures is to enlist a panel to review all measures. The panel would include researchers, teachers, and others who are members of different cultural members. These individuals could review the different tests, directions, and constructed sentences. The researchers would bring their knowledge and expertise in the area of ELLs, content area, and English. The different cultural members would provide feedback to examine whether there are cultural differences in the constructed sentences and suggest ways to make it valid and reliable across diverse populations.

It is also important to develop standardized vocabulary measures that measure students' vocabulary growth. In most vocabulary research, researchers have used researcher-constructed measures because these were found to be more effective at measuring students' comprehension growth. For example, Elleman et al. (2009) found that vocabulary instruction was effective at increasing students with RD's ability to comprehend text and used teacher-constructed measures to demonstrate growth. Elleman et al. (2009) noted that although the teacher-constructed measures were sufficiently sensitive to detect overall effects in comprehension and vocabulary, their ability to interpret growth was restricted due to the lack of confidence in the reliability and validity of the measures used. It is important that future vocabulary assessments have guidelines

and criteria for selecting words to assess and creating distractors that may prove useful for future standardized measures.

Conclusion

There is a consistent need for vocabulary intervention research to decrease the vocabulary gap in order to improve academic outcomes for ELLs with RD. Only one published vocabulary investigation (Helman et al., in press) included vocabulary with secondary ELLs with RD. The current study added to the literature on vocabulary by further investigating the effect of integrating two generative vocabulary strategies, contextual analysis and morphemic analysis, to improve acquisition of science words for secondary ELLs with RD. The effects of using CLUES to improve students' ability to analyze science words is promising considering that all four participants made immediate gains following introduction of the intervention. Given that this is a small sample of the population, additional research needs to explore the use of CLUES with larger student groups.

This study also added to the literature by investigating students' ability to maintain use of the CLUES strategy to analyze and define word part meanings and science words following intervention. All four participants maintained their ability to recall CLUES steps, although their performance was not at the level observed during intervention. Further exploration of additional explicit instruction in morphemes to help students better maintain gains should be conducted.

This study also added to the literature by assessing students' ability to generalize CLUES when given controlled and uncontrolled instructional text. Although students generalized CLUES when given controlled syllable text, it may behoove future researchers to teach secondary ELLs with RD how to generalize CLUES to real text without use of an organizer.

References

Abu-Rabia, S., & Siegel, L. (2002). Reading, syntactic, orthographic, and working memory skills of bilingual Arabic-English speaking Canadian children. *Journal of Psycholinguistic Research, 31*(6), 661-678.

Abbott, S. P., & Berninger, V. W. (1999). It's never too late to remediate: Teaching word recognition to students with reading disabilities in Grades 4-7. *Annals of Dyslexia, 49*, 223-250.

Adams, M. J. (1990). *Beginning to read*. Cambridge, MA: Bradford.

Alloway, T. P., Gathercole, S. E., Willis, C., & Adams, A. M. (2004). A structural analysis of working memory and related cognitive skills in young children. *Journal of Experimental Child Psychology, 87*, 85-106.

Anderson, R. C. & Nagy, W. (1992). In R. Barr, M. L., Kamil, P. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research, Vol. 2* (pp. 690-724).

Anders, P., Bos, C., & Filip, D. (1984). The effect of semantic feature analysis on the reading comprehension of learning-disabled students. In J.A. Niles & L.A. Harris (Eds.), *Changing perspectives on research in reading/language processing and instruction* (pp.162-166). Rochester, NY: National Reading Conference.

Anglin, J. M., Miller, G. A., & Wakefield, P. C. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development, 58* (Serial No. 238), 1-186.

Armbruster, B. B., & Gudbrandsen, B. (1986). Reading comprehension in social studies programs. *Reading Research Quarterly, 21*, 36-48.

Artley, A. S. (1943). Teaching word meaning through context. *Elementary English Review, 20*, 68-74.

Atkinson, R. C. (1975). Mnemotechnics in second-language learning. *American Psychologist, 30,* 821-828.

Aud, S., Wilkinson-Flicker, S., Kristapovich, P., Rathbun, A., Wang, X., and Zhang, J. (2013). The Condition of Education 2013 (NCES 2013-037). U. S. Department of Education, National Center for Education Statistics. Washington, DC. Retrieved (August 8, 2013) from http://nces.ed.gov/pubsearch.

August, D., Carlo, M., Dressler, C., & Snow, C. (2005). The critical role of vocabulary development for English language learners. *Learning Disabilities Research and Practice, 20,* 50-57. doi: 10.1111/j.1540-5826.2005.00120

August, D., & Gray, J. L. (2010). Developing comprehension in English language learners: Research and promising practices. In K. Ganske & D. Fisher (Eds.), Comprehension *across the curriculum: Perspectives and practices K-12* (pp. 225-246). New York: Guilford.

August, D. & Hakuta, K. (Eds.). (1997). *Improving schooling for language-minority children: A research agenda.* Washingtion, DC: National Academy Press.

August, D., & Shanahan, T. (2006). Developing literacy in second-language learners: Report of the national literacy panel on language-minority children and youth. Mahwah, New Jersey: Lawrence Erlbaum Associates.

August, D. & Shanahan, T. (2010). Response to a review and update on Developing Literacy in Second-Language Learners: Report of the National Literacy Panel on Language Minority Children and Youth, *Journal of Literacy Research, 42*(3), 341-348: doi: 10.1080/1086296X.2010.503745

August, D., & Siegel, L. S. (2006). Literacy instruction for language-minority children in special education settings. In D. August & T. Shanahan (Eds.), *Developing literacy in second*

language learners (pp. 523-553). Mahwah, NJ: Erlbaum.

August, D., & Snow, C. (2007). Developing vocabulary in English-language learners: A review of the experimental research. In B. Taylor & J. Ysseldyke (Eds.), *Effective Instruction for struggling readers, K-6* (pp. 84-105). NY: Teachers College.

Avila, E., & Sadoski, M. (1996). Exploring new applications of the keyword method to acquire English vocabulary. *Language Learning, 46*, 379-395.

Baddeley, A. D. (1983). Working memory. Philo-sophical Transactions of the Royal Society of London, B302, 311-324.

Baddeley, A. D. (1986). Working memory. New York, NY: Oxford University Press.

Baddeley, A., Gathercole, S., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological review*, *105*(1), 158.

Baker, S. K., Simmons, D. C., & Kameenui, E. J. (1995). Vocabulary acquisition: Synthesis of the research (Tech. Rep. No. 13). Eugene: University of Oregon, National Center to Improve the Tools of Educators.

Baker, S. K., Simmons, D. C., & Kame'enui, E. J. (1998). Vocabulary acquisition: Synthesis of the research, Tech Rep. No. 13. Retrieved August 4, 2013 from http://idea.uoregon.edu/~ncite/documents/techrep/tech13.html

Barr, S., Eslami, Z., & Joshi, R. M. (2012). Core strategies to support English language learners. *The Educational Forum*, *76*, 105-117.

Barrett, M.T., & Graves, M.F. (1981). A vocabulary program for junior high school remedial readers. *Journal of Reading, 25,* 146-150.

Baumann, J. F., Edwards, E. C., Boland, E., Olejnik, S., & Kame-enui. E.J. (2003). Vocabulary tricks: Effects of instruction in morphology and context on fifth-grade students' ability to derive and infer word meaning. *American Educational*

Research Journal, 40, 447-494. doi: 10.3102/00028312040002447

Baumann, J. F., Edwards, E. C., Font, G., Tereshinski, C. A., Kame'enui, E. J., & Olejnik, S. (2002). Teaching morphemic and contextual analysis to fifth-grade students. *Reading Research Quarterly, 37,* 150-176.

Baumann, J. F., & Kame'enui, E. J. (2003). Research on vocabulary instruction: Ode to Voltaire. In J. Flood, D. Lapp, J. R. Squire, & J. M. Jensen (Eds.), *Handbook on research teaching the English language arts* (2nd ed., pp. 604-632). Mahwah, NJ: Erlbaum.

Baumann, J. F., & Graves, M. F. (2010). What is academic vocabulary? *Journal of Adolescent & Adult Literacy, 54 (1),* 4-12.

Beck, I., McKeown, M. & Kucan, L. (2002). *Bringing words to life: Robust vocabulary instruction.* New York: The Gilford Press.

Beck, I., & McKeown, M., (1991). Conditions of vocabulary acquisition. In R. Barr, M. L. Kamil, P. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research, Vol. 2* (pp. 789-814). Mahwah, NJ: Erlbaum.

Beck, I. L., & McKeown, M. G. (2006). *Improving comprehension with questioning the author: A fresh and expanded view of a powerful approach*. New York, NY: Scholastic.

Beck, I. L., McKeown, M. G., & McCaslin, E. S. (1983). Vocabulary development: All contexts are not created equal. *The Elementary School Journal, 83*(3), 177-181.

Beck, I. L., Perfetti, C. A. , & McKeown, M. G. (1982). Effects of a long-term vocabulary instruction on lexical access and reading comprehension. *Journal of Educational Psychology, 74,* 506-521.

Bender,W. N. (2004*). Learning Disabilities: Characteristics, identification and teaching strategies* (5th Ed.), Montreal, QC: Pearson.

Berninger, V., Nagy, W., Carlisle, J., Thomson, J., Hoffer, D., Abbott, S., et al. (2003). Effective treatment for dyslexics in grades 4 to 6. In B. Foorman (Ed.), *Preventing and remediating reading difficulties: Bringing science to scale* (pp. 382-417). Timonium, MD: York Press.

Berninger, V., Nielsen, K., Abbott, R., Wijsman, E., & Raskind, W. (2008). Writing problems in developmental dyslexia: Under-identified and under-treated. *Journal of School Psychology, 46*, 1-21.

Biancarosa, G., & Snow, C. E. (2006). *Reading next- A vision for action and research in middle and high school literacy: A report to Carnegie Corporation of New York*. Washington, DC: Alliance for Excellence in Education. Retrieved from http://www.all4ed.org/files/ReadingNext.pdf

Biemiller, A. (1999, April). *Estimating vocabulary growth on ESL children with and without listening comprehension instruction*. Paper presented at the annual conference of the American Educational Research Association, Montreal, Quebec.

Biemiller, A., & Boote, C. (2006). An effective method for building meaning vocabulary in primary grades. *Journal of Educational Psychology*, *98*(1), 44.

Biemiller, A., & Slonim, M. (2001). Estimating root word vocabulary growth in normative and advantaged populations: Evidence for a common sequence of vocabulary acquisition. *Journal of Educational Psychology*, *93*, 498-520.

Bishop, D. V., North, T., & Donlan, C. (1996). Nonword repetition as a behavioural marker for inherited language impairment: Evidence from a twin study. *Journal of child Psychology and Psychiatry, 37*(4), 391-403.

Blachowicz, C., & Fisher, P. (2000). Vocabulary instruction. In M. L. Kamil, P. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research*,

Vol. 3 (pp. 503-523). Mahwah, NJ: Erlbaum.

Blachowicz, C., & Fisher P. J. (2006). Teaching vocabulary in all classrooms (3rd ed.). Upper Saddle River, NJ: Pearson Merrill Prentice-Hall.

Blachowicz, C. L. Z., Fisher, P. J., L., Ogle, D., & Watts-Taffe, S. (2006). Vocabulary: Questions from the classroom. *Reading Research Quarterly, 41*(4), 524-539.

Blachowitz, C. L., & Ogle, D. (2001). Reading comprehension: *Strategies for independent learners*.New York: Guilford Press.

Block, J. (2008). Issues for DSM-V: Internet addiction. *American Journal of Psychiatry, 165*, 306-307.

Bolger, D. J., Balass, M. Landen, E., & Perfetti, C. A. (2008) Context variation and definitions in learning the meaning of words: An instance-based learning approach. *Discourse Processes, 45,* 122-159.

Bos, C. S., Allen, A. A., & Scanlon, D. J. (1989). Vocabulary instruction and reading comprehension with bilingual learning disabled students. In *National Reading Conference Yearbook*. National Reading Conference.

Bos, C. S., Anders, P. L., Filip, D., & Jaffe, L. E. (1989). Semantic feature analysis and long term learning. In J. A. Niles & R. V. Lalick (Eds.), *Issues in Literacy: A research perspective (34th yearbook)* (pp. 42-46). Rochester, NY: National Reading Conference.

Boulware-Gooden, R., Carreker, S., Thornhill, A., & Joshi, R. M. (2007). Instruction of metacognitive strategies to enhance reading comprehension and vocabulary achievement of third-grade students. *The Reading Teacher, 61*(1), 70-77.

Bowers, P. N., Kirby, J. R., & Deacon, S. H. (2010). The effects of morphological instruction on literacy skills: A systematic review of the literature. *Review of Educational Research, 80,* 2, 144-179.

Brown, V. L., Wiederholt, J. L. & and Hammill, D. D. (1999). Test of reading comprehension (TORC-4). Austin, TX: Pro-Ed.

Brown, V. L., Wiederholt, J. L. & Hammill, D. D. (2009). Test of reading comprehension (TORC-4). Austin, TX: Pro-Ed.

Bryant, D. P., Goodwin, M., Bryant, B., & Higgins, K. (2003). Vocabulary instruction for students with learning disabilities: A review of the research. *Learning Disability Quarterly, 26,* 117-128.

Cain, K., Oakhill, J. V., & Elbro, C. (2003). The ability to learn new word meanings from context by school-age children with and without language comprehension difficulties. *Journal of Child Language*, 30, 681-694.

Cain, K., Oakhill, J. V., & Lemmon, K. (2004). Individual differences in the inference of word meanings from context: the influence of reading comprehension, vocabulary knowledge, and memory capacity. *Journal of Educational Psychology*, 96, 671-681.

Cain, K. (2007). Deriving word meaning from context: Does explanation facilitate contextual analysis? *Journal of Research in Reading, 30*(2), 1-13.

Calderon, M. E., & Minaya-Rowe, L. (2011). *Preventing long-term ELs: Transforming schools to meet core standards.* Thousand Oaks: Corwink, New York

Campbell, N. A., Williamson, B. & Heyden, R. (2003). *Biology: Exploring life*. Upper Saddle River, NJ: Pearson Education.

Carlisle, J. F., & Katz, L. A. (2006). Exploring the role of morphemes in word reading. *Reading Research Quarterly, 40,* 428-449.

Carlisle, J. F., Stone, C. A., & Katz, L. A. (2001). The effects of phonological transparency on reading derived words. *Annals of Dyslexia, 51,* 249-274.

Carlisle, J. F. (2007). Fostering morphological processing, vocabulary development, and reading

comprehension. In R. K. Wagner, A. E. Muse, & K. R. Tannenbaum (Eds.*), Vocabulary acquisition: Implications for reading comprehension* (pp. 78-103). New York: Guilford.

Carlo, M. S., August, D., McLaughlin, B., Snow, C.E., Dressler, C., Lippman, D. N., et al. (2004). Closing the gap: Addressing the vocabulary needs of English language learners in bilingual and mainstream classrooms. *Reading Research Quarterly*, *39*, 188-206. doi:10.1598/RRQ.39.2.3.

Carnine, D., Kameenui, E. J., & Coyle, G. (1984). Utilization of contextual information in determining the meaning of unfamiliar words. *Reading Research Quarterly*, 19, 188-204.

Casalis, S., Cole, P., & Sopo, D. (2004). Morphological awareness in developmental dyslexia. *Annals of Dyslexia, 54*, 114-138.

Cervetti, G. N., Jaynes, C. A., & Hiebert, E. H. (2009). Increasing opportunities to acquire knowledge through reading. In E. H. Hiebert (Ed.), *Reading more, reading better* (pp. 79-100). New York: Guilford.

Chall, J. S., Conard, S. S., & Harris-Sharples, S. (1991). *Should textbooks challenge students? The case for easier or harder textbooks*. New York: Teachers College Press.

Chall, J. S., Jacobs, V. A., & Baldwin, L. E. (1990). The reading crisis*: Why poor children fall behind.* Cambridge, MA: Harvard University Press.

Chamot, A. U., & O'Malley, J. M. (1994). *The CALLA handbook: Implementing the cognitive academic language learning approach*. Reading, MA: Addison-Wesley Publishing Company.

Chiappe, P., Hasher, L., & Siegel, L. S. (2000). Working memory, inhibitory control, and reading disability. *Memory & Cognition, 28*, 8-17.

Chiappe, P., Siegel, L. S., & Wade-Woolley, L. (2002). Linguistic diversity and the development of reading skills: A longitudinal study. *Scientific Studies of Reading, 6*(4), 369-400.

Chomsky, N., & Halle, M. (1968). *The sound pattern of English*. New York: Harper & Row.

Chu, S. Y., & Flores, S. (2011). Assessment of English language learners with learning disabilities. *The Clearing House, 84*, 244-248.

Cirino, P. T., Pollard-Durodola, S. D., Foorman, B. R., Carlson, C. D., & Francis, D. J. (2007). Teacher characteristics, classroom instruction, and student literacy and language outcomes in bilingual kindergartners. *The Elementary School Journal*, *107*(4), 341-364.

Coleman, R., & Goldenberg, C. (2010). What Does Research Say about Effective Practices for English Learners? Part IV: Models for Schools and Districts. *Kappa Delta Pi Record*, *46*(4), 156-163.

Collins, M. F. (2010). ELL preschoolers' English vocabulary acquisition from storybook reading. *Early Childhood Research Quarterly*, *25*(1), 84-97.

Condus, M. M., Marshall, K. J., & Miller, S. R. (1986). Effects of the keyword mnemonic strategy on vocabulary acquisition and maintenance by learning disabled children. *Journal of Learning Disabilities*, *19*(10), 609-613.

Coxhead, Averil. (2000). A new academic word list. TESOL Quarterly, 34, 213-238. http://language.massey.ac/nz/staff/awl/index.shtml.

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research, 49*(2), 222-251.

Cummins, J. (1981). Age on arrival and immigrant second language learning in Canada, *Applied Linguistics, 2,* 132-149.

Cunningham, A. E., & Stanovich, K. E. (1998). The impact of print exposure on word recognition. *Word Recognition in Beginning Literacy*, 235-262.

Dale, E. (1965). Vocabulary measurement: Techniques and major findings. *Elementary English, 42*, 82-88.

Davidson, J., & Miller, J. (2002). *Scholastic's READ 180: A heritage of research*. New York: Scholastic.

Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics*, *25*, 223–238.

Deacon, S. H., Kirby, J. R., & Bell-Casselman, M. (2009). How robust is the contribution of morphological awareness to general spelling outcomes? *Reading Psychology*, *30*, 301–318.

De Avila, A. & Duncan, S. E. (2000). *Pre LAS 2000 technical manual, English.* Monterey, CA: CTB/McGraw-Hill.

Deshler, D. D., Schumaker, J. B., Bui, Y. N., & Vernon, S. (2005). High schools and adolescents with disabilities: Challenges at every turn. In D. D. Deshler & J. B. Schumaker (Eds.), *High school students with disabilities: Strategies for accessing the curriculum* (pp. 1-34). New York: Corwin Press.

Dickinson, D. K., McCabe, A., Clark-Chiarelli, N., & Wolf, A. (2004). Cross-language transfer of phonological awareness in low-income Spanish and English bilingual preschool children, *Applied Psycholinguistics, 25,* 323-347.

Duke, N. K. (2000). 3.6 minutes per day: The scarcity of informational texts in first grade. *Reading Research Quarterly*, *35*, 202-224.

Duke, N. K. (2010). The real-world reading and writing U.S. children need. *Phi Delta Kappan, 95*, 3, 68-71.

Durgunoglu, A. Y. (2002). Cross-linguistic transfer in literacy development and implications for language learners, *Ann. of Dyslexia, 52,* 189-204

Ebbers, S. M. (2011). Vocabulary through Morphemes: Suffixes, Prefixes, and Roots for

Intermediate and Secondary Grades (Second Edition). Longmont, Colorado: Cambium Learning Group: Sopris.

Ebbers, S. M., & Denton, C. A. (2008). A root awakening: Vocabulary instruction for older students with reading difficulties. *Learning Disabilities Research & Practice, 23*(2), 90-102.

Ecchevarria, J., Vogt, M., & Short, D. (2004). *Making content comprehensible for English language learners: The SIOP model*. New York: Pearson Education, Inc.

Eleman, A. M., Lindo, E. J., Morphy, P., & Compton, D. L. (2009). The impact of vocabulary instruction on passage-level comprehension of school-age children: A meta-analysis, *Journal of Research on Educational Effectiveness, 2*(1), 1-44. DOI: 10.1080/19345740802539200

Filippini, A. L. (2007). *Effects of a Vocabulary-added Instructional Intervention for At-risk English Learners: Is Efficient Reading Instruction More Effective?*.Unpublished doctoral dissertation, University of California, Santa Barbara..

Fishley, K. M., Konrad, M., Hessler, T., & Keesey, S. (2012). Effects of GO FASTER on Morpheme Definition Fluency for High School Students with High-Incidence Disabilties. *Learning Disabilities Research & Practice, 27*(3), 104-115.

Fitzgerald (1995). Literacy and students who are learning English as a second language. The Reading Teacher, *46*(8), 638-647.

Fletcher, J. M., Coulter, W. A., Reschly, D. J. & Vaughn, S. (2004). Alternative approaches to the definition and identification of learning disabilities: Some questions and answers. *Annals of Dyslexia, 54,* 304-331.

Fowler, A., & Scarborough, H. S. (1999). Reading disability. In D.A. Wagner, R. L. Venezky, & B. V. Street (Eds.), Literacy: *An international handbook* (pp. 54-59).

Cumnor Hill, NJ: Westview Press.

Fowler, A., & Liberman, I. Y. (1995). Morphological awareness as related to early reading and spelling ability. In L. Feldman (Ed.), *Morphological aspects of language processing* (pp. 157-188). Hillsdale, NJ: Erlbaum.

Francis, D. J., Lesaux, N. K., & August, D. (2006). Language of Instruction. In August, D. & Shanahan, T. (Eds.), Developing literacy in second language learners: Report of the national literacy panel on language-minority children and youth. Mahway, New Jersey: Lawrence Erlbaum Associates, 123-139.

Fukkink, R. G., & de Glopper, K. (1998). Effects of Instruction in deriving word meaning from context: A meta-analysis. *Review of Educational Research, 69*, 261-285. doi: 10.310/00346543068004450

Fukkink, R.G., Blok, H., & De Glopper, K. (2001). Deriving word meaning from written context: a multicomponential skill. *Language Learning*, 51, 477-498.

Fukkink, R. G. (2005). Deriving word meaning from written context: A process analysis. *Learning and Instruction, 15*, 23-43.

Garcia, G. E. (1991). Factors influencing the English reading test performance of Spanish-speaking Hispanic children. *Reading Research Quarterly, 26(4),* 371-392.

Gathercole, S. E., & Baddeley, A. D. (1990). Phonological memory deficits in language disordered children: Is there a causal connection?. *Journal of memory and language, 29*(3), 336-360.

Gathercole, S. E., & Baddeley, A. D. (1993). *Working memory and language*. Lawrence Erlbaum Associates, Inc.

Gathercole, S. E. (1998). The development of memory. *Journal of Child Psychology and Psychiatry, 39*(1), 3-27.

Gardner, D. (2007). Children's immediate understanding of vocabulary: Contexts and dictionary definitions. *Reading Psychology, 28,* 331-373.

Gersten, R., Baker, S., (2000). What we know about effective instructional practices for English-language learners. *Exceptional Children, 66*(4), 454-471.

Geva, E., & Wang, M. (2001). The development of basic reading skills in children: A cross-language perspective. *Annual Review of Applied Linguistics, 21*, 182-204.

Geva, E., Yaghoub-Zadeh, Z., & Schuster, B. (2000). Understanding individual differences in word recognition skills of ESL children. *Annals of Dyslexia, 50,* 123-154.

Goldenberg, C. (2008). Teaching English Language Learners: What the research does-and does not-say. *American Educator, 32,* 8-23.

Goldenberg, C. & Coleman, R. (2010) *Promoting academic achievement among English language learners: A guide to the research.* Thousand Oaks, CA: Corwin.

Goodwin, A. P., & Ahn, S. (2010). A meta-analysis of morphological interventions: effects on literacy achievement of children with literacy difficulties. *Ann. of Dyslexia, 60*(1), 183-208.

Gorman, B. K. (2009). Cross-linguistic universals in reading acquisition with applications to english-language learners with reading disabilities. *Seminars in Speech and Language, 30*(4), *247-260.*

Gottardo, A. (2002). The relationship between language and reading skills in bilingual Spanish-English speakers. *Topics in Language Disorders, 22(5),* 46-70.

Gottardo, A., Collins, P., Baciu, I., & Gebotys, R. (2008). Predictors of Grade 2 word reading and vocabulary from Grade 1 variables in Spanish-speaking children: Similarities and differences. *Learning Disabilities Research & Practice, 23,* 11-24. Doi: 10.1111/j.1540-5826.2007.00259.x

Graves, M. F. & Watts-Taffe, S. M. (2002). The place of word consciousness in a research-based vocabulary program. In S. J. Samuels & A. E. Farstrup (Eds.), What research has to say about reading instruction (3rd ed., pp. 140-165). Newark, DE: International Reading Association.

Graves, M. F., & Watts-Taffe, S. (2008). For the love of words: Fostering word consciousness in young readers. *The Reading Teacher*, *62*(3), 185-193.

Graves, M. F. (2006). *The vocabulary book: Learning and instruction*. New York: Teachers College Press.

Graves, M. F., August, D., & Mancilla-Martinez, J. (2012). *Teaching vocabulary to English language learners.* New York: Teachers College Press.

Graves, M. G., & Watts-Taffe, S. (2008). For the love of words: Fostering word consciousness in young readers. *The Reading Teacher, 62(3),* 185-193.

Grillo, K. J. (2011). *An Investigation of the Effects of Using Digital Flash Cards to Increase Biology Vocabulary Knowledge in High School Students with Learning Disabilities* (Doctoral dissertation, University of Central Florida Orlando, Florida)

Gu, P. Y. (2005). *Vocabulary learning strategies in the Chinese EFL context*. London: Marshall Cavendish Academic.

Gu, P. Y. and Johnson, K. R. (1996). Vocabulary learning strategies and language learning outcomes. *Language Learning, 46*, 643-679.

Guion, S. G., Harada, T., and Clark, J. J. (2004). Early and late Spanish-English bilinguals' acquisition of english word stress patterns. *Bilingual Language and Cognition, 7,* 207-226. doi: 10.1017/S1366728904001592

Gunn, B., Smolkowski, K., Biglan, A., Black, C., & Blair, J. (2005). Fostering the Development

of Reading Skill Through Supplemental Instruction Results for Hispanic and Non-Hispanic Students. *The Journal of Special Education*, *39*(2), 66-8

Gupta, P., & Tisdale, J. (2009). Word learning, phonological short-term memory, phonotactic probability and long-term memory: towards an integrated framework. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1536), 3755-3771.

Hallahan, D.P., Lloyd, J.W., Kauffman, J.M., Weiss, M.P., & Martinez, E.A. (2005) *Learning Disabilities. Foundations, characteristics, and effective teaching* Boston, MA: Allyn & Bacon.

Hairell, A., Rupley, W., & Simmons, D. (2011). The state of vocabulary research. *Literacy Research and Instruction, 50,* 253-271, DOI: 10.1080/19388071.2010.514036

Harmon, J. M., Hedrick, W. B. (2005). Research on vocabulary instruction in the content areas: implications for struggling readers. *Reading & Writing Quarterly, 21*(3), 261-280.

Harris, Monica L. (2007). *The effects of strategic morphological analysis instruction on the vocabulary performance of secondary students with and without disabilities.* Ed.D. dissertation. (Doctoral dissertation, University of Kansas).

Harris, M. L., Schumaker, J. B., & Deshler, D. D. (2011). The effects of strategic morphological analysis instruction on the vocabulary performance of secondary students with and without disabilities. *Learning Disabilities Quarterly, 34 (1),* pp. 17-34.

Hasseler, N. P. (2005). *Vocabulary vine: A spiral study of Latin and Greek roots.* Salinas, CA: Hasseler Publishing.

Heller, R. & Greenleaf, C. (2007). Literacy instruction in the content areas: Getting to the core of

middle and high school improvement. Washington, DC: Alliance for Excellent Education.

Helman, Calhoon, M. B. & Kern, L. (2015) Improving the science vocabulary of English language learners with reading disabilities, *Learning Disabilities Quarterly, 38* (1), 40-52.

Hiebert, E. H., & Cervetti, G. N. (2012). What differences in narrative and informational texts mean for the learning and instruction of vocabulary. *Vocabulary instruction: Research to practice, 2,* 322-344.

Hiebert, E. H., & Lubliner, S. (2008). The nature, learning, and instruction of general academic vocabulary. In A. E. Farstrup & S. J. Samuels (Eds.), *What research has to say about vocabulary instruction* (pp. 106-129). Newark, DE: International Reading Association.

Hirsch, E. D. (2003). Reading comprehension requires knowledge—of words and the world: Scientific insights into the fourth-grade slump and the nation's stagnant comprehension scores. *American Educator, 27,* 10-48.

Hirsch, E. D. (2007). The knowledge deficit: Closing the shocking education gap for American children: Houghton Mifflin Harcourt.

Horn, E., & Peterson, T. (1943). *The basic vocabulary of business letters: Words most commonly used in writing business letters.* New York: The Gregg Pub. Co.

Horton, S. V., Lovitt, T. C., Givens, A., & Nelson, R. (1989). Teaching Social Studies to High School Students with Academic Handicaps in a Mainstreamed Setting Effects of a Computerized Study Guide. *Journal of Learning Disabilities*, *22*(2), 102-107.

Individuals With Disabilities Education Improvement Act of 2004. Pub. L. No. 108-446, 300.115

(2004).

Jenkins, J. R., Matlock, B., & Slocum, T. A. (1989). Two approaches to vocabulary instruction: The teaching of individual word Meanings and practice in deriving word meaning from context. *Reading Research Quarterly, 24*, 215-235. Retrieved July 7, 2005, from PsycINFO database.

Jenkins, J. R., Stein, M. L., & Wysocki, K. (1984). Learning vocabulary through reading. *American Educational Research Journal, 21*(4), 767-787.

Jitendra, A. K., Edwards, L. L., Sacks, G., & Jacobson, L. A. (2004). What research says about vocabulary instruction for students with learning disabilities. *Exceptional Children, 70*, 299-322.

Johnson, G., Gersten, R., & Carnine, D. (1987). Effects of instructional design variables on vocabulary acquisition of LD students: a study of computer-assisted instruction. *Journal of Learning Disabilities, 20*, 206-213.

Johnson, D. D., & Pearson, P. D. (1984). *Teaching reading vocabulary* (2nd ed.). New York: Holt, Rinehart, & Winston.

Johnson, D. D., Pittelman, S. D., & Heimlich, J. E. (1986). Semantic mapping. *Reading Teacher, 39*, 778-783.

Just, M. A. & Carpenter, P. A. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review, 99*(1), 122-149.

Kamil, M. L. (2008). How to get recreational reading to increase reading achievement. In Y. Kim, V. J., Risko, D. L. Compton, D. K. Dickinson, M. K. Hundley, R. T. Jimenez, & D. Well Rowe (Eds.), 57th yearbook of the National Reading Conference (pp. 31-40). Oak Creek, WI: National Reading Conference.

Katz, L. A., & Carlisle, J. F. (2009). Teaching students with reading difficulties to be

close readers: A feasibility study. *Language, Speech, and Hearing Services in Schools, 40,* 325-340.

Kennedy, M. J., & Wexler, J. (2013). Helping Students Succeed Within Secondary-Level STEM Content: Using the "T" in STEM to Improve Literacy Skills. *TEACHING Exceptional Children, 45*(4), 26-33.

Kieffer, M. J., & Box, C. D. (2013). Derivational morphological awareness, academic vocabulary, and reading comprehension in linguistically diverse sixth graders. *Learning and Individual Differences, 24,* 168-175.

Kieffer, M. J. & Lesaux, N. K. (2008). The role of morphology in the reading comprehension of Spanish-speaking English language learners. *Reading and Writing: An Interdisciplinary Journal, 21,* 783-804.

Kieffer, M. J., & Lesaux, N. K. (2007). Breaking down words to build meaning: Morphology, vocabulary, and reading comprehension in the urban classroom. *The Reading Teacher, 61* (2), 134-144.

Kieffer, M. J., & Lesaux, N. K. (2012). Effects of academic language instruction on relational and syntactic aspects of morphological awareness for sixth graders from linguistically diverse backgrounds. *The Elementary School Journal, 112, 3,* 519-545.

Kieffer, M. J. & Vukovic, R. K. (2013). Growth in reading-related skills of language minority learners and their classmates: More evidence for early identification and intervention. *Reading and Writing: An Interdisciplinary Journal, 26,* 1159-1194.

King-Sears, M. E., Mercer, C. D., & Sindelar, P. T. (1992). Toward Independence with Keyword Mnemonics A Strategy for Science Vocabulary Instruction. *Remedial and Special Education*, *13*(5), 22-33.

Klingner, J. K., Artiles, A. J., & Mendez Barletta, L. (2006). English language learners who struggle with reading: Language acquisition or LD*? Journal of Learning Disabilities, 39,* 108-128.

Krashen, S. (2001). More smoke and mirrors: A critique of the National Reading Panel report on fluency. *Phi Delta Kappan, 83,* 119-123.

Kuhn, M. R., & Stahl, S. A. (1998). Teaching children to learn word meanings from context: A synthesis and some questions. *Journal of Literacy Research, 30*(1), 119-38.

Lee, J. (2005, June). Tracking achievement gaps and assessing the impact of NCLB on the gaps: An in-depth look into national and state reading and math outcome trends. Cambridge: MA: The Civil Rights Project of Harvard University.

Leong, C. K., Simmons, D., R., and Izatt-Gambell, M. (1990). The effect of systematic training in elaboration on word meaning and prose comprehension in poor readers. *Annals of Dyslexia, 40,* 192-215.

Leong, C. K., Tse, S. K., Loh, K. Y., & Hau, K. T. (2008). Text comprehension in Chinese children: Relative contribution of verbal working memory, pseudoword reading, rapid automatized naming, and onset-rime phonological segmentation. *Journal of Educational Psychology, 1,* 135-149.

Lesaux N. K., Kieffer M. J., Faller S., Kelley J. G. (2010). The effectiveness and ease of implementation of an academic vocabulary intervention for linguistically diverse students in urban middle schools. *Reading Research Quarterly, 45,* 196–228.

Lesaux, N. K. & Siegel, L. S. (2003). The development of reading in children who speak English as a second language. *Developmental Psychology, 39,* 1005-1019.

Lesaux, N. K., Rupp, A. A., & Siegel, L. S. (2007). Growth in reading skills of children from

diverse linguistic backgrounds. *Reading and Writing, 19,* 99-131. Doi: 10.1037/0022-0663.99.4.821

Levin, B. R., & Lenski, R. E. (1983). Coevolution in bacteria and their viruses and plasmids, *Coevolution* 99-127.Sinauer, Sunderland, MA.

Levin, J. R. , McCormick, C. B., Miller, G. E., Berry, J. K., & Pressley, M. (1982). Mnemonic versus nonmnemonic vocabulary-learning procedures. *American Education Research Journal, 19,* 121-136.

Lindsey, K., A., Manis, F. R., & Bailey, C. E. (2003). Prediction of first-grade reading in Spanish-speaking English-language learners. *Journal of Educational Psychology, 95,* 482-494. Doi: 10.1037/0022-0663.95.3.482.

Lipka, O., & Siegel, L. S. (2007). The development of reading skills in children with English as a second language. *Scientific Studies of Reading*, *11*(2), 105-131.

Long, D., & Rule, A. C. (2004). Learning vocabulary through morpheme word family object boxes. *Journal of Authentic Learning, 1,* 40-50.

Lubliner, S. & Smetana, L. (2005). The effects of comprehensive vocabulary instruction on Title I students' metacognitive word-learning skills and reading comprehension. *Journal of Literacy Research, 37,* 163-200.

Mancilla-Martinez, J., & Lesaux, N. K. (2011). The gap between Spanish speakers' word reading and word knowledge: A longitudinal study. *Child development*, *82*(5), 1544-1560.

Manis, F. R., Lindsey, K. A., & Bailey, C. E. (2004). Development of Reading in Grades K–2 in Spanish-Speaking English-Language Learners. *Learning Disabilities Research & Practice*, *19*(4), 214-224.

Marinova-Todd, S. H. (2012). Corplum is a core from a plum: The advantage of bilingual

children in the analysis of word meaning from verbal context. *Bilingualism: Language and Cognition,* 15 (1), 117-127.

Marzano, R. J. (2004). *Building background knowledge for academic achievement*. Alexandria, VA: Association for Curriculum and Development (ASCD).

Mastroprieri, M. A., Scruggs, T. E., & Fulk, B. M. (1990). Teaching abstract vocabulary with the keyword method: Effects on recall and comprehension. *Journal of Learning Disabilities, 23(*2*),* 92-96.

Mastropieri, M. A., Scruggs, T. E., Levin, J. R., Gaffney, J., & McLoone, B. (1985). Mnemonic vocabulary instruction for learning disabled students. *Learning Disability Quarterly,* 8 (1), 57-63.

Mastroprieri, M. A., Spencer, V. G., Scruggs, T. E., & Talbott, E. (2000). Students with disabilities as tutors: An updated research synthesis. In T.E. Scruggs & Mastropieri (Eds.), Advances in learning and behavioral disabilities (Vol. 14, pp. 247-279). Stanford: JAI Press Inc.

McCardle, P., & Chhabra, V. (2004). *The voice of evidence in reading research.* Baltimore: Brookes Publishing.

McCardle, P., Keller-Allen, C., & Shuy, T. (2008). Learning disability identification. In E. Grigorenko (Eds.), *Educating individuals with disabilities* (pp.137-164). New York, NY: Springer.

McCardle, P., Mele-McCarthy, J., Cutting, L., Leos, K., & D'Emilio, T. (2005). Learning disabilities in English language learners: Identifying the issues. *Learning Disabilities Research & Practice, 20,* 1-5. Doi: 10.1111/j.1540-5826.2005.00114.x

McGregor, K. K., Newman, R. M., Reilly, R. M., & Capone, N. C. (2002). Semantic representation and naming in children with specific language impairment. *Journal of*

Speech, Language and Hearing Research, 45(5), 998

McKeown, M. G., Beck, I. L., Omanson, R. C., * Perfetti, C.A. (1983). The effects of long-term vocabulary instruction on reading comprehension: a replication. *Journal of Reading Behavior, 15,* 3-18.

McKeown, M. G., Beck, I. L., Omanson, R. C., & Pople, M. T. (1985). Some effects of the nature and frequency of vocabulary instruction on the knowledge and use of words. *Reading Research Quarterly, 20,* 522-535.

Meyer, B. J., & Ray, M. N. (2011). Structure strategy interventions: Increasing reading comprehension of expository text. *International Electronic Journal of Elementary Education, 4*(1), 127-152.

Moir, J., & Nation, I. S. P. (2002). Learners' use of strategies for effective vocabulary learning. *Prospect, 17(1),* 15–35.

Nagy, W. E., & Anderson, R. C. (1984). How many words are there in printed school English? *Reading Research Quarterly, 19,* 304-330. Retrieved April 11, 2006, from PsycINFO database.

Nagy, W. E., & Herman, P. A. (1987). Depth and breadth of vocabulary knowledge: Implications for acquisition and instruction. In M. G. McKeown & M. E. Curtis (Eds.), *The nature of vocabulary acquisition* (pp. 19-35). Hillsdale, NJ: Erlbaum.

Nagy, W. E., & Scott, J. A. (2000). Vocabulary processes. In R. Barr, M. L. Kamil, P. Mosenthal, & P. D Pearson (Eds.), *Handbook of reading research, Vol. 3* (pp. 269-284). New York: Longman.

Nagy, W. E., Diakidoy, I. N., & Anderson, R. C. (1993). The acquisition of

morphology: Learning the contribution of suffixes to the meanings of derivatives. *Journal of Reading Behavior, 25*, 155-170.

Nagy, W., Berninger, V. W., & Abbott, R. D. (2006). Contributions of morphology beyond phonology to literacy outcomes of upper elementary and middle school students. *Educational Psychology, 98*, 134-147.

Nash, M., & Donaldson, M. L. (2005). Word learning in children with vocabulary deficits. *Journal of Speech, Language and Hearing Research, 48*(2), 439.

Nash, H., & Snowling, M. (2006). Teaching new words to children with poor existing vocabulary knowledge: a controlled evaluation of the definition and context methods. *International Journal of Language and Communication Disorders, 41*, 335-354.

Nation, I.P.S. (1990). *Teaching and learning vocabulary*. Boston: Heinle & Heinle Publishers.

National Assessment of Educational Progress (2009). *The nation's report card*. September 12th, 2012 from http://nces.ed.gov/nationsreportcard/naepdata

National Assessment of Educational Progress (2011). *The nation's report card*. Retrieved September 12th, 2012 from http://nces.ed.gov/nationsreportcard/naepdata

National Council of Teachers of English. 2008. English language learners: A policy research brief. Urbana, IL: National Council of English. http://www.ncte.org/library/NCTEFiles/Resources/PolicyResearch/ELL ResearchBrief.pdf.

National Reading Panel (2000). *Report of the National Reading Panel: Teaching children to read. Bethesda, MD*: National Institute of Child Health and Human Development. Retrieved from http://www.nichd.nih.gov/publications/nrp/upload/smallbook_pdf.pdf

No Child Left Behind Act of 2001, Congress of the United States of America, 107th Sess. 1425-2094.

Nunes, T., Bryant, P., & Olsson, J. (2003). Learning morphological and phonological spelling rules: An intervention study. *Scientific Studies of Reading, 7*, 289–307.

Ordon˜ez, C. L., Carlo, M. S., Snow, C. E., & McLaughlin, B. (2002). Depth and breadth of vocabulary in two languages: Which vocabulary skills transfer? *Journal of Educational Psychology, 94,* 719–728.

Ortiz, A. A., Wilkinson, C. Y., Robertson-Courtney, P., & Kushner, M. I. (2006). Considerations in implementing intervention assistance teams to support English language learners. *Remedial and Special Education, 27*(1), 53-63.

Otterman, L. M. (1955). The value of teaching prefixes and word-roots. *Journal of Educational Research, 48*, 611-615.

Padilla, A. M. (2001). Issues in culturally appropriate assessment. *Handbook of multicultural assessment: Clinical, Psychological, and Educational Applications*, *2*, 5-27.

Pany, D., Jenkins, J. R., & Schreck, J. (1982). Vocabulary instruction: Effects on word knowledge and reading comprehension. *Learning Disability Quarterly*, 202-215.

Pearson, P. D., & Johnson, D. D. (1978). *Teaching reading comprehension*. New York: Holt, Rinehart, & Winston.

Pearson, P. David, and Rand J. Spiro. (1982). The New Buzz Word in Reading is Schema. *Instructor, 91*, 46-48

Perez, E. (1981). Oral language competence improves reading skills of Mexican American third graders. *Reading Teacher, 35*(1), 24-27.

Pennsylvania State Science and Technology Standards (2002) Harrisburg, PA: Pennsylvania State Department of Education. Retrieved March 5, 2009 from

http://www.pde.state.pa.us/k12/lib/k12/scitech.pdf

Pimperton, H. & Nation, K. (2010). Suppressing irrelevant information from working memory: Evidence for domain-specific deficits in poor comprehenders. *Journal of Memory and Language, 62,* 380-391.

Pressley, M., & Afflerbach, P. (1995). Verbal protocols of reading: The nature of constructively responsive reading, Hillsdale, NJ: Erlbaum.

Pressley, M., Levin, J. R., & Miller, G. E. (1982). The keyword method compared to alternative vocabulary learning strategies. *Contemporary Educational Psychology, 7,* 50-60.

Pressley, M., Levin, J. R., & Miller, G. E. (1981). How does the keyword method affect vocabulary comprehension and usage? *Reading Research Quarterly, 16,* 213-226.

Proctor, C. P., Carlo, M., August, D., & Snow, C. (2005). Native Spanish-speaking children reading in English: Toward a model of comprehension. *Journal of Educational Psychology, 97,* 246-256. Doi: 10.1037/0022-0663.97.2.246

Proctor, C. P., Dalton, B., Uccelli, P., Biancarosa, G., Mo, E., Snow, C. E., & Neugebauer, S. (2009). Improving comprehension online: Effects of deep vocabulary instruction with bilingual and monolingual fifth graders. *Reading and Writing, 24, 517-544.*Doi: 10.1007/s11145-009-9218-2

RAND Reading Study Group. (2002). *Reading for understanding: Toward an R&D program in reading comprehension.* Santa Monica, CA: RAND Education.

Reed, D. K. (2008). A synthesis of morphology interventions and effects on reading outcomes for students in grades K-12. *Learning Disabilities Research and Practice, 23 (1),* 26-49.

Roberts, G., Torgesen, J. K., Boardman, A., & Scammacca, N. (2008). Evidence-based strategies for reading instruction for older students with learning disabilities. *Learning Disabilities Research & Practice,* 23, 63-69.

Roman, A. A., Kirby, J. R., Parrila, R. K., Wade-Woolley, L., & Deacon, S. H. (2009). Toward a comprehensive view of the skills involved in word reading in Grades 4, 6, and 8. *Journal of Experimental Child Psychology*, *102*, 96–113.

Ross, A. H., & Stevens, K. B. (2003). Teaching spelling of social studies content vocabulary prior to using the vocabulary in inclusive learning environments: An examination of constant time delay, observational learning, and instructive feedback. *Journal of Behavioral Education*, *12*, 287-309.

Scammacca, N., Roberts, G., Vaughn, S., Edmonds, M., Wexler, J., Reutebach, C. K., et al. (2007). *Interventions for adolescent struggling readers: A meta-analysis with implications for practice*. Portsmouth, NH: RMC Research Corporation, Center on Instruction.

San Francisco, A. R., Mo, E., Carlo, M., August, D., & Snow, C. (2006). The influences of language of literacy instruction and vocabulary on the spelling of Spanish-English bilinguals. *Reading and Writing*, *19*, 627-642.

Schatschneider, C., Buck, J., Torgesen, J. K., Wagner, R. K., Hassler, L., Hecht, S., et al. (2004). A multivariate study of factors that contribute to individual differences in performance on the Florida Comprehensive Reading Assessment Test. (Technical Report No. 5). Tallahassee, FL: Florida Center for Reading Research.

Schmitt, N. (1997). Vocabulary learning strategies. In Schmitt, N., & McCarthy Vocabulary: Description, Acquisition, and Pedagogy *(pp. 199-227).* Cambridge University Press.

Scruggs, T. E., & Mastroprieri, M. A. (2000). The effectiveness of mnemonic instruction for students with learning and behavior problems: An update and research synthesis. *Journal of Behavioral Education*, *10*, 163-173.

Service, E. (1992). Phonology, working memory, and foreign language. *Quarterly Journal of Experimental Psychology: A Human Experimental Psychology, 45,* 21-50.

Short, D. J. & Fitzsimmons, S. (2007). *Double the work: Challenges and solutions to acquiring language and academic literacy for adolescent English language learners: A report to Carnegie Corporation of New York.* Alliance for Excellent Education.

Shore , J. R., & Sabantini, J. (2009). English language learners with reading disabilities: A review of the literature and the foundation for a research agenda. ETS Research Report Series 2009, no. 1 (2009): i-48.

Siegel, L. S., & Ryan, E. B. (1989). The development of working memory in normally achieving and subtypes of learning disabled children. *Child Development, 60,* 973-980. Doi: 10.2307/1131037

Sinatra, Richard, Josephine Stahl-Gemake, and David Berg. (1984). Improving Reading Comprehension of Disabled Readers through Semantic Mapping. *The Reading Teacher, 38*, 22-29.

Singson, M., Mahony, D., & Mann, V. (2000). The relation between reading ability and morphological skills: Evidence from derivational suffixes. *Reading and Writing, 12*(3), 219-252.

Slavin, R. E., & Cheung, A. (2005) A synthesis of research on language of reading instruction for English language learners. *Review of Educational Research, 75,* 247-, 284. DOI: 10.3102/00346543075002247.

Smith, M. (1941). Measurement of the size of general English vocabulary through the elementary grades and high school. *Genetic Psychology Monographs, 24,* 311-345.

Snipes, J., Horwitz, A., Soga, K., & Casserly, M. (2008). Beating the Odds VIII: An Analysis of Student Performance and Achievement Gaps on State Assessments. Results from the

2006-2007 School Year. *Council of the Great City Schools.*

Snow, C. E., Burns, M. S., & Griffin, P. (1998). *Preventing reading difficulties in young children.* Washington, D. C.: National Academy Press.

Snow, C. E., & Kim, Y. S. (2007). *Large problem spaces: The challenge of vocabulary for English language learners*. Gilford Press, New York.

Snow, C. E., Uccelli, P., Olson, D. R., & Torrance, N. (2009). The challenge of academic language. The Cambridge handbook of literacy, 112-133.

Spencer, A. (2001). *Morphological theory: An introduction to word structure in generative grammar.* Oxford: Blackwell.

Stahl, S. A., & Fairbanks, M. M. (1986). The effects of vocabulary instruction: A model-based meta-analysis. *Review of Educational Research, 56*, 72-110.

Stahl, S. A., & Nagy, W. E. (2006). *Teaching word meanings*. Mahwah, NJ: Erlbaum.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*, 360-407.

Stanovich, K. & Siegel, L. (1994). Phenotypic performance profile of children with reading disabilities: A regression-based test of phonological-core variable-difference model.

Journal of Educational Psychology, *86*, 24-53.

Steele, S. C. & Watkins, R.V. (2010). Learning word meanings during reading by children with language learning disability and typically-developing peers. *Clinical Linguistics and Phonetics 24*, 520–539.

Sternberg, R. J. (1987). Most vocabulary is learned from context. *The Nature of Vocabulary Acquisition, 89-105.*

Sternberg, R. J., & Powell, J. S. (1983). Comprehending verbal comprehension. *American Psychologist, 58,* 878-893.

Swanborn, M. S. L. & de Glopper, K. (1999). Incidental word learning while reading: A meta-analysis. *Review of Educational Research, 69(3),* 261-285.

Swanson, H. L. (1983). A study of nonstrategic linguistic coding on visual recall of learning disabled and nondisabled readers. *Journal of Learning Disabilities, 16,* 209-216.

Swanson, H. L. (1989). The effects of central processing strategies on learning disabled, mildly retarded, average, and gifted children's elaborative encoding abilities. Journal of *Experimental Child Psychology, 47,* 370-397.

Swanson, H. L. (1993). Working memory in learning disability subgroups. *Journal of Experimental Child Psychology, 56,* 87-114.

Swanson, H. L., Mink, J., & Bocian, K. M. (1999). Cognitive processing deficits in poor readers with symptoms of reading disabilities and ADHD: More alike than different*? Journal of Educational Psychology, 91,* 321-333. Doi: 10.1037/0022-0663.91.2.321

Swanson, H. L., Saez, L., & Gerber, M. (2006). Growth in literacy and cognition in bilingual children at risk or not at risk for reading disabilities. *Journal of Educational Psychology, 98,* 247-264. Doi: 10.1037/0022-0663.98.2.247

Swanson, H. L. (2010). Does the dynamic testing of working memory predict growth in nonword fluency and vocabulary in children with reading disabilities*? Journal of Cognitive Education and Psychology, 85,* 1-31.

Swanson, H. L., Saez, L., & Gerber, M. (2004). Do phonological and executive processes in English learners at risk for reading disabilities in grade 1 predict performance in grade 2? *Learning Disabilities Research & Practice, 19*(4), 225-238.

Swanson, H.L., Saez, L., & Gerber, M., & Leafstedt, J. (2004). Literacy and cognitive functioning in bilingual and nonbilingual children at or not at risk for reading disabilities. *Journal of Educational Psychology, 96,* 3-18. Doi: 10.1037/0022-0663.96.1.3

Swanson, H. L., Rosston, K., Gerber, M., & Solari, E. (2008). Influence of oral language and phonological awareness on ELL children's bilingual reading. *Journal of School Psychology, 46,* 413-429. Doi: 10.1016/j.jsp.2007.07.002

Swanson, H. L., Orosco, M. J., & Lussier, C. M. (2011). Cognition and literacy in English language learners at risk for reading disabilities. *Journal of Educational Psychology, 103*(4), 838-856.

Tawney, J. & Gast, D. L. (1984). *Single Subject Research in Special Education.* Columbus, OH, Charles Merrill.

Terman, L. M. (1916). *The measurement of intelligence.* Boston: Houghton Mifflin.

Terrill, M. C., Scruggs, T. E., & Mastropieri, M. A. (2004). SAT vocabulary instruction for high school students with learning disabilities. *Intervention in School and Clinic, 39,* 288-294.

Thomas, W. P. & Collier, V. P. (2003). What we know about: *Effective instructional approaches for language minority learners.* Arlington, VA: Educational Research Service.

Thorn, A. S., & Gathercole, S. E. (1999). Language-specific knowledge and short-term memory in bilingual and non-bilingual children. *The Quarterly Journal of Experimental Psychology: Section A, 52*(2), 303-324.

Thorn, A. S., Gathercole, S., & Frankish, C. R. (2002). Language familiarity effects in short-term memory: The role of output delay and long-term knowledge. *Quarterly of Experimental Psychology: A Human Experimental Psychology, 55,* 1363-1383.

Tomeste, M., & Arnoutse, C. (1998). Effects of an intstructional programme for deriving word

meanings. *Educational Studies, 24,* 107-128.

Torgesen, J. K., Houston, D. D., Rissman, L. M., Decker, S. M., Roberts, G., Vaughn, S. et al. (2007). Academic literacy instruction for adolescents: A guidance document from the center of instruction.

Townsend, D., & Collins, P. (2009). Academic vocabulary and middle school English learners: An intervention study. *Reading and Writing*, *22*(9), 993-1019.

Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language, 28,* 127-154.

Ulanoff, S. H., & Pucci, S. L. (1999). Learning words from books: The effects of read-aloud on second language vocabulary acquisition. *Bilingual Research Journal, 23*(4), 409-422.

U.S. Department of Education. (2002). *Twenty-fourth annual report to congress on the implementation of the Individuals with Disability Education Act*. Washington, DC: U.S. Department of Education.

U.S. Department of Education. (2003). *Twenty-fifth annual report to congress on the implementation of the individuals with disabilities education act.* Washington DC: US Department of Education.

Vacca, R. T., & Vacca, J. L. (2008). Content area reading: Literacy and learning across the curriculum (9th ed.) Boston: Allyn & Bacon.

Vadasy, P., Sanders, E., & Peyton, J. (2006). Code-oriented instruction for kindergarten students at risk for reading difficulties: A randomized field trial with paraeducator implementers. *Journal of Educational Psychology, 98*(3), 508-528.

Vaughn-Shavuo, F. (1990). Using story grammar and language experiences for improving recall and comprehension in the teaching of ESL to Spanish-dominant first graders.

Unpublished doctoral dissertation, Hofstra University, Hempstead, NY.

Vaugh, S., Gersten, R., & Chard, D. J. (2000). The underlying message in LD intervention research: Findings from research syntheses. *Exceptional Children, 67*, 99-114.

Vaughn, S., Martinez, L. R., Linan-Thompson, S., Reutenuch, C. K., Carlson, C. D., & Francis, D. J. (2009). Enhancing social studies vocabulary and comprehension for seventh-grade English language learners: Findings from two experimental studies. *Journal of Research on Educational Effectiveness, 2*, 297-324.

Vaughn, S., Linan-Thompson, S., Mathes, P. G., Cirino, P. T., Carlson, C. D., Pollard-Durodola, S. D., & Francis, D. J. (2006). Effectiveness of Spanish intervention for first-grade English language learners at risk for reading difficulties. *Journal of Learning Disabilities, 39*(1), 56-73.

Venezky, R. (1995). How English is read: Grapheme-phoneme regularity and orthographic structure in word recognition. In I. Taylor & D. Olson (Eds.), *Scripts and literacy: Reading and learning to read alphabets, syllabaries, and characters, pp. 111-129*, New York: Kluwer.

Wanzek, J., Wexler, J., Vaughn, S., Ciullo, S. (2010) Reading interventions for struggling readers in the upper elementary grades: A synthesis of 20 years of research. *Reading and Writing, 23*(8), 889-912.

Wagner, R. K., Francis, D. J., & Morris, R. D. (2005). Identifying English language learners with learning disabilities: Key challenges and possible approaches. *Learning Disabilities Research and Practice, 20*(1), 6-15.

Wagner, M., Newman, L., Cameto, R., & Levine, P. (2006). *The academic achievement and functional performance of youth with disabilities. A report from the national longitudinal*

transition study-2 (NLTS2). Menlo Park, CA: SRI International. Retrieved from www.nlts2.org/reports/2013_08/nlts2_report_2013_complete.pdf.

WIDA English Language Proficiency Standards and Resource Guide, 2007 Edition, Pre-Kindergarten through Grade 12. Retrieved April 25, 2010, from http://www.wida.us/standards/Resource_Guide_web

Wimmer, H., Mayringer, H., Landerl, H. (2000). The double-deficit hypothesis and difficulties in learning to read a regular orthography. *Journal of Educational Psychology, 92*, 668-680.

Witt, J. C., & Elliott, N. S. (1985). Acceptability of classroom management strategies. In T. R. Kratochwill (Ed.). *Advances in school psychology* (Vol. 4, pp. 251-288). Mahwah, NJ: Erlbaum.

White, T. G., Power, M. A., & White, S. (1989). Morphological analysis: Implications for teaching and understanding vocabulary growth. *Reading Research Quarterly, 24*, 283-304.

Wysocki, K., & Jenkins, J. R. (1987). Deriving word meanings through morphological generalization. *Reading Research Quarterly, 22*, 66-81. Retrieved July 6, 2005, from PsycINFO database.

Xin, J. F., & Reith, H. (2001). Video-assisted vocabulary instruction for elementary school students with learning disabilities. Information Technology in Childhood Education Annual (pp. 87-104). Norfolk, VA: Association for Advancement of Computing in Education.

Zehler, A. M., Fleischman, H. L., Hopstock, P. J., Stephenson, T. G., Pendzick, M. L., & Sapru, S. (2003). *Descriptive study of services to LEP students and LEP students with*

disabilities, Volume 1A: Research report. Development Associates, Inc. Retrieved June 28, 2013, from http:www.devassoc.com/LEPdoclist.html

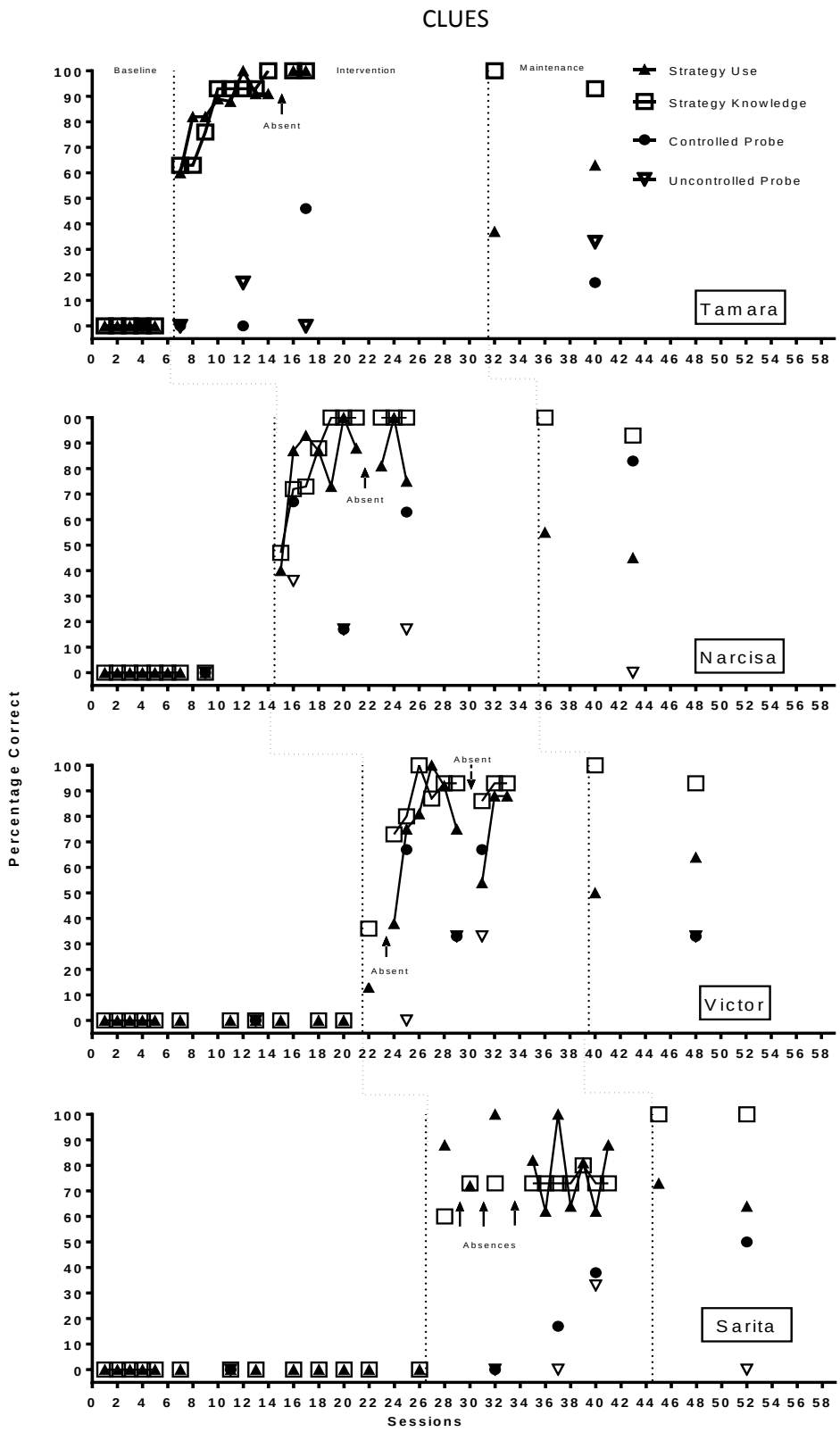


Figure 1. Percentage of strategy knowledge and strategy use steps completed on the CLUES probe.

Table 1

Description of Participants and Screening Criteria

Participants	Tamara	Narcisa	Victor	Sarita
Characteristics				
Age	16-1	16-9	16-4	16-6
Gender	Female	Female	Male	Female
Home Language	Spanish	Spanish	Spanish	Spanish
Ethnicity	Hispanic	Hispanic	Hispanic	Hispanic
Socio-Economic Status	Economically Disadvantaged	Economically Disadvantaged	Economically Disadvantaged	Economically Disadvantaged
Grade Level	10th	10th	10th	10th
PreLAS Total Scaled Score (English)	0	0	0	0
Pre LAS Proficiency Level	1, Beginning	1, Beginning	1, Beginning	1, Beginning
WIDA Language Proficiency Composite Score	3.7	3.5	3.8	4.0
SRI Inventory Lexile Score and Reading Level	632- 4th grade	615 - 4th grade	601-4th grade	600- 4th grade
Year Identified as an ELL	Kindergarten	Kindergarten	Kindergarten	Third
Year Identified with RD	3rd grade	4th grade	2nd grade	3rd grade

Table 2

Pre- and Post-TORC-4 Subtest scores (percentage) for Word Knowledge Test, Word Part Test, and Word Mapping Strategy Use Test

	Word Knowledge		Word Part Test		Word Mapping Strategy Use	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Tamara	0	22	0	16	0	62
Narisa	0	7	0	12	0	73
Victor	0	6	0	4	0	72
Sarita	0	16	0	16	0	71

Table 3

Pre- and Post-TORC-4 Subtest Scores

	Tamara				Narcisa				Victor				Sarita			
	Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test	
Subtests	*GE*	*SS*	*GE*	*SS*	*GE*	*SS*	*GE*	*SS*	*GE*	*SS*	*GE*	*SS*	*GE*	*SS*	*GE*	*SS*
RV	5.5	7	3.2	5	4.8	8	3.5	5	4.1	7	3.2	5	6.4	8	2.9	7
SC	5.0	6	5.6	8	5.6	8	4.5	6	5.0	7	5.0	7	5.9	8	7.8	9
PC	8.5	10	4.9	8	9.2	11	7.9	9	4.2	9	5.9	8	7.4	10	1.7	6
TC	4.8	7	4.8	5	5.4	8	6.1	8	4.0	7	2.2	6	4.8	8	4.2	7
CF	5.1	5	5.8	5	5.0	5	5.8	4	4.1	5	4.6	5	4.9	6	5.8	7

Note. RV = Relational Vocabulary; SC = Sentence Completion; PC = Paragraph Construction; TC = Text Comprehension CF = Contextual Fluency; GE = Grade Equivalent; SS = Standard Score

Appendices

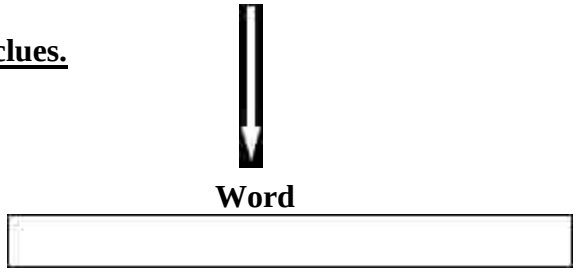
Appendix A

CLUES Strategy Teacher- Led Practice

Intervention Lesson 2: Teacher-Led Practice

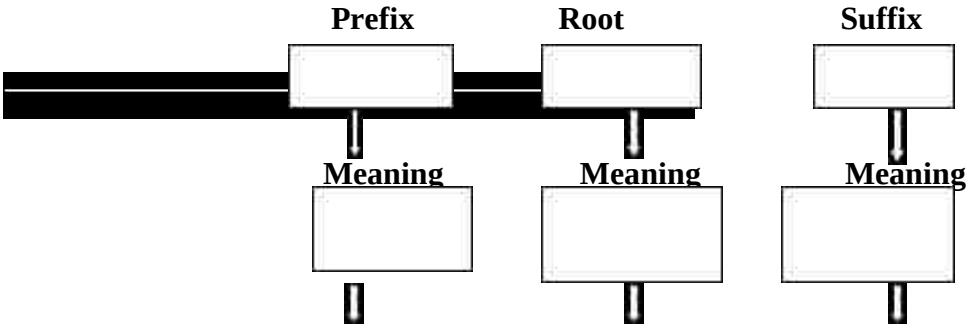
Connect to the context. **Erythromycin,** pills formed from red fungus, was used to treat the girl's sickness.

Label the two contextual clues.

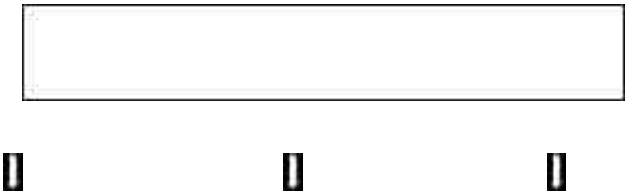


Use the clues to write

and define the word parts.



4. Explain the science word. **Predicted Word Meaning**



5. See if you are correct. **Definition**

Appendix B

CLUES Lesson 1 Guided Practice

Directions: First, write the CLUES Strategy next to each strategy step. Second, use each step of the CLUES Strategy to figure out the unknown word. Write each answer in the boxes in the organizer. Do your best work! ☺

He did a postmortem exam after the animal died. (15 syllables)

1. Connect to the text

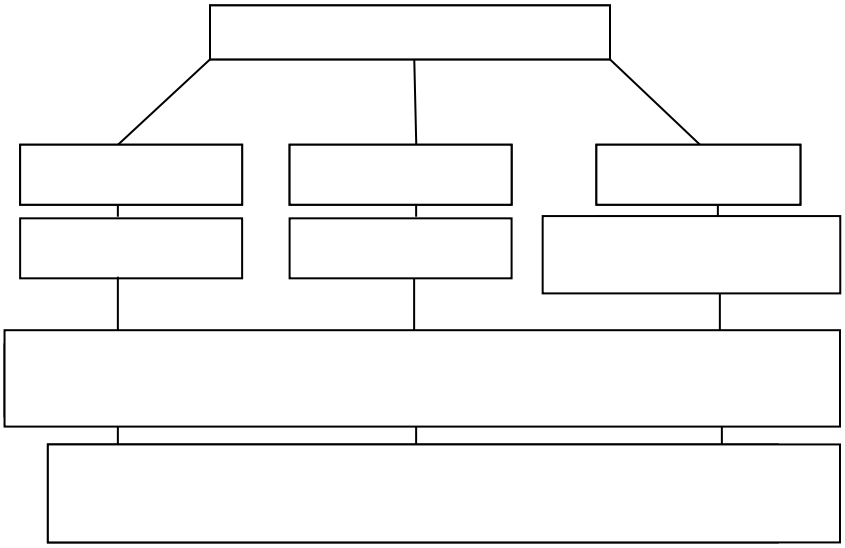
2. Label two clues

3. Use the clues to define

the word parts

4. Explain the word

5. See if you are correct



Points:_____/15___ Points:_____/8_

Appendix C

CLUES Lesson 1 Independent Practice Answer Key

Directions: First, write the CLUES Strategy next to each strategy step. Second, use each step of the CLUES Strategy to figure out the unknown word. Write each answer in the boxes in the organizer. Do your best work! ☺

He did a <u>postmortem</u> exam after the animal died. (15 syllables)

1._____

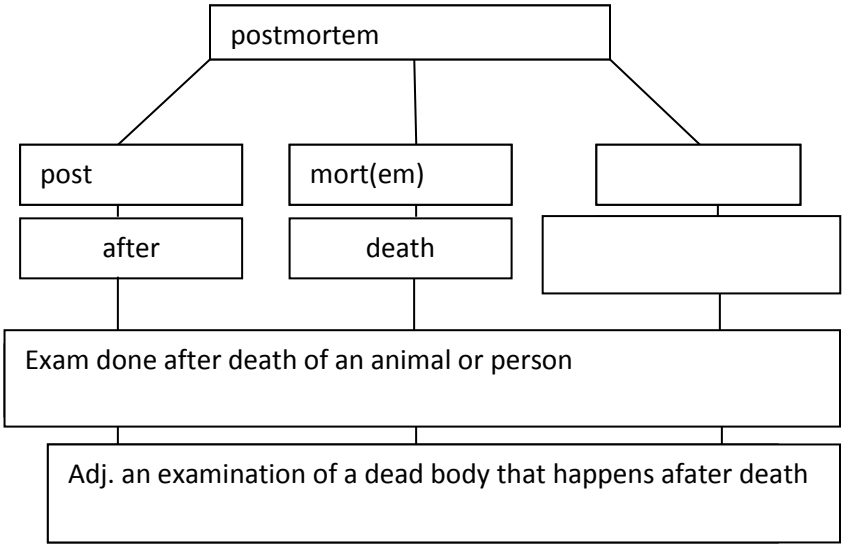
2._____

3._____

_____

4._____

5._____



Points:_____/15___ Points:_____/8__

Appendix D

CLUES Strategy Sample Answer Key

Intervention Lesson 2: Teacher-Led Practice

Connect to the context. **Erythromycin,** pills formed from red fungus, was used to treat the girl's sickness.

Label the two contextual clues.

Word

ethromycin

Use the clues to write and define the word parts.

Prefix	Root	Suffix
ethro	myc	in
Meaning	**Meaning**	**Meaning**
red	fungus	in, into

4. Explain the science word. **Predicted Word Meaning**

Antibiotics or pills formed from red fungus to treat illness or infections

5. See if you are correct. **Definition**

Antibiotics formed from red fungus to treat bacterial infections

Appendix E

CLUES Training Lesson Guided Notesheet
Lesson #2: Morphemes

Name:_____ **Date:_____**

Today's lesson is on _Morphemes_____.

Definition of morpheme	
Morpheme Rules	_____ _____ _____ _____ _____

Example Word: humanoid **Number of morphemes:_____**
Morphemes:_____

Example Word: intestine **Number of morphemes:_____**
Morphemes:_____

Example Word: utterly **Number of morphemes:_____**
Morphemes:_____

Example Word: protozoa **Number of morphemes:_____**
Morphemes:_____

Appendix F

Science Words, Definitions, and Sentences

Word 1.Root: myc	Definition	Sentence
ascomycota	(n.) a class of sac fungi	He used the sac fungi, or **ascomycota**, as yeast to bake bread. (17 syllables)
mycology	(n.) a branch of biology dealing with fungi	**Mycology,** the study of fungus, helps farmers make lots of mushrooms. (19 syllables)
blastomycotic	(n) an infection caused by breathing in a type of fungus found in wood or soil	A disease caused by breathing in a fungus found in wood or soil called **blastomycosis**.
ethromycin	(n) a type of red fungus	**Erythromycin,** pills formed from red fungus, was used to treat the girl's sickness. (20 syllables)
actinomycosis	(n): infection with or disease, a chronic disease of cattle, swine, and humans characterized by hard granulomatous masses usually in the jaw	Cows can get a disease called **actinomycosis** that can begin in the mouth. (20 syllables)

2.Root: mort		
immortal	(adj.) not capable of dying, living forever	The vampire would not die but would live forever since he was **immortal.** (18 syllables)
postmortem	(adj.) done, occurring, happening after death	He did a **postmortem** exam after the animal died. (15 syllables)
mortuary	(n.) of or relating to death or burial	The **mortuary** in the hospital is a place where dead patients are kept.(19 syllables)
rigormortis	(n.)temporary stiffness of the body that happens soon after death	After the animal died, its body became stiff and **rigormortis** set in. (20 syllables)
mortician	(n.)a person whose job is to prepare dead people to be buried and to arrange and manage funerals	A **mortician** manages a funeral for a person who has died. (18 syllables)

3.Root:derm		
Epidermis	(n.)the outer layer of an external part of the animal body that is derived from the embro,	The outer skin layer of an animal's body is called epidermis. (19 syllables)
echinoderm	(n.) Classification of starfish and sea urchins based on skin types	The starfish is a common **echinoderm** found at the shore. (15 syllables)
taxidermy	(n.) The art or operation of preparing, stuffing, and mounting the skins of dead animals for exhibition in a lifelike state	The man was good at **taxidermy**, stuffing the skins of dead deers, to hang up. (20 syllables)
ostracoderm	(n.) any of the early fossil jawless fishes with bony covering of plates or scales	The ostracoderm is the light layer of skin on the shell of early fish. (19 syllables)
dermatophyte	(n.) any of various fungi that can cause parasitic skin infections	The ringworm cause is a feature of fungi that is called **dermatophytes**.

4.Root: card		
myocardium	(n.) the middle muscular layer of the heart wall	**Myocardium** is the middle and thickest layer of the heart wall.
carditis	(n.) inflammation of the muscles in the heart	Jan had **carditis**, or the inflammation of the heart muscle.
cardiology	the study of the heart and its action and diseases	The doctor went to college for the study of the heart, or **cardiology**. (20 syllables).
endocarditis	(n).inflammation of the lining of the heart and its valves	He suffered from **endocarditis,** a disease of the lining of the heart**. (**19 syllables**)**
cardiograph	**n.)**an instrument that shows the movements of the heart	The **cardiograph** was done to see the movement in the man's heart. (16 syllables)

5.Root: cyte		
cytoplasm	(n.) the organized complex of inorganic and substance between the cell embryo and its outer membrane	**Cytoplasm**, a jelly like substance, is between the cell center and its crust. (20 syllables)
leukocyte	(n.) white blood cell that helps the body fight against infections or diseases	The **leukocyte**, or white blood cell, protects the body from disease. (17 syllables)
Phagocyte	(n.) a bactetia eating white blood cell in the body system	The **phagocyte** is a white blood cell that eats harmful dead cells and bacteria. (17 syllables)
astrocytoma	(n) nerve tissue tumor	A nerve-tissue tumor of the cells that is star shaped is called **astrocytoma**. **(20 syllables)**
anisocytosis	(n) different sized cells, such as red blood cells)	She had **anisocytosis**, or a disease caused by unequal sized blood cells.(**20 syllables)**

6.Root: aqua		
semiaquatic	(adj) adapted for living or growing in or near water, not entirely aquatic	A **semiaquatic** animal lives in the water and stays on the land. (19 syllables)
subaqueous	(n.) soils that formed in sediment found in shallow, permanently flooded environments	The soil that is formed in flooded land and around rocks is **subqueous.**
Aquanaunt	(n.) One who travels under water, a person who trained to work in an underwater chamber	A scuba diver, or **aquanaunt**, is trained to work in underwater chambers. (20 syllables)
Aquarist	(n.)A person who studies aquatic life, owner of an aquarium	A person who studies underwater animals is called an **aquarist**. (19 syllables)
aquaculture	(n)The growing of microorganisms, tissue cells, or other living matter in a specially prepared nutrient	People farm animals or plants, a type of **aquaculture**, such as trout, for food. (20 syllables)

7.Root: hydr-		
hydrology	(n.)branch of science or geology that studies the Earth's watef	One type of science is called **hydrology** or the study of water.
hydrocarbon	(n.)a substance (such as coal or natural gas) that contains only carbon and hydrogen	Coal is a type of matter that is called a **hydrocarbon**.
Geohydrologist (n.)	A person who studies the science that deals with the character, source, and mode of occurrence of underground water	A person who studies ground water sources is called a **geohydrologist.** (20 syllables)
hydrozoan	any class of coeleneterates including the jellyfishes and single or colonial polyps	A class of polyps, or **hydrazoan,** are animals that live in water. (19 syllables)
geohydrology	A science that deals with the character, source, and mode of occurrence of underground water	**Geohydrology** is the study of ground water sources on Earth. (18 syllables)

8. Root: therm		
isotherm	a line on a map linking points having the same temperature	The map was used to show the places that had the same heat pattern or isotherm. (20 syllables).
geothermal	of or relating to using the natural heat produced inside the Earth	**Geothermal** heat is produced in the ground deep inside the Earth's soil. (17 syllables)
thermophile	(n.) an organism (such as bacteria or plant) that thrives under warm conditions	A **thermophile,** a type of plant or virus, loves living at high heat. (18 syllables)
hyperthermia	(n.) unusually high body temperature	The heat stroke made her body heat increase due to **hyperthermia**.
stenotherm	capable of surviving over only a narrow range of temperatures	Some animals ,or **stenotherms**, can only live within a narrow heat range.

9.Root: pod/ped		
gastropod	(n.) any large class of mollusks (snails, slugs) that have a muscular foot at the bottom and a spiral shell	A slug, known as the "stomach foot" or **gastropod** crawled around the marine land. (20 syllables)
apodal	(adj.) having no feet	A shocking fact about **apodals** has to do with them having no feet. **(18 syllables)**
pedomotive	(adj.) moved or worked by the action of the foot or feet on a pedal or treadle	He used **pedomotive** action to petal the bike around the yard. (17 syllables)
amphipod	any of a large order of small crustaceans (sand flea) with a compressed body (adj)	An **amphipod**, such as a flea, has no feet on both sides of its body. **(**18 syllables)
quadraped	(n.) four footed animal	A horse, or a **quadruped**, is an animal with four feet**.** (15 syllables)

10.Root: dent/dont		
denture	(n.) set of false teeth,	Pa got new **dentures**, a fake set of teeth, since he lost his old set .(18 syllables)
orthodontist	(n.)A branch of dentistry that helps make teeth grow straight, helps straighten teeth	The **orthodontist** told the boy he would need braces to make his teeth straight.(19 syllables)
dentiscalp	(n.) set of false teeth,	Pa got new **dentures**, a fake set of teeth, since he lost his old set .(18 syllables)
edentate	(n.)Has to do with a mammal that lacks teeth	A sloth is a mammal with no teeth that is part of the **edentate** family.
dentoid	(n.) resembling a tooth	He found what looked like a **dentoid**, or a form of a tooth, in the ground. (17 syllables)

Appendix G

CLUES Probe # 2

Directions: First, write the Clue Word strategy next to each strategy step. Second, use each step of the Clue Word Strategy to figure out the unknown word. Write each answer in the boxes in the organizer. Do your best work! ☺

Mycology, the study of fungus**,** helps farmers make lots of mushrooms.

1._____

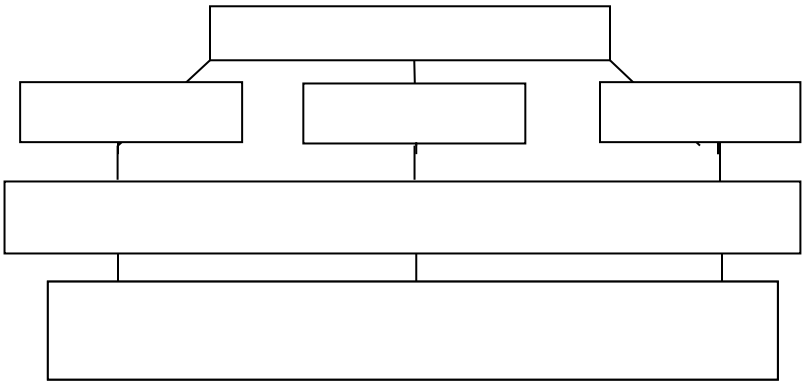
2._____

3._____

_____

4._____

5._____



Points:_____/15__ Points:_____/8___

Appendix H

CLUES Strategy Probe Scoring Checklist for analyzing words: 2 Word Parts

Please find the Word Key in the Instructor Vocabulary Folder in order to grade this probe.

The word is:_____

Wrote the word parts in the correct boxes (Total 2 points)

Use this sheet to score words with two word parts (prefix-root or root-suffix)

2 points	**1 point**	**0 point**
Wrote 2 out of 2 word parts in the correct boxes	Wrote one out of 2 word parts in the correct boxes	Wrote no word parts in the correct box

Wrote correct/similar word part definition in the appropriate box (Total 3 points)

2 points	**1 point**	**0 point**
Wrote the similar word part definition for 2 out of 2 word parts	Wrote the similar word part definition for 1 out of 2 word parts	No definition was written/answer is not similar to definition

Accurately defined the word based on the predicted word meanings (Total 3 points)

3 points	**2 points**	**1 point**	**0 point**
Accurately defined the word based on the predicted word meanings	Defined the word similar to the predicted word meaning	Wrote a loose definition of the word.	No definition of the word was written.

Checked the dictionary/vocabulary folder (Total 3 points)

3 points	**2 points**	**1 point**	**0 point**
Checked dictionary then the vocabulary folder answer key to see if he/she was right and wrote the correct definition below predicted definition.	Checked only the dictionary or vocabulary answer key folder (sheet) of the definition	Checked the dictionary and wrote down some of the definition	Did not use dictionary or vocabulary folder, wrote down a definition that was irrelevant

Appendix I

CLUES Probe Strategy Use Scoring Checklist

Connect to the context.

3 points	2 points	1 point	O point
Connect to the context or Connect to context or Connect the context	Connect Context	Context or Connect Check	Nothing written

Label two contextual clues.

3 points	2 points	1 point	O point
Label two contextual clues Or Label two context clues	Label two clues Or Label two contexts	Label context	Nothing written

Use the clues to write and define the word parts.

3 points	2 points	1 point	O point
Use the clues to write and define the word parts. OR Use clues to write and define the word parts. OR Use clues to write and define the morphemes	Use the clues to write and define the parts. OR Use clues to write and define the morphemes. .	Use clues to define the word parts. OR Use clues to write the word parts. OR Write and define the word parts.	Nothing written

Explain the science word.

3 points	2 points	1 point	O point
Explain the science word.	Explain the word.	Explain!	Nothing written

See if you are correct.

3 points	2 points	1 point	0 point
See if you are correct.	See if correct. OR See if you correct. OR See if are correct.	Correct. OR See.	Nothing written

Appendix J

Generalization Probe # 1

Name:_____ **Date:**_____

Directions: Use the CLUES strategy to identify the morphemes, define the morphemes, and define the science word.

The nurse wrote down the **systolic** pressure, each time the heart tightens.

Write the morphemes in the science word. Next, define the morphemes in the science word.

Prefix:_____ Definition:_____

Root:_____ Definition:_____

Suffix:_____ Definition:_____

Define the science word.

systolic:

_____

_____

_____

Appendix K

Name: _____ Date:_____

Word Knowledge Test

Directions: Fill in the blanks for each underlined word and its parts. Separate each word by its parts (affixes and roots). Give each part's meaning and then predict what the entire word means. There may be more (boxes) than needed for each word. If you do know the word, please mark an X on that line and move to the next word. Good luck!

Example 1: isobar

___X__ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

Example 2: plasmid

_____ I have not seen this word before
_____X_ The word looks familiar. It might mean__some type of DNA in cells__.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
____X__ I can use this word in a sentence…_____Plasmid is found in cells._____
_____.
_____ This word means____jelly substance found in cells_____

1.ascomycota

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____

2.mycology

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…__
_____.
_____ This word means_____.

3.blastomycotic

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.

4.immortal

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

5.rigormortis

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

6.mortician

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

7.taxidermy

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

8.ostraderm

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

9.dermatophyte

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

10.carditis

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

11.cardiograph

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

12.endocarditis

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

13.endocardial

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

14.cytoplasm

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.

_____ This word means_____. _____.

15.leukocyte

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

16.anisocytosis

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

17.phagocyte

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

18.semiaquatic

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

19.aquanaunt

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

20.aquaculture

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

21. geohydrologist

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

22. hydrozoa

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____.
_____.

23.hydrology

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____ _____.

24.apodal

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____
_____ This word means_____ _____.

25.pedomotive

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____ _____.

26.amphipod

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

27.quadraped

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

28.denture

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

29.orthodontist

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

30. dentoid

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

31.heterotroph

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

32.herbivore

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

33.extracellular

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

34.dissect

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

35.eucoelmate

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____.
_____.

36. hemocyst

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

37.lipase

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means
_____.
_____ I can use this word in a sentence…_____
_____.
_____ This word means_____
_____.

38.adipose

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____ _____.

39.abductor

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____. _____.

40.chromosome

_____ I have not seen this word before
_____ The word looks familiar. It might mean_____.
_____ I can identify one of the word parts. One word part is _____ and it means _____.
_____ I can use this word in a sentence…_____ _____.
_____ This word means_____ _____.

Total points: _____/120

Appendix L

Name:_____ **Date:_____**

Word Part Test

Directions: This is the word part, or morpheme, test. The word parts are called roots, suffixes, and prefixes. Read the small word part and guess its meaning. If you do not know the word, you may skip it and move to the next word part. Do your best.

Directions: Please write the definition of each root on the line next to it. Remember to do your best and give it your best guess.

Section 1: Roots (10 points)

Example: un not____

1. mort _____
2. myc _____
3. hydr _____
4. aqua _____
5. dent _____
6. derm _____
7. therm _____
8. card _____
9. cyto _____
10. ped _____
11. zoa _____
12. nat _____
13. helix _____
14. hepa _____

Section 2: Prefixes (16 points)

Directions: Please write the definition of the **prefixes** listed below

1. asco _____
2. leuko _____
3. blasto _____
4. acro _____
5. phago _____
6. aniso _____
7. im _____
8. semi _____
9. geo _____
10. gastro _____
11. rigor _____
12. ortho _____
13. quad _____
14. ostraco _____
15. steno _____
16. endo _____
17. a _____
18. amphi _____
19. taxi _____
20. eu _____
21. eco _____
22. angio _____

Section 3: Suffixes (16 points)

Directions: Please write the definition of the each **suffix** on the each line listed below.

1. ota _____
2. scalp _____
3. culture _____
4. otic _____
5. ology _____
6. plasm _____
7. ure _____
8. osis _____
9. ist _____
10. cian _____
11. y _____
12. phyte _____
13. plasm _____
14. kinin _____
15. itis _____
16. phil _____
17. motive _____
18. graph _____
19. cide _____
20. emia _____
21. gram _____

Pre-test
Total possible points: ____/ 57
_____%

Appendix M

Name:_____ **Date:_____**

Examiner:_____

Word Mapping/Strategy Use Test

Directions: First read the sentence that contains the unknown word. Second, fill in the strategy key phrases on the left-hand side. Third, read the sentence and fill in the organizer to figure out the unknown word.

(#1).

1. _____ His body had less iron since his red blood cells lacked **hemoglobin**.

2._____

3. _____

_____

4. _____

5. _____

(# 2).

1. _____ Ken knew that **<u>cerebrospinal</u>** fluid surrounds the brain and spinal cord.

2._____

3. _____

_____

4. _____

5. _____

_____/22 + _____/30 = _____/52 points

Section 2: Rules

Directions: Read the sentence. Put your answers on the blank line. Do your best!

3. Define the following words:

Context:_____

_____

Morpheme:_____

_____

Root:_____

_____

Prefix:_____

_____

Suffix:_____

_____

4. List **two rules** for context.

_____

_____

5. List **two rules** for morphemes.

_____

_____

_____

_____

6. List **two rules** when identifying roots.

_____

_____

_____

_____

7. List **two rules** when identifying prefixes.

_____

_____

_____

_____

8. List **two rules** when identifying suffixes.

_____

_____

_____

_____

9. List the **five CLUES steps**.

_____

_____

_____

_____

_____

Section 2: _____/30

Total Section 1 and Section 2 Points: _____/52 + _____/30 = _____/82 points

Appendix N

Name: _____
Date:_____

Adapted Child Intervention Rating Profile (CIRP; Witt & Elliot, 1985)

	I do not agree					**I agree**
	1	2	3	4	5	6
I am satisfied with how the CLUES helped me analyze vocabulary words.	____	____	____	____	____	____
The instructor clearly explained and showed how to use the CLUES during each lesson.	1 ____	2 ____	3 ____	4 ____	5 ____	6 ____
CLUES Strategy is a fair tool to help me define unknown science words.	1 ____	2 ____	3 ____	4 ____	5 ____	6 ____.
There are better ways to learn words than to use the CLUES	1 ____	2 ____	3 ____	4 ____	5 ____	6 _____
I would recommend the CLUES strategy to other students to help other students learn vocabulary	1 ____	2 ____	3 ____	4 ____	5 ____	6 ____
I liked the CLUES strategy and found it easy to use.	1 ____	2 ____	3 ____	4 ____	5 ____	6 ____
I think that CLUES will help me do better in school.	1 ____	2 ____	3 ____	4 ____	5 ____	6 ____

Comments:_____

_____

_____

Total points: _____/42 points

Appendix O

Training Lesson Fidelity Checklist

Teacher: _____ Observer: _____ School: _____

Date: _____

Directions: As you observe the lesson, please write an "X" in the "yes" box located next to each step if the behavior was observed. Place an "X" in the "no" column if the behavior was not observed. Once the lesson is complete add the total number of "X"s in the "no" and "yes" column separately.

Observable Teacher Behaviors	**Yes**	**No**
Teacher has the appropriate materials prepared for the lesson (e.g., vocabulary binder, dictionary, pencils on the desk, graphic organizer and markers) available		
Teacher uses the CLUES review sheet to review previous material (e.g., teacher asks a question than the student chorally responds)		
Teacher implements error correction procedures during CLUES review (e.g., teacher repeats correct answer three times if the student says the answer incorrectly)		
Teacher asks the student the definition of the term being instructed (e.g., context, morphemes, roots, prefixes, suffix)		
Teacher asks the student to state the definition of context and waits for an answer		
Teacher provides the definition		
Teacher and student both write down the definition on the poster/guided notesheet (teacher on poster, student on binder sheet)		
Teacher tells the student to identify rules (e.g., of context, morphemes, roots, prefixes, suffixes)		
Teacher states the list of rules		
Teacher writes the context rules on the blank laminated sheet		
Teacher has the student write down the context rules in the vocabulary binder		
Teacher provides 4 examples and some non-examples		
Teacher writes each examples/non-examples on the board and has		

the student write down examples on the guided note sheet		
Teacher models at least 2 examples and uses "think aloud" cognitive strategies		
Teacher uses error correction procedures (e.g., provides correct answer) when necessary during examples		
Teacher reviews the term and rules taught at the end of the lesson		
Total Number of behaviors observed (Yes column)		
Total Number of behaviors not observed (No column)		

Teacher Fidelity: ____/16 points Total Y / by Y +N x 100 = _____%

Appendix P

Fidelity Checklist

Teacher:_____ School:_____Observer:_____
Date:_____ Root:_____

Directions: As you observe the CLUES intervention lesson, please write an "X" in the "yes" box located next to each step if the behavior was observed. Place an "X" in the "no" column if the behavior was not observed. Once the lesson is complete add the total number of "X's" in the "no" and "yes" column separately. Please add additional comments in the box provided below the observable behaviors section.

Observable Teacher Behaviors	**Yes**	**No**
TEACHER-LED PRACTICE		
Materials are prepared for instruction (e.g., dictionary(s), vocabulary folder, lesson binder, markers, laminated posters		
Teacher begins the lesson with the CLUES review and provides a quick pace throughout the duration (e.g., chorally responds then signals for the student to chorally respond within 2 seconds then repeats the next question)		
Teacher provides error correction procedures during the CLUES review when needed (e.g., if student provides an incorrect answer teacher will have student repeat the question and correct answer three times with the student before moving to the next question)		
Teacher has the student turn to the lesson guided note sheets in the binder.		
Teacher states the root/root type (Latin or Greek) and the science word and part of speech (n/adj,etc.)		
Teacher writes the first sentence on the CLUES teacher-led organizer.		
The teacher asks the students to state each step of the CLUES strategy and writes it on the poster when comes to each step.		
The teacher models how to use each CLUES step during the process and uses think aloud strategies to figure out the word part meanings and words.		
Teacher provides error correction procedures by stating the correct answer and having students restate the correct answer before moving to the next part of the lesson (e.g., if student states wrong CLUES step, writes a word part in an incorrect box, etc.)		

Note: This does not include students attempting to guess word part meanings as this is part of the proces and they will discuss when check the answers s)		
Teacher models how to check the dictionary and/or vocabulary binder after writing the last step.		
GUIDED PRACTICE		
Teacher has student turn to the guided practice notesheet for the lesson.		
Teacher asks the student what root/root type they are learning.		
Teacher writes the sentence on the graphic organizer.		
Teacher states and writes each of the CLUES steps throughout the lesson.		
Teacher models how to use each of the CLUES steps and uses think aloud strategies throughout each lesson.		
Teacher provides error correction procedures (e.g., if student states wrong CLUES step, writes a word part in an incorrect box, etc.) ***Note: This does not include students attempting to guess word part meanings as this is part of the process and they will discuss when check the answers)***		
Teacher asks the student to locate the word and definition in the dictionary and find the answer key sheet as they review the word.		
INDEPENDENT PRACTICE		
Teacher has student turn to independent practice sheet and tells them to complete use the CLUES strategy steps to complete this sheet but to ask for help if needed.		
Teacher monitors the student's work and answers/provides error correction when necessary.		
Teacher reviews the sheet with the student once they have finished and have reviewed the dictionary/answer key sheet then collects the binder.		
Total number of behaviors observed (Y or "yes" column)		
Total number of behaviors not observed (N or "no" column)		

Teacher Fidelity Total: __/20 points Total Y/Total Y + N x 100 = _____%

Appendix Q

Data Collector:_____ Fidelity Examiner:_____
Training/Observation Date:_____

Test of Reading Comprehension (TORC-4) 5 Subtests

Subtests	Yes	No
Relational Vocabulary		
Examiner read the directions verbatim		
Examiner did allowed unlimited time per manual instructions		
Examiner continued after example 1 only if the student correctly wrote the answer to example 1		
Examiner continued after example 2 only if the student correctly wrote the answer to example 2		
Examiner told the student they would tell them when to stop (when student reached ceiling)		
Examiner told the student when to begin		
Examiner did not provide the student with any answers		
Sentence Completion		
Examiner read the directions verbatim		
Examiner allowed unlimited time for the test per manual instructions		
Examiner continued after example 1 only if the student correctly wrote the answer to example 1		
Examiner continued after example 2 only if the student correctly wrote the answer to example 2		
Examiner told the student they would tell them when to stop (when student reached ceiling)		
Examiner told the student when to begin		
Examiner did not provide the student with any answers		
Sentence Construction		
Examiner read the directions verbatim		
Examiner allowed unlimited time per manual instructions		
Examiner continued after example 1 only if the student correctly wrote the answer to example 1		
Examiner continued after example 2 only if the student correctly wrote the answer to example 2		
Examiner told the student they would tell them when to stop (when student reached ceiling)		
Examiner told the student when to begin		
Examiner did not provide the student with any answers		
Text Comprehension		
Examiner read the directions verbatim		
Examiner allowed unlimited time per manual instructions		

Examiner continued after example 1 only if the student correctly wrote the answer to example 1		
Examiner continued after example 2 only if the student correctly wrote the answer to example 2		
Examiner told the student they would tell them when to stop (when student reached ceiling)		
Examiner told the student when to begin		
Contextual Fluency		
Examiner provided directions verbatim		
Examiner told the student that this subtest would have a 3 minute time limit		
Examiner continued after example 1 only if the student correctly wrote the answer to example 1		
Examiner continued after example 2 only if the student correctly wrote the answer to example 2		
Examiner told the student when to begin		
Examiner told the student to stop after 3 minutes (when timer beeped)		

Appendix R

Data Collector:_____ Fidelity Examiner:_____
Training/Observation Date:_____

Word Knowledge Test Training Fidelity Protocol

Directions	Yes	No
1. Examiner reads the directions verbatim.		
2. Examiner reads and explains the example.		
3. Examiner states the test is untimed.		
4. Examiner does NOT provide any feedback or praise, only statements about student effort such as "Try your best" or "I like how you are working hard."		
5. Examiner reads the directions to each section of the test.		
6. Examiner re-reads the directions once if student asks.		
7. Examiner collects the test once the student says he/she is finished.		
Total correct steps		

Appendix S

Data Collector:_____ Fidelity Examiner:_____
Training/Observation Date:_____

Word Part Test Training Fidelity Protocol

Directions	Yes	No
8. Examiner reads the directions verbatim.		
9. Examiner reads and explains the example.		
10. Examiner states the test is untimed.		
11. Examiner does NOT provide any feedback or praise, only statements about student effort such as "Try your best" or "I like how you are working hard."		
12. Examiner reads the directions to each section of the test.		
13. Examiner re-reads the directions once if student asks.		
14. Examiner collects the test once the student says he/she is finished.		
Total correct steps		

Fidelity: _____ / _____ = _____ %
Total Endorsed / Total Possible

Appendix T

Data Collector:_____ Fidelity Examiner:_____
Training/Observation Date:_____

Word Mapping/Strategy Use Test Training Fidelity Protocol

Directions	Yes	No
15. Examiner reads the directions verbatim		
16. Examiner states the test is untimed		
17. Examiner provides the student a dictionary for the first two items ONLY if the student writes the S "See if you are correct" step and has completed the probe.		
18. Examiner monitors the student to make sure the student only uses the dictionary to write the definition from the dictionary or answer key sheet and does not change ANY other answers on the probe		
19. Examiner does NOT provide any feedback or praise, only statements about student effort such as "Try your best" or "I like how you are working hard"		
20. Examiner reads the directions to each section of the test		
21. Examiner re-reads the directions once if student asks.		
22. Examiner collects the test once the student says he/she is finished.		
Total correct steps		

Fidelity: _____ / _____ = _____ %
Total Endorsed / Total Possible

Appendix U

Data Collector:_____ Fidelity Examiner:_____
Training/Observation Date:_____

Administration of CLUES baseline, intervention, maintenance, and generalization probes

Directions	Yes	No
1. Reads CLUES probe directions verbatim to the student		
2. Instructor does NOT provide praise or feedback for ability during testing (praises only effort) with statements such as "Do your best work" or "Try your best" rather than using praise statements.		
3. During the assessment, the instructor may tell the student once to "Give it your best guess" or re-read the directions if the student asks them to repeat it.		
4. The instructor does not set a time limit on the probe administration.		
5. The instructor provides a dictionary/and or answer key sheet to the student to see if they are correct ONLY if the student writes the S step "See if you are correct."		
6. The instructor monitors that the student only writes the definition and does not change any answers although reviewing the dictionary definition or answer key sheet.		
7. The instructor collects the probe immediately after the student is finished.		
Total Steps correct		

Fidelity: _____ / 7 = _____ %
Total Endorsed / Total Possible

Appendix V

CLUES Strategy Steps

C = "Connect to the context"
L = "Label two contextual clues"
U = Use the clues to write and define the word parts"
E = Explain the science word"
S = "See if you are correct"

Appendix W

Training Lesson #1: Context

Materials
Lesson plan Dry erase markers Blank laminated poster Vocabulary binder Dictionary Guided note sheet: Training Lesson #1 Context CLUES Review Sheet (not used until Training Lesson 2)

Prior to instruction, the teacher passes out the vocabulary folder and dictionary. **Teacher:** Good morning/afternoon. Today we were learning about context. I have given you a vocabulary folder that has labeled sections. The first section is guided notes that we were using this week. There are 6 sections. I will let you know the section and lesson you need to open each day. A dictionary will also be available if we use it during the lessons. **Teacher**: Today we were in section 1 of the vocabulary binder titled "Lesson 1: Context." Remember, the vocabulary binder were used during instruction. *(Teacher makes sure the student is in the correct section of the vocabulary binder)* **Teacher***:* How would you define the word context? *(Teacher waits 3-5 seconds for student response).* **Teacher:** Context is defined as words or phrases that come before or after an unknown word that gives clues to the unknown word meaning and usually influences its meaning or effect. That is, context is the words that surround an unknown word, such as synonyms that give clues to the same meaning of the word, describing words such as adjectives, or other words that help give clues to the definition.We will review some examples after writing and discussing context some more. Teacher: I am going to write the definition on the poster (teacher begins to write) and I want you to write the definition on your guided notesheet where it says context definition. (teacher checks the sheet).	**Student:** *Provides definition of context or states what they know* *Student writes context definition* **Student:** Repeats

Teacher: *What is context?* **Teacher**: What are two rules about context? *(Teacher waits 3-5 seconds for a response).* **Teacher***:* After I state a rule, I am going to write it on the poster. I would like you to write the context rules on the guided note sheet in the section labeled context rules. The first important rule about context is that context gives readers clues to the meaning of the word they don't know and can be one word, two words, or a phrase of words in a sentence. Sometimes context around the word does not fully define the word or definition but provides "clues" to its meaning Context usually surrounds the unknown word at the beginning, middle, or end of a sentence. It is important to read a sentence to identify context clues at least two times. This will help you identify important clues by reading it a second or third time. **Teacher:** What are the rules about context? Remember, you can use your guided note sheet to help you state each rule. *(Teacher waits for the students to state the context rules)* **Teacher**: Great. Now, we are going to look at 4 example sentences to help better understand context. There are 4 sentences at the bottom of the guided note sheet. I post each sentence on the laminated poster one at a time. **Sentence #1:** When working out, **<u>neurotransmitters</u>** send messages from nerve to nerve. We are going to apply the context rules to try and figure out the context phrases that surround an unknown word. What is the first thing we should remember about context? *(Teacher waits for student response)* (review rules with students (e.g., usually gives us some clues about the whole word but not the whole definition, can be located as one word, two words, or a phrase at the beginning, middle, or end of the sentence) . Teacher: Let's read the sentence again to help us identify contextual clues. First, what are some clues around the unknown word neurotransmitter? *(Teacher waits for student response)* *Teacher*: Great. One clue for the word neurotransmitter is that messages are sent from nerve to nerve. I will underline the phrase send messages from nerve to nerve with a marker. I want you to underline this sentence on your sheet. *(Teacher monitors*	definition of context. **Student**: States rules about context **Student:** States context rules to help students figure out the context clues in the sentence. **Student:** States different contextual clues around the unknown word. **Student:** Underlines contextual clues

student underlining this phrase in the sentence). Let's see if there is a second clue. If I look at the beginning of the sentence, I see that messages are sent when working out, the means I must be active. Therefore, I am going to underline the clue phrase working out and I want you to do the same. We will review how to use these clues to define the word parts and science word neurotransmitters. **Teacher***:* Let's look at another example sentence: **Sentence # 2:** Ben's **epiglottis** was put to work after he chewed then swallowed a piece of steak. **Teacher:** Using contextual rules, I will need to identify some contextual clues to help me understand the unknown word. What is one contextual clue? *(Teacher waits for student response)* **Teacher:** One clue that is at the beginning, middle, or end of the sentence is swallowed steak. I think that somehow Ben's epiglottis helps him swallow food. I am going to underline the word swallowed. Sometimes contextual clues are one word, two words, or more words. Now, what is another clue? I think that a second clue is that the epiglottis has to work to help Ben swallow food. I will underline the phrase put to work. These clues can help me make sense of what the word epiglottis means. We are just practicing our ability to identify contextual clues that surround the unknown science word. We will learn about the morphemes within the science word tomorrow that will help us define the unknown word. Please make sure that the two contextual clues are underlined on your paper like I have done on the poster. **Teacher:** Let's look at a third example. Let's read the sentence together. Sentence # 3: The **oviparous** bird waited for her baby chicks to hatch after laying the eggs in the nest. **Teacher:** Make sure you always think back to the context rules. Using the context rules, what are two phrases that we could underline to help us figure out the meaning of oviparous? *(Teacher waits for student response)* **Teacher***:* Great. Let's re-read the sentence, one of our context rules. One clue is laying the eggs and another is waiting to hatch. Let's underline those clues.	**Student:** Underlines contextual clues **Student:** states contextual clues then underlines them (swallowed steak, or put to work, or chewed, **Student**: States a contextual clue **Student:** state contextual clues such as: laying eggs, waited for hatching

Teacher: Let's read the fourth example sentence. I want you to figure out at least two word phrases using context rules. We will then review the sentence. **Sentence 4**: Vegetable oil contains **<u>lipids</u>** that can cause people to gain weight. **Teacher**: What are two rules about context? *(Teacher waits 3-5 seconds for a response).* **Teacher:** Let's review the two clues. What two contextual clues did you underline? **Teacher:** Right, vegetable oil is a contextual clue at the beginning of the sentence. The second clue is that it can cause weight gain. **Teacher:** Great. We are done with our lesson. Before we are done, let's review the definition of context and context rules. You can read them from your guided note sheet. **Teacher:** What is context? Teacher: *(waits for student response than restates context definition)* Context is defined as words or phrases that come before or after an unknown word that gives clues to the unknown word meaning and usually influences its meaning or effect. That is, context is the words that surround an unknown word, such as synonyms that give clues to the same meaning of the word, describing words such as adjectives, or other words that help give clues to the definition. **Teacher:** What are the context rules? **Teacher:** *(waits for student response than restates context rules)* Context gives readers clues to the meaning of the word they don't know and can be one word, two words, or a phrase of words in a sentence. Sometimes context around the word does not fully define the word or definition but provides "clues" to its meaning Context usually surrounds the unknown word at the beginning, middle, or end of a sentence. It is important to read a sentence to identify context clues at least two times. This will help you identify important clues by reading it a second or third time.	**Student:** Reads the sentence again and then underlines two phrases **Student:** States contextual clues

Appendix X

CLUES Review Sheet

Directions: The teacher will state the directions in the Teacher Response box on the left. The student will chorally respond immediately (not more than 5 seconds lag) with the correct answer. If the student states an incorrect answer, the teacher will state the correct answer. The teacher will then repeat the initial question and then have the student state the correct answer three times before moving to the next question.

Lesson 1 Pre-training Teacher: a. "Context is…" b."Context rules are…"	Student response… a. defined as words or phrases that come before or after an unknown word that gives clues to the unknown word meaning and usually influences its meaning or effect. ● b. Sometimes context around the word does not fully define the word or definition but provides "clues" to its meaning ● Context usually surrounds the unknown word at the beginning, middle, or end of a sentence. ● It is important to read a sentence to identify context clues at least two times. This will help you identify important clues by reading it a second or third time.
Lesson 2 Pre-training a. "Morphemes are…" b. "Morpheme rules are…"	Student response… a. are combination of sounds that have a meaning and are the smallest unit of meaning. b. Morphemes are also called word parts that have meaning include prefixes, suffixes, and roots. Morphemes are often thought of as words but this is not always correct Morphemes are not syllables, although sometimes they are thought of as syllables. There are two types of morphemes called free and bound morphemes.
Lesson 3 Pre-training a. "A root are…" b. "Root rules are…"	Student response… a. the most basic component of a word or family of related words and are the core part of a word that other word parts, or particles, such as prefixes and suffixes, attach to. ● b. Roots have specific meanings ● Sometimes two roots make up a whole word ● Most definitions/terms contain two roots ● There must be at least one root in a word ● Roots are either Latin or Greek, more can occur in a word, but the number of roots in a particular word is generally small
Lesson 4 Pre-training a. "A prefix is…" b. "Prefix rules are…" c. "A suffix is…" d. "Suffix rules are…"	Student Response… a. morpheme that is attached in front, or before, a root. b. Always appear before the root word, a word part that carriers meaning, its definition is made up of one or two words. c. morpheme that comes at the end of the word and is a letter, word part, or group of syllables added to the end of the

	word that changes the word meaning. d. Some suffixes have meanings although some suffixes change the part of speech or grammar of the word Suffixes are always attached to the end of the root word, or after the root Suffixes change the grammar of the word meaning
Lesson 1 CLUES a. "The root **mort** means…"	a. death
Lesson 2 CLUES a. "The root **myc** means…"	a. fungi
Lesson 3 CLUES a. "The root **hydra** means…"	a. water
Lesson 4 CLUES a. "The root **aqua** means…"	a. water
Lesson 5 CLUES a. "The root **dent/dont** means…"	a. teeth
Lesson 6 CLUES a. "The root **algia** means…"	a. pain
Lesson 7 CLUES a. "The root **therm** means…	a. heat
Lesson 8 CLUES a. "The root **card** means…"	a. heart
Lesson 9 CLUES a. "The root **cyte/cyto** means…"	a. cell
Lesson 10 CLUES a. "The root **ped/pod means**…"	b. foot/feet

Appendix Y

Intervention Lesson: Card

4.Root: card		
myocardium	(n.) the middle muscular layer of the heart wall	**Myocardium** is the middle and thickest layer of the heart wall.
carditis	(n.) inflammation of the muscles in the heart	Jan had **carditis**, or the inflammation of the heart muscle.
cardiology	the study of the heart and its action and diseases	The doctor went to college for the study of the heart, or **cardiology**. (20 syllables).
endocarditis	(n).inflammation of the lining of the heart and its valves	He suffered from **endocarditis,** a disease of the lining of the heart**. (**19 syllables**)**
cardiograph	**n.)**an instrument that shows the movements of the heart	The **cardiograph** was done to see the movement in the man's heart. (16 syllables)

Materials

CWS Laminated Enlarged CLUES Teacher-Directed Organizer
CWS Laminated Enlarged CLUES Guided-Practice Organizer
Independent Practice Organizer
Dry Erase Markers
Teacher Scripted Lesson Binder
Student Vocabulary Binder
Pencils
CWS Intervention Probe
Raffle ticket
Small reward bucket
Videotape
Fidelity checklists

CLUES Strategy

C = "Connect to the context"
L = "Label two contextual clues"
U = Use the clues to write and define the word parts"
E = Explain the science word"
S = "See if you are correct"

Teacher: Welcome to CLUES Strategy Instruction! Let's review all of the terms you have learned before learning our new root.

****Teacher used CLUES Review sheet prior to the new lesson that includes all terms, previous roots, and review of the CLUES steps. Teacher will state the questions, students will respond with the correct answers. If the student does not respond within 5 seconds, the teacher will repeat the answer, then repeat the answer with the student 3 times before moving onto the next question.***

Teacher-Led Practice (use graphic organizer poster with labels) *Prior to instruction, the teacher passes out the vocabulary folder and dictionary.*	**Student Response Column**
Teacher: You have your vocabulary folder, pencils, and a dictionary that we will sometimes use—today we were using it. In your notes, turn to Section 8 and to Intervention Lesson #8. *(Teacher checks to make sure student is at the correct section).* ***Teacher****: Great!* If you look up at the board, you see that there is a blank graphic organizer. We learned all about context, morphemes, prefixes, roots, and suffixes and how all of these concepts are used in the CLUES strategy. You learned what the letters in the CLUES Strategy stand for and how this will help you figure out unknown science words. You used all of the knowledge and rules about context, morphemes, prefixes, suffixes, and roots to help you. Today's lesson has three parts. First, I modeled how to use the CLUES strategy with help from you, next we will work through another sentence to figure out the unknown science word using the CLUES strategy, and finally you will read a sentence to analyze and figure out the unknown science word using the CLUES strategy independently. **Teacher:** Today, we will focus on the root 'card' the means heart. Card is both a Greek and a Latin root. What type of root is card? (Teacher waits for students to state Greek and Latin root). ***Teacher****:* I would like you to read the sentences. We will go through each step together. *(Teacher writes the sentence with the unknown word on the board if needed)* **Teacher:** Before we begin, there is a list of the CLUES strategy steps that you can use as a reminder as we go through each step. This is located in section 6 of your binder. Also, I have part of the	**Student:** "Connect to the Context" **Error Correction**: If the student does not state the correct answer, the teacher will

strategy step written on this form so that you don't have to always write it down. The "C" in the CLUES strategy stands for…? *(Teacher waits for student response)* "Connect to the context". Connect to the context means reading the sentence and then re-reading the sentence with the unknown science word a second time. I am going to write the steps and you can read them to me from the paper. (Teacher writes the sentence although the student reads the sentence). So, we are going to read the sentence. I will read the sentence out loud: (or student) **Teacher reads: Myocardium** is the middle thick muscle tissue of the heart wall. (18 syllables) **Teacher:** Now, the second step of the CLUES strategy begins with an L. Do you have any idea what the L stands for? *(Teacher waits for S response).* Well, L stands for "Label two contextual clues" that surround the unknown word. Since I read and re-read the sentence, my next step is to find two key phrases that will help me define the words parts and define the science word. I am going to write this phrase on the organizer although you read it to me. So, do we see any clues that surround the word? These clues can be words or phrases just like we learned about with context. *(Teacher waits for student response)* **Teacher:** Well, I do see the phrase "tissue of the heart wall" so I will underline this phrase and I want you to underline this clue in the sentence on your sheet. Now, I need to find another clue. I have to remember that root word and prefix definitions are usually one word. I can also underline a third clue if I have three word parts. I see another phrase thick middle muscle" and I will underline this second clue. I think my one phrase may have two clues to two word part definitions. **Teacher:** In these two steps, I were using contextual analysis to identify the words surrounding my unknown word. I might need to go to the third step to find more clues. The third step begins with the letter U. The letter U means…(Teacher waits for the student response) Teacher : Yes, the U stands for "Use the clues to write and define the word parts." It is time for us to analyze the word and break it into its morphemes. That is, morphemes are words parts such as prefixes, roots, and suffixes. How many morphemes do we have in this word? *(Teacher waits for student response)* **Teacher***:* Great. There are 3 morphemes.	repeat the correct answer and have the student repeat the answer correctly before moving to the next step. **Student response:** "Label two contextual clues" **Student response:** may identify clues in the sentence **Student response:** Use the clues to write and define the word parts" **Student response**: 3 morphemes

Teacher: Ok. The first morpheme, or the center of the word is called…" Teacher: Correct. The center part of the word is called the root. The root word, or morpheme, in this word is… Teacher: Correct. The root word is card. I will write the root word in the box labeled root on the CLUES organizer although you write the root on you organizer sheet. (Teacher writes the root word card) Teacher: Correct. The morpheme that attaches to the beginning of the root is called…" Teacher: Correct. The prefix is the morpheme that attaches to the beginning of the root. The prefix is myo. I will write the root word in the box labeled prefix although you write the prefix in the correct box located on your CLUES organizer" Teacher: Yes. Finally, the morpheme that attaches to the end of the root is called the…: Teacher: Correct. The suffix is the morpheme word part that attaches to the end of the root. The suffix in this word is 'ium I will write the root word in the box labeled prefix although you write the suffix 'ium' in the correct box located on your CLUES organizer"' Teacher: Now, we will continue to use the clues to write and define our word parts. We wrote our word parts and now we used the clues in the sentence to help us define the three word parts. First, let's reread the sentence and talk about the clues that we underlined. Teacher: (re-reads the sentence): <u>Myocardium</u> is the thick, middle muscle tissue of the heart wall. (18 syllables) Teacher: One clue that was underlined was thick layer of the heart wall. The root word part definitions are usually one word. I think that most of this is describing the heart wall. If I choose the word that makes the most sense would be the heart. I am going to predict that the root morpheme, or word part, card, means 'heart'. I am going to write that definition of the root word card, 'heart', on my organizer although you write the card 'heart' on the organizer sheet. Teacher: Now, let's define the prefix morpheme. The prefix is myo and it is attached to the root morpheme 'card'. We already looked at our sentence to figure out the meaning of 'card'. Now, we will look at the clues to figure out the meaning of myo. Well, the other clue was thick, middle muscle. I think that the myo means muscle. I will write that down in the prefix box on the CLUES organizer although you write this down on your CLUES organizer sheet (Teacher writes as the student writes) Teacher: Now, it's time to define the suffix 'ium'. We are going to look for clues again. Suffixes may be one or two word definitions. Often they help us figure out the grammar or part of speech of a word. In this case, the clue we need to define ium may be in the clues we have. We already identified heart as the root word card definition, we defined myo as the muscle, and we have the words thick, middle, and tissue	Student: the root Student: card (Student writes root word card) Student: prefix Student: myo Student: suffix Student: ium

left. Well, the tissue, or structure, may make the most sense to define the suffix "ium'. I am going to write down the word tissue as the suffix for 'ium'. Teacher: The next clue letter is "E". We will "Explain the science word." This means that we will have to look at all of the clues that surround the unknown science word myocardium and look at how we used the clues to define the word parts. We want to make sure that all of the clues we used to define the word parts are in the definition we use to explain our unknown word. Let's see, we said that 'myo' means muscle, 'card' means heart, and ium means tissue. Teacher: I see that the clues in the sentence that I underline talked about myocardium being thick middle muscle tissue in the heart walls. I am going to think that myocardium means muscle tissue in the heart and write that down in the big box to define the science word. I would like you to write the definition on your paper. Do you agree or do you have anything to add after looking at the clues? Teacher waits. Teacher: Great. Now, our final clue is "See if you are correct." I am not going to check my answer in the dictionary. It is important that I begin by looking up the first letter of the word 'm', and the next letter, y, and continue down the list until I locate the word myocardium. Some science words are not listed in the dictionary but can be reviewed online. I also have the answer key sheet to review our answers. Teacher: I am going to find the word myocardium in my dictionary although you review yours (Teacher and students look for the word). Great. Does our definition match? It may be shorter but it is similar. Let's look at our answer key sheet. The answer key sheets provides the correct word parts, word part definitions, and science word definition. Did we have the correct definition? (Teacher waits) Teacher: Great. Now, I am going to guide you through another word but want you do help me through figuring out the word parts and definitions. <u>GUIDED PRACTICE:</u> Teacher: I will not have our guided practice poster up on the board. I want you to turn to the CLUES guided practice sheet to do this work. It is located behind the sheet we just wrote on in your vocabulary binder. We will reading the sentence with an unknown science word and identifying morphemes and their definitions to help us figure out the science meaning just like we did in the first example. Ready? *Teacher:* I would like you to read the sentence with me. We will go through each step together. *(Teacher writes the sentence with the unknown word on the board if*	Student: (Reads sentence aloud) Student: Connect to the Context

needed) Jan studied the treatment of heart systems or <u>cardiology</u>. (16 syllables) Teacher: First, we weregin by using the C step of the CLUES strategy. Since the CLUES steps are written on both my and your sheet already, you can read them to me from the paper. The "C" in the CLUES strategy stands for…? *(Teacher waits for student response)* "Connect to the context". Connect to the context means reading the sentence and then re-reading the sentence with the unknown science word a second time. So, please read the sentence out loud: *(Teacher waits for the student to read the sentence aloud).* <u>Teacher reads:</u> Jan studied the treatment of heart systems or <u>cardiology</u>. (16 syllables) Teacher: Now, the second step of the CLUES strategy begins with an L. The L stands for ? *(Teacher waits for S response).* Well, L stands for "Label two contextual clues" that surround the unknown word. Since I read and re-read the sentence, the next step is to find two key phrases that will help define the words parts and define the science word. What is one clue that surrounds the word? These clues can be words or phrases just like we learned about with context. *(Teacher waits for student response)* Teacher: Well, I do see the phrase "studied the treatment" so I will underline this phrase and I want you to underline this clue in the sentence on your sheet. Now, I need to find another clue. I have to remember that root word and prefix definitions are usually one word. I can also underline a third clue if I have three word parts. I see another phrase "of heart systems" and I will underline this second clue. I think my one phrase may have two clues to two word part definitions. Teacher: In these two steps, I were using contextual analysis to identify the words surrounding my unknown word. I might need to go to the third step to find more clues. The third step begins with the letter U. The letter U means…(*Teacher waits for the student response)* Teacher : Yes, the U stands for "Use the clues to write and define the word parts." It is time for us to analyze the word and break it into its morphemes. That is, morphemes are words parts such as prefixes, roots, and suffixes. Remember, not all words contain a prefix, root, and suffix. Some words contain a prefix and a root or a root and a suffix. How many morphemes do we have in this word? *(Teacher waits for student response)* Teacher*:* Great. There are 2 morphemes. Teacher: Ok. The first morpheme, or the center of the word is called…" Teacher: Correct. The center part of the word is called the root. The	Student: Label two contextual clues. Student: Provides answer Student: Use the clues to write and define the word parts. Student: 2 morphemes Student: root Student: card Student: No Student: suffix Student: ology

root word, or morpheme, in this word is… Teacher: Correct. The root word is card. I will write the root word in the box labeled root on the CLUES organizer although you write the root on you organizer sheet. (Teacher writes the root word card) Teacher: Correct. Do we have a prefix, or a morpheme part that goes before the root in this word? Teacher: Correct. There is no prefix in the word cardiology Teacher: Yes. Finally, the morpheme that attaches to the end of the root is called the…: Teacher: Correct. The suffix is the morpheme word part that attaches to the end of the root. The suffix in this word is 'ology' I will write the root word in the box labeled prefix although you write the suffix 'ology' in the correct box located on your CLUES organizer"' Teacher: Now, we will continue to use the clues to write and define our word parts. We wrote our word parts and now we used the clues in the sentence to help us define the three word parts. First, let's re-read the sentence and talk about the clues that we underlined. Teacher: (re-reads the sentence): Jan studied the treatment of heart systems or <u>cardiology.</u> Teacher: One clue that was underlined was "heart system". During the first part of the lesson, we learned that 'card' meant heart. I am going to predict and use my prior knowledge that the root morpheme, or word part, card, means 'heart'. I am going to write that definition of the root word card, 'heart', on my organizer although you write the card 'heart' on the organizer sheet. Teacher: Now, it's time to define the suffix 'ology'. We are going to look for clues again. Suffixes may be one or two word definitions. Often they help us figure out the grammar or part of speech of a word. In this case, the clue we need to define ology may be in the clues we have. We already identified heart as the root word card definition, we defined ology as the study of that is a clue in the second phase. I am going to write down the word 'study of' for the suffix ology. Teacher: The next clue letter is "E" that stands for… . We will "Explain the science word." This means that we will have to look at all of the clues that surround the unknown science word cardiology and look at how we used the clues to define the word parts. We want to make sure that all of the clues we used to define the word parts are in the definition we use to explain our unknown word. Let's see, we said that 'card' means heart, 'card' and 'ology' means 'study of' Teacher: I see that the clues in the sentence that I underline talked about cardiology being the study of the heart. I am going to write that definition in the big box to define the science word. I would like you to write the definition on your paper. Do you agree or do you have anything to add after looking at the clues? *Teacher waits.*	Student: Explain the science word. Student: See if you are correct

Teacher: Great. Now, our final clue is "See if you are correct." I am not going to check my answer in the dictionary. It is important that I begin by looking up the first letter of the word 'c', and the next letter, a, and continue down the list until I locate the word cardiology. Some science words are not listed in the dictionary but can be reviewed online. I also have the answer key sheet to review our answers. Teacher: I am going to find the word cardiology in my dictionary although you review yours *(Teacher and students look for the word).* Great. Does our definition match? It may be shorter but it is similar. Let's look at our answer key sheet. The answer key sheets provide the correct word parts, word part definitions, and science word definition. Did we have the correct definition? *(Teacher waits)* Teacher: Great. Now, I am going to guide you through another word but want you do help me through figuring out the word parts and definitions <u>BOOSTER SESSION: ONE MORE SESSION GUIDED PRACTICE</u> <u>(Note: *Teacher only uses a booster session if students have not responded to the last three CLUES intervention lessons based on data). Teacher used the following sentence: and have one extra copy of the guided practice organizer and sheet for the student. The teacher used the same procedures used for guided instruction during this session for extra practice)*</u> Teacher: Now, we are going to go through another guided practice with the root word card- we are going to work together—but I will need more of your help. *Sentence:* The **<u>cardiograph</u>** was done to see the movement in the man's heart. (16 syllables) <u>INDEPENDENT PRATICE:</u> Teacher: The last part of the lesson is for you to practice using the CLUES strategy independently, or on your own. Turn to section 7 of your binder to find the independent practice sheet. This will see if you can write the strategies down and figure out a word with the root card in it. You used the CLUES strategy to figure out the unknown word in the sentence on the sheet. (see below). I were able to answer questions. You can check the answer key to check your answers when you are finished. I will review the sheet with you to discuss what you may need to review. This will help yourself and me figure out how the strategy is helping you. *Sentence:* He suffered from **<u>endocarditis,</u>** a disease of the lining of the heart**. (**19 syllables**)** *(Teacher will monitor as the student completes the CLUES independent*	

sheet.) Teacher: When you are finished, you can check the answer key to review the definition. I were here to review it after you are finished. This will help yourself and me figure out how the strategy is helping you. (*Teacher waits although student works and monitors work/there for* *questions.)* (Independent practice should be approximately 5 minutes) Teacher: We are going to review each of the practice sheets. We will review the teacher-led practice sheet, guided practice sheet, and lastly the independent practice sheet. First, we will review the set of CLUES steps. We will do this only once. Then we will point to where we use that strategy step on the organizer. Next, we will point and read the science word, the science morphemes, the morpheme meanings, and then the science word meaning. Please place your teacher-led organizer on your desk. Ready? (Teacher begins the review by pointing her finger on the first CLUES step) Teacher and student review each organizer at a quick DI pace). This should take about 5 minutes for review. Teacher: Great work today. Please place the vocabulary binder in the box along with the dictionary. I will see you tomorrow.	

Appendix Z

CLUES Maintenance Probe

Name:_____ Date:_____

Directions: First, write the CLUES strategy next to each strategy step. Second, use each step of the CLUES Strategy to figure out the unknown word. Write each answer in the boxes in the organizer. Do your best work! ☺

He felt ill after digesting his food with a condition called **dyspepsia**.

1._____

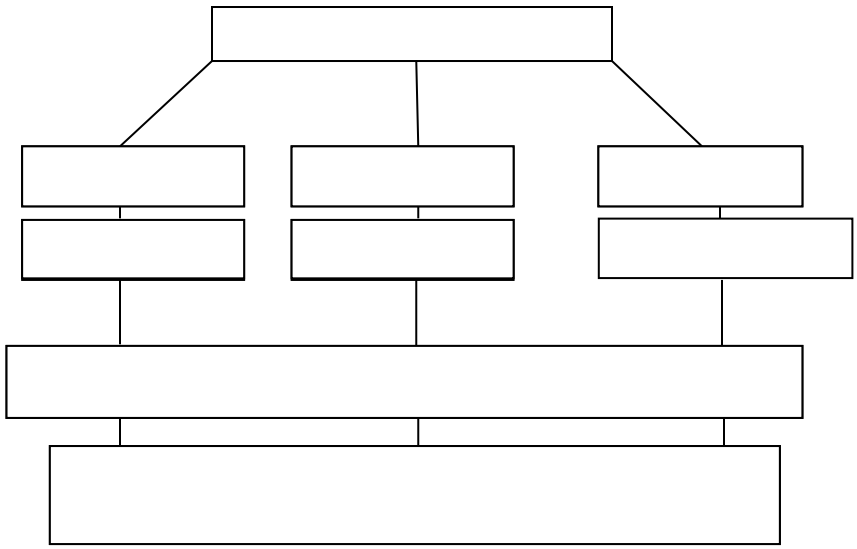
2._____

3._____

_____

4._____

5._____



Points :_____/15___ Points:_____/11__