Examining Irregular Word Learning:
Do Young Readers Use Decoding and Context to Read Irregular Words?
by

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Abstract

The purpose of this study was to examine how readers build orthographic knowledge for irregular words, defined as words that do not conform to conventional phonics rules and patterns. This study tests my theory that readers use phonological decoding, crosschecking and mental markings to read and spell unfamiliar irregular words. Forty-three students in first and second grades participated in the study. One experimental group received instruction in decoding and crosschecking while reading stories containing target irregular words. One control group did not receive any instruction while reading the same stories. A second control group received only vocabulary instruction in target word meanings. Print was not used. Pretests and posttests in target word recognition and vocabulary knowledge were compared. Data indicated there were no statistically significant differences in pretest and posttest scores measuring word recognition of target words and vocabulary knowledge of target words. There were, however, statistically significant differences among pretest scores in word recognition, but not vocabulary knowledge, suggesting students in the vocabulary control group had stronger prior knowledge of the target words. Scores on a spelling posttest were compared across groups. There were no statistically significant differences in scores. Despite the lack of statistically significant differences in scores, this study yields telling evidence about how readers build orthographic knowledge for irregular words.

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I believe the doctrine of election, because I am quite certain that, if God had not chosen me, I should never have chosen Him; and I am sure He chose me before I was born, or else He never would have chosen me afterwards; and He must have elected me for reasons unknown to me, for I never could find any reason in myself why He should have looked upon me with special love. ~ Charles Spurgeon

Style manual used: American Psychological Association Style Manual, 6th Edition

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Computer software used: SPSS 21.0 for data analysis; Microsoft Word 2011 for word processing

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Chapter I.

Introduction

After teaching beginning readers as a first grade teacher and Title I reading specialist, and later teaching undergraduate pre-service teachers as an instructor at Auburn University, I am now a literacy coach for a large K-3 school in Alabama and a doctoral student in reading education at Auburn University. (All references to "I" in this paper refer to me.) As a teacher of beginning readers and as one who instructs pre-service and in-service teachers to effectively teach beginning readers to read, I am quite interested in exploring how young children learn to read and spell words with irregular spellings, as these often prove so troublesome to learn.

While we know a great deal about how children learn to read words with regular spellings and how to effectively instruct them to do so, we know much less about how they learn to read words with spelling patterns that do not follow conventional rules. Researchers have long supposed that irregular words are learned through repeated exposures and memorization of the whole word (Moats, 2010). As a teacher, I noticed that beginning readers seemed to employ more than mere memorization when reading irregular words. They seemed to use reading strategies, such as decoding parts of the word they recognized and context to confirm or reject the attempt. The compelling research findings of my committee co-chair and mentor, Dr. Bruce Murray, who has spent years examining irregular word learning and hypothesized that readers mentally mark irregular elements to help them read irregular words, inspired this study. His research, notably his wordmapping study (Murray & Steinen, 2010), along with my

experiences as a teacher, led me to ask these research questions and subsequently design the current experiment. I hypothesized in this paper that rather than merely memorizing irregular words, readers actively engage in a process of decoding and crosschecking that prompted mental markings in order to store a complete, or near complete, entry in their sight word vocabularies. This study tested that hypothesis.

For the purposes of this paper, all references to 'sight words' refer to any words that a reader can read automatically, upon sight. All references to 'sight word recognition' or 'sight word reading' indicate words a reader has stored in his or her vocabulary for fast and easy retrieval.

Numerous experimental and quasi-experimental studies conducted over the past fifty years have consistently indicated that explicit phonics instruction is the most effective and efficient way to equip children to quickly and easily build large sight word vocabularies (Chall, 1967; Dykstra, 1968; Anderson et al., 1985; Balmuth, 1982; Adams, 1990). Explicit phonics instruction has been proven more effective than programs without phonics instruction, regardless of whether they teach converting letters to speech and blending, analogizing with known words, or using sight chunks as pronounceable parts. The National Reading Panel's *Reports of the Subgroups* (NICHD, 2000) provided a synthesis of these studies indicating that reading instruction in which children are explicitly and systematically taught to decode is more effective than other methods of instruction (such as whole language approaches or implicit phonics instruction).

The conventional view of phonics and reading instruction is a result of current orthographic theories and is based on the premise that children can be taught to read

regular and irregular spelling patterns, but can only be taught to decode regular spelling patterns. "Orthography" refers to the conventional spelling system of a language and includes the study of spelling and how letters combine to represent sounds and forms. Regular spelling patterns are those predictable patterns that follow a so-called 'rule,' or more aptly named 'generalization,' meaning the pattern can be counted on to hold true at least 45 percent of the time. For example, regular spellings may contain patterns such as a_e = /A/ or igh = /I/. Irregular spellings contain unpredictable silent letters or graphemes with atypical phonemes, such as *island*, *sword* or *Wednesday*. Irregular words have been described as those words that cannot be decoded because the sounds of the letters are unique to that word or the student has not yet learned the letter-sound correspondences in the word (Carnine, Silbert & Kame'enui, 1997). The prevailing theories, and resulting instructional practices, assume that readers must memorize, through repeated exposures, words with irregular spelling patterns (Moats, 2010). This study tested current theories of orthographic processing and hypothesized that rather than memorizing words with irregular spelling patterns, readers learn all words, regardless of spelling pattern, by applying decoding strategies that prompt mental marking of irregular elements and crosschecking to confirm or reject the pronunciation.

Need for the Study

While much is known about how children learn to read, what comprises skillful reading, and even how to remediate reading difficulties, important questions remain about the most effective methods of teaching children how to quickly and efficiently read irregular words. Experimental and quasi-experimental research, particularly those studies

analyzed by the National Reading Panel and conducted since the Panel's *Report of the Subgroups* (NICHD, 2000), have provided crucial guidance in the structuring of current reading programs. Tested theories and resulting instructional recommendations and implications operate on the assumption that beginning readers cannot accurately decode words with irregular spellings. They are taught, instead, to memorize them, usually through skill-and-drill procedures (such as using flash cards to provide multiple exposures). The hypothesis that readers actually decode, mentally marking irregular patterns, and engage in crosschecking to confirm or reject the pronunciation has been proposed but not proven. Venerated researcher Linnea Ehri, along with Lee Wilce, suggested in 1982 that readers may flag irregular word parts as exceptionalities and that irregularities such as silent letters can make irregular words easier to store in lexicons because their uniqueness leaves a mark and is memorable enough to give the word superior recall. Murray and graduate student Nancy Steinen (2011) worked with high school students to test a type of spelling instruction they developed called wordmapping, which involves physically marking the irregular elements of words. They conducted a study of wordmapping for a treatment group and compared results to those for a control group that received vocabulary instruction but no spelling instruction. The treatment group made greater gains in spelling irregular words. Their findings suggested that focusing a student's attention on the irregular pattern and teaching the student to mark the irregularity prompts the storage of the spelling in orthographic memory and learning of the word's irregular spelling. However, this limited evidence may not adequately explain how young readers learn to read and spell irregular words.

Share's self-teaching theory (1995, 1999) offered the hypothesis that orthographic learning occurs as a result of phonological decoding within context. According to this theory, when children attempt to phonologically decode unfamiliar words, the attempt functions as a self-teaching mechanism that builds orthographic representations (Share, 1999). Based on his research findings, Share argued that orthographic learning depends on decoding even when the mapping is not predictable and that readers apply decoding strategies to irregular words, though the resulting orthographic representation might be imprecise (1995). Context is needed when decoding is inadequate. Wang, Castles, Nickels and Nation (2011) examined the effects of context on orthographic learning and found contextual information is important to orthographic learning only when words are irregular. This evidence supports my theory that readers attempt phonological decoding and use context to crosscheck in order to confirm or reject the pronunciation when reading irregular words.

Rigorous experimental research conducted during the past several decades has produced data that provide deep insight into how beginning readers use their knowledge of the alphabetic system to decode unfamiliar words, amass a sight word vocabulary, and retrieve words from memory (Adams, 1990). To help readers understand the need for this study, I will begin by establishing what we know about how children learn to read words. Gough's Simple View of Reading (1972) was one of the first models to explain how readers comprehend written text. It converted the reading process into a mathematical equation: Decoding multiplied by Language Comprehension equals Reading Comprehension (D X LC = RC). Rumelhart (1977) found that the decoding component of the equation involves two processes, knowledge of the language's

graphophonic system (the patterns of relationships between words and sounds) and one's lexicon (sight word vocabulary and spoken vocabulary). Ehri used Rumelhart's interactive model of reading as the basis for her research. His interactive model combined part-to-whole and whole-to-part methods and focused on both the cognitive processes and the product of the reader's interaction with the information and prior knowledge. Using this theoretical basis, Ehri (1998a) identified five ways readers read words using knowledge of the graphophonic system, decoding, pronouncing and blending familiar spelling patterns, which is a more advanced form of decoding, analogizing words to words already known, using context clues to predict words, and reading words by sight. When reading words by sight, the reader retrieves the word automatically from memory with no decoding necessary.

Perfetti (1985) found that as a reader engages in word identification to read printed text, regardless of whether decoding strategies or sight word recognition is used, confirmatory processes are rapidly and automatically occurring to help the reader maintain accuracy, make him sensitive to reading errors and offer the reader a means of self-correction when reading errors affect comprehension. These confirmatory processes include alphabetic knowledge, which confirms that the pronunciation matches the spelling; syntactic knowledge which confirms the word fits the sentence; and schemata and text memory which confirm that the word fits in with the meaning of the text (1985). Thus, skillful word recognition includes both direct visual processing and phonological translation, two routes that operate not as "separate alternatives but parts of the same process…" (Adams, 1990, p. 105).

The multiple, simultaneous processes occurring when readers encounter printed text include those related to orthography, meaning, and pronunciation. Orthographic processing is the first route to word identification. Adams (1990) notes that "The help that skilled readers gain from knowledge of words and spelling patterns neither supplants nor overcomes the direct visual information available from the actual letters of the fixated string" (p. 111). Research has indicated that readers must visually process every single letter in the printed text they are reading and the resulting associations they make with each one bind together multiple letter units so that even when encountering words with irregular spelling elements, they are able to recognize the word with ease and automaticity if they have attended to these words several times (1990). Skilled readers are able to reconstruct letter order accurately and effortlessly (1990). Seidenberg and McClelland (1989) believe that even our recognition of whole words is the result of activity distributed across the letter recognition machinery.

According to Adams (1990), when a skillful reader fixates on a word, each individual grapheme activates its own recognition unit in the reader's memory and each activated unit sends activation to each other, strengthening the associations between them. Sensitivity to likely and unlikely spelling patterns usually begins toward the end of first grade and grows in a gradual but systematic manner; however, there is little research comparing skilled and unskilled readers' sensitivity to likely and unlikely spelling patterns (1990). Adams et al. (1980) tested the hypothesis that sensitivity to spelling patterns explains poor readers' difficulties and McClelland and Johnston (1977) found that even when guessing is controlled, letters embedded in orthographically regular strings are more accurately perceived than those embedded among orthographically

irregular strings. However, researchers have much to learn about the sensitivity to likely and irregular spelling patterns and the reader's response to each type of pattern.

Purpose of the Study

In response to the limited research in the area of irregular word learning, this experimental study compared the effects of using decoding and crosschecking to read irregular words with the effects of incidental exposure and the effects of vocabulary instruction on irregular word reading. In this study, students were randomly assigned to one of three groups, including one experimental group and two controls. All three groups were exposed to the same forty irregular words, receiving eight target words a day for five days. The intensive pace of instruction was designed to limit memorization. The experimental group received instruction in decoding and crosschecking when readers miscued or paused while reading target words. The oral reading control group received no instruction when reading stories containing target words. If the participant miscued or paused when reading a target word, the word was provided and the student continued reading. Participants in the experimental and no-instruction oral reading control group read the same stories. The vocabulary control group received oral vocabulary instruction in target word meanings. Print was not used.

Research Questions

The study was designed to address the following research questions:

1) To what extent is there a difference in scores for a one-second read on irregular word reading for a) students who received instruction in decoding and

crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant?

2) To what extent is there a difference in scores for a three-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant?
3) To what extent is there a difference in pretest and posttest scores on vocabulary knowledge for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on vocabulary knowledge of target words are held constant?

Hypothesis

The following null hypotheses were tested.

There were no statistically significant differences in scores for a one-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking,

and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant.

There were no statistically significant differences in scores for a three-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant.

There were no statistically significant differences in scores on vocabulary knowledge for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on vocabulary knowledge of target words are held constant.

Limitations

Instrument sensitivity was a limitation to this study. Sensitivity refers to the likelihood that if an effect is present, it will be detected. The posttest measures assessing word recognition and vocabulary knowledge did not seem sensitive enough to detect differences in learning among groups. If the posttest of word recognition had included a means of measuring if students were applying decoding strategies to achieve a partial pronunciation of target words, the results would have been more telling.

Researcher bias should have been eliminated through random selection, random assignment and a carefully scripted treatment plan for each group.

Significance of the Study

This study tested a hypothesis that had not been previously tested by experimental research. The review of literature indicates a paucity of research related to irregular word learning. Because random assignment was used, the findings can be generalized to larger populations of beginning readers.

Definitions of Terms

deciphering – (see 'decoding') letter-sound mapping (sounding out) to read words

decoding – letter-sound mapping (sounding out) to read words

deep orthography – an alphabetic language that does not consistently follow predictable letter-sound correspondence rules, examples are English, French, German and Greek

graphemic buffer – short-term memory

grapho-phonemic correspondences – letter-sound relationships

lexicon (or mental lexicon) – the reader's vocabulary

one-second read – a word recognition measure of word reading automaticity created as a power point presentation; children were asked to read target irregular words that appeared for one second in a flash presentation

orthography – the conventional spelling system of a language, the study of how letters and sounds combine to represent words

orthographic processing – using visual memory to read words, recognizing and

remembering the spatial orientation and sequence of language symbols

phonological awareness – an individual's awareness of the phonological, or sound structure, of language

phonological decoding – letter-sound mapping (sounding out) to read words

phonological processing – an auditory processing skill, detecting and discriminating speech sounds

phonological recoding – (see 'decoding') using one's knowledge of letter-sound correspondences to 'sound out' or read words

reading – simultaneously decoding and comprehending a word quickly and accurately

shallow orthography – an alphabetic language that follows letter-sound correspondence rules, examples are Spanish, Italian and Finnish

sight words – words recognized accurately and automatically

three-second read – a word recognition measure of word reading accuracy created as a power point presentation; children were asked to read target irregular words that appeared for three seconds in a flash presentation

CHAPTER II.

Review of Related Literature

This chapter contains a review of the literature related to word reading and orthographic knowledge. It includes results of studies that examined the effects of phonological decoding on orthographic learning, crosschecking to assist in building orthographic representations, evidence that readers mentally mark irregular elements to read irregular words, and how young children learn to read and spell irregular words. It is organized into four sections: 1) The theoretical frameworks for how young children learn to read; 2) Research examining irregular word learning; 3) The effects of crosschecking and mental markings of irregular elements; and 4) Learning to spell irregular words.

The Theoretical Frameworks For How Children Learn to Read

Experimental and quasi-experimental reading research conducted during the past several decades yielded crucial information about how children learn to read and led to a growing understanding of why this process is so easy for some children and yet so difficult for others. To read proficiently, readers must have high quality lexical representations sufficient for automatic and accurate word recognition (Perfetti & Hart, 2002). Gough's Simple View of Reading (Gough, 1972; Gough & Tunmer, 1986; Hoover & Gough, 1990) explains that reading involves two basic processes, deciphering and comprehending print. As children progress in their knowledge and skill, they are able to quickly decode print in order to focus their attention on gaining meaning from the text, which is the ultimate goal of reading. Skilled readers have developed large sight word

vocabularies that allow them to decode quickly and easily, leaving time and mental resources, such as attention, to focus on determining meaning and monitoring comprehension (Adams, 1990). Sight word reading is the short-term goal; it is the means to the end, which is comprehension. When children can read words automatically, recognizing the pronunciations and meanings instantly, they are engaging in sight word reading (LaBerge & Samuels, 1974; Ehri, 1987).

Reading and listening comprehension processes are so similar that children learn to comprehend during the course of learning to speak (Hoover & Gough, 1990) yet they cannot learn to read this way. First, learning to read requires a deep phonological awareness, an "awareness of the phonological structure of the words of the language, an awareness that must be more explicit than is ever demanded in the ordinary course of listening and responding to speech" (Liberman et al., 1989, p. 5). After this phonological awareness is acquired, the reader must use this deeper understanding of oral language to begin breaking the written code. Further, processing written language requires different mental processes than those required to process spoken language. Processing spoken language "is a matter of processing combinations of rapidly executed, co-articulated, motoric gestures that are controlled by central processes in the brain" (Ehri, 1998a, p. 5). Learning to speak and to process speech are relatively natural processes; the brain has specialized equipment for processing spoken language (Liberman, 1992). Both speakers and listeners have the same mental equipment needed to process oral language. The specific sound segments needed to process speech do not lie in the signal, but rather in the brain and are detected and processed successfully by both speakers and listeners because both are equipped to do so (Ehri, 1998a). While the brain has special

phonological structures created for the purpose of processing oral language, it does not have such a structure for processing written language (Liberman, 1992). To break the written code, readers must take advantage of the phonological structures they do have – those used to process speech. Therefore, the printed text must be processed through the brain's equipment for processing speech. To do so, the printed word must be converted to speech sounds, which can then successfully be processed through these structures. Liberman (1992) notes that this is often problematic because speech is seamless, making it difficult to discern individual phonemic units. In addition, further compounding the problem, the English alphabet does not consistently represent the sounds in spoken English (Goswami, 1998a). Because of the seamless nature of speech and the intricacy involved in segmenting and later blending individual speech sounds encoded as written language, "special experiences are needed to engage the brain in deciphering print (Ehri, 1998a, p. 5).

These special experiences must include instruction designed to lead children to an understanding of the alphabetic code, build their alphabetic knowledge, and allow them guided opportunities to apply this knowledge to decode unfamiliar words. Several decades ago, the conventional view of beginning reading was that children memorized the visual forms of words in order to acquire additional sight words. This theory led to reading instruction that used the shapes of letters and forms of words to help children memorize unfamiliar words. Ehri's (1992; 1994) groundbreaking research found this view of sight word learning to be inaccurate. She found that rather than memorizing the shapes of words, which can be an inefficient and inaccurate strategy, beginning readers must engage in the rigorous process of using their alphabetic knowledge in order to

successfully decode new words (1992). Research conducted by Ehri and her colleagues indicated the most effective and efficient method of adding words to one's mental lexicon involves "bonding the written letters in individual words with their spoken identities already present in memory" (Gaskins, Ehri, Cress, O'Hara & Donnelly, 1997, p. 173). This bonding occurs when readers engage in breaking the alphabetic code. To break the code, readers analyze the letters in the written code in light of the corresponding sounds each represents in oral language. They must then blend the sounds together to generate pronunciations. This process includes knowledge of letter-sound correspondences, as well as segmenting and blending skills. Readers must be able to segment the written words into individual sounds, know which letters usually represent each of those sounds, then blend the sounds together to form a word (Gaskins, et al., 1997). After this rigorous process of mapping out letter-sound correspondences to decode an unfamiliar word, the spelling is then recoded in memory as the word's visual representation. Upon encountering this word again, the reader is able to retrieve this visual representation from memory and instantly recognize the word (Adams, 1990; Ehri & Wilce, 1987a & 1987b; Perfetti, 1992).

However, this is not an easy task for every reader. Rumelhart's Interactive Theory of Reading (1977) presents reading as a multi-faceted process in which readers simultaneously engage in a variety of processes utilizing lexical, orthographic, phonological and semantic knowledge. According to his theory, reading utilizes both perceptual and cognitive processes, calling upon feature extraction, lexical knowledge, and semantic knowledge. The reading experience involves accessing stored information that includes one's knowledge of language along with factual, experiential and schematic

knowledge about the world. Readers retrieve information from memory to recognize, or decode, and interpret, or comprehend, text (Rumelhart, 1977). Rumelhart's model of reading identifies two knowledge sources for decoding unfamiliar words, graphophonic and lexical knowledge. Graphophonic knowledge is alphabetic knowledge; it is a reader's knowledge of letter-sound correspondences and the ability to use this knowledge to decode unfamiliar words. Lexical knowledge refers to information stored in one's mental lexicon, or mental dictionary; it includes all of the words in one's memory that can be recognized upon sight (Adams, 1990).

Coltheart (1978) introduced a Dual Route Model of Reading in which reading involves using lexical and non-lexical routes. Lexical routes depend on sight word recognition, which depends on retrieving the word from one's lexicon; non-lexical routes depend on using knowledge of letter-sound correspondences to decode an unfamiliar word. Coltheart's theory focused on reading regular words. An unfamiliar irregular word would not be in one's sight vocabulary and yet a non-lexical route cannot be taken, because an attempt at applying alphabetic knowledge would result in the incorrect pronunciation. Therefore, irregular words require a separate non-lexical route in which the exception is noted and learned (Coltheart, 1978). Based on these theories, the act of reading words can be distilled into two important processes, deciphering and sight word reading. Both theories are supported by the findings of Swiss linguist de Saussure, who, in 1922, wrote that "We read in two ways; the new or unknown word is scanned letter after letter, but a common or familiar word is taken in at a glance, without bothering about the individual letters; its visual shape functions like an ideogram" (p. 34). According to de Saussure, one either instantly recognizes the word or one employs one or

more strategies to decode the unknown word. Reitsma (1983a) found that the average first grader can add a word to his or her sight word vocabulary after as few as four exposures. However, these findings were only true of good readers. Poor readers in his study still struggled to recognize words after six trials.

Ehri's research with beginning readers led to the identification of at least four ways to read words (1992; 1994) based on the foundation of Rumelhart's model of graphophonic and lexical sources. One method is to read words by sight. Sight word reading occurs when information about the word is immediately retrieved from memory based on previous encounters with the word. However, Ehri then parsed out four methods of reading using alphabetic knowledge: letter-sound decoding, pronouncing and blending familiar spelling patterns, which is a more advanced form of decoding, analogizing to known words, and contextual guessing to predict words (1998a). Letter-sound decoding is the process of mapping out the letter-sound correspondences in a word and blending them together to read the word. An example of letter-sound decoding is saying each individual sound, such as /ch/ /a/ /t/, then blending those sounds to read the word *chat*. This strategy can enable children to read words they have never encountered before, but it can also be a slow and laborious method of reading (Ehri & Wilce, 1983). The inconsistent patterns in English make this, at times, an unreliable strategy because so many words have variable or irregular spellings (Ehri, 1998b). Words with common letter patterns are easier for beginning readers to decode (Bowey & Hansen, 1994; Juel, 1983; Laxon, Coltheart & Keating, 1988; Treiman, Goswami & Bruck, 1990). Though extremely useful for both beginning readers and even for advanced readers who encounter unfamiliar words, letter-sound decoding is considerably more demanding of

time and resources than sight word reading (Ehri & Wilce, 1983; Perfetti & Hogaboam, 1975).

Children also read words by analogizing (Baron, 1977; Bowey & Hansen, 1994; Cunningham, 1976; Gaskins et al., 1988; Glushko, 1979, 1981; Goswami, 1986, 1988; Laxon et al., 1988; Marsh, Freidman, Welch & Desberg, 1981). Analogizing accesses memory information about a word already in one's lexicon and uses this information to read a similar unknown word (Ehri, 1998a). An example of analogizing is reading the word *sting* by drawing on knowledge of an analogous word such as *bring*. Goswami (1990) found that children can use their knowledge of rhyming words to read by analogy, but Ehri and Robbins (1992) found that having at least some decoding skill is necessary for beginning readers to analogize new words using prior knowledge of sight words.

Readers may also engage in contextual guessing, using context clues, such as the preceding text or pictures, to guess an unfamiliar word (Ehri, 1998a; 1998b). An example of contextual guessing is using picture clues to guess an unknown word in a sentence. Or, a reader may skip a troublesome word and read to the end of the sentence, then use the context provided to guess the unfamiliar word. Use of this strategy is evident when students misread a word, but the substitution fits the sentence structure and meaning (Ehri, 1998a; Biemiller, 1970; Clay, 1968; Goodman, 1976; Weber, 1970). Contextual guessing is arguably the least reliable reading strategy. Most readers do not rely on context to read words (Stanovich, 1980), which is understandable since Ehri (1998a) says studies have indicated that usually only 25 to 30 percent of words in a text can be read accurately by guessing.

Sight word reading is the quickest, most efficient method of reading, but the other three access routes can be used when an unfamiliar word is encountered. Perfetti (1985) offered an interactive model of reading based on Rumelhart's (1977) model that shows decoding, reading by analogies, and contextual guessing support sight word reading. While words are being rapidly read by sight, these other processes confirm the identities of each word. Alphabetic knowledge confirms that the pronunciation matches the spelling; syntactic knowledge confirms that the word is the right part of speech to fit the sentence; and schemata and text memory confirm that the word fits in with the meaning of the text (Perfetti, 1985). These confirmatory processes occur as rapidly and automatically as sight word reading. They help the reader maintain accuracy, become sensitive to reading errors, and offer a means of self-correction when reading errors affect comprehension (Ehri, 1998a).

After determining that readers can read words in different ways, Ehri's continuing research indicated that readers learn to do so while progressing through four phases, or stages, of word recognition: pre-alphabetic, partial alphabetic, full alphabetic and consolidated alphabetic (1994; 1995). Pre-alphabetic readers are visual cue readers (Ehri & Wilce, 1985). They do not yet have the letter-naming knowledge or phonemic awareness needed to decode words; rather, they use single salient visual cues to remember words (Gough & Hillinger, 1980). For example, a reader in this phase may use a visual cue such as the tail on the g at the end of *dog* to remember this word or remember two O's in *look* as two *eyes* to read this word (Gough, Juel & Roper-Schneider, 1983). A pre-alphabetic reader might recognize the word *McDonald's* if the restaurant's notable Golden Arches are present or read *Coca Cola* if the soft drink

company's well-known graphic surrounded the words. However, in the absence of these recognizable icons, pre-alphabetic readers cannot read these words. While in this phase of word recognition, the reader must rely heavily on memory to recognize words and must generate memorable connections with each word as an icon. This is a burdensome task. Word recognition becomes easier as pre-alphabetic readers become phonemically aware and acquire knowledge of letter names and sounds.

As they begin to recognize a few letter-sound correspondences in words, beginning readers progress into the second phase of word recognition, the partial alphabetic or phonetic cue reading phase (Ehri, 1994). This level of word recognition is still very limited. Partial alphabetic readers can only read some of a word's letter-sound mapping, not the complete spelling. For example, a phonetic cue reader might be able to read the initial sound and/or the final sound in a word and guess at the rest of the mapping. Still, the reader is beginning to understand that each printed word is composed of letters that represent sounds in our speech and that these letter-sound correspondences can be mapped into words.

As readers become more adept at mapping out letters and sounds, they move into the full alphabetic phase, also identified as the cipher reading stage (Gough & Hillinger, 1980) and the spelling-sound stage (Juel, 1991). Now they are able to analyze a word's spelling into its constituent parts and blend the sounds together to read the word (Ehri, 1992). Readers in this phase can sound out and blend together consonant-vowel-consonant (CVC) words, such as *hit* or *sock*. Because children can use a word's entire spelling to map out the pronunciation in this phase, they can distinguish between even

similarly spelled words, can read new words by analogy, and can add words to their mental lexicon. Most children in this phase begin to rapidly amass a sight word vocabulary, primarily consisting of CVC words.

After ample experience learning to analyze the spellings of words and to map out the letter-sound correspondences to generate pronunciations, readers move into the consolidated alphabetic or orthographic phase of word recognition. In this phase, readers can chunk words into recognizable parts and blend them together to read multi-syllabic words. According to Ehri (1998a), "As fully connected spellings of more and more words are retained in memory, letter patterns that recur across different words become consolidated. Repeated experience reading a letter sequence that symbolizes the same phoneme blend across different words yields a consolidated unit" (p. 22). In this phase, readers can recognize larger grapheme units, such as –ing or –est, automatically, reducing the memory requirements for storing sight words. Therefore, because a reader can access the word chunk –est automatically, the unknown word 'chest' can be decoded rapidly (1998a). Consolidated units also facilitate letter identification, making sight word reading more rapid (Juel, 1983; Venezky & Massaro, 1979).

Ehri's (1994) Phase Theory posited that orthographic knowledge is necessary for word learning. According to the self-teaching model of early reading acquisition, the orthographic representations required for fast and accurate word recognition develop as a function of phonological recoding, which involves print-to-sound translations, and practice associating print with the sounds it represents (Cunningham, Perry, Stanovich & Share, 2002). Phonological recoding acts as a self-teaching device that helps readers

develop the orthographic knowledge necessary to read words (Share, 1995). Many studies have found that while necessary, efficient phonological processing is not sufficient for orthographic learning (Juel, Griffith & Gough, 1986; Tunmer & Nesdale, 1985). Some researchers have theorized that a reader's skill in forming, storing, and accessing orthographic information may explain the difference in word recognition skills not accounted for by phonological factors (Barker, Torgesen & Wagner, 1992; Cunningham & Stanovich, 1990, 1993; Stanovich & West, 1989). Other studies have indicated orthographic learning requires phonological decoding (Ehri, 1992; Ehri & Saltmarsh, 1995; Perfetti, 1992; Reitsma, 1983a; Share, 1995). Yet in a study conducted by Cunningham, Perry, Stanovich and Share to control for both print exposure and target decoding accuracy, researchers found contrasting results indicating that orthographic learning does not seem completely dependent on decoding ability (2002). Cunningham and her colleagues found that phonological and orthographic processing skills are separable components of variance in word recognition during early stages of reading, which is consistent with earlier findings that the two sources contribute differentially to reading difficulties (Bryant & Impey, 1986, Stanovich, Siegel & Gottardo, 1997, Treiman, 1994). How readers form, store, and retrieve orthographic information is a critical factor in exploring how readers learn to read irregular words.

Research Examining Irregular Word Learning

English is considered to be a deep orthography. Orthographic depth is related to how consistently the written language follows letter-sound correspondence rules. Shallow orthographies, such as Spanish and Italian, are relatively easy to learn to read because

they consistently follow letter-sound correspondence rules. Deep orthographies, such as English and French, are more difficult to learn to read because they have many words that deviate from general letter-sound correspondence patterns. In other words, they have many words that are considered to be irregular. Often, these irregular words are loan words, borrowed from another language. English has many loan words from a variety of other languages. These words quite often break English rules for letter-sound mapping and appear to be irregular.

Yet despite the frequent appearance of words with irregular spellings in text and the subsequent categorization as a deep orthography, written English is actually highly reliable (Gough & Hillinger, 1980). Some consider English quasi-regular because higher-level regularities can be found even in irregular words (Plaut, McClelland, Seidenberg & Patterson, 1996). About 87 percent of English words are reliable for reading (Hanna, Hanna, Hodges & Rudorf, 1966) and the remaining words can usually be inferred from context with ample phonological awareness and approximate pronunciation (Share & Stanovich, 1995). Hanna and colleagues estimated that when factors such as word meaning and word origin are eliminated, only about four percent of English words are truly irregular (1966). Usually, these irregularities affect only vowels and silent consonants, and the consonants quite often provide enough support for the reader to use partial decoding to determine the pronunciation (Share & Stanovich, 1995). Moats (2006) noted that the spelling of English words is usually governed by five principles, including the word's language of origin or history of use, the word's meaning and part of speech, or the fact that sounds are usually represented by a single letter or a combination of up to

four letters. She also pointed out that the spelling of a single sound can vary and that the spellings of some sounds depend on letter sequences and patterns (2006).

This can all be quite troublesome to young readers. Especially problematic for young readers and spellers is the conundrum caused by the penchant English has for representing sounds in various ways. For example, the sound /k/ can be spelled k as in lake, c as in cap, ck as in duck, ch as in Christmas, and qu as in quiet. The word's origin plays a large role in determining sound-to-letter mapping. For instance, if ch appears in a word of Greek origin, such as Christmas, it usually makes a /k/ sound. If it appears in a word of French origin, such as chalet, it usually makes a /sh/ sound. Multiple letters and letter patterns for each sound can make reading unfamiliar irregular words tricky for novice readers. However, Gough and Hillinger (1980) found that readers can analyze irregular words to determine their irregularities, and in doing so, prove irregularities are not arbitrary, reinforce reliable grapheme-phoneme correspondences, and build orthographic memory of the words. Ehri and Wilce (1982) noticed that the more phonics knowledge the reader has, the better he is able to determine that the irregular word is exceptional.

Ehri's (1992) phase theory does not specifically address how readers learn to read words with irregular spelling patterns, but she assumes that learning irregular words is more difficult than learning words that follow a reliable pattern because graphemes that do not follow the conventional system in symbolizing phonemes are ostensibly more difficult to store in visual memory. Each of Ehri's phases of word recognition explains the reader's ability to apply decoding skills to read words and subsequently add those

words to his or her sight word vocabulary. Research has shown that the more children know and understand about the alphabetic system, the more accurate and automatic they will read (Adams, 1990; Gough, Ehri & Treiman, 1992; Rieben & Perfetti, 1991). Likewise, those with the least knowledge of the alphabetic system will likely have a difficult time learning to read (Rack, Snowling & Olson, 1992). Results of these studies indicated that alphabetic knowledge does, indeed, make the difference. As readers acquire knowledge of grapheme-phoneme correspondences, they build their orthographic knowledge and learn patterns in language that provide important scaffolding for acquiring additional orthographic knowledge (Share & Stanovich, 1995).

Foorman, Francis, Novy and Liberman (1991) compared children who received a great deal of phonics instruction to those who had not and found that the children more highly trained in phonics showed greater gains in reading both regular and irregular words than children who were not. Bryne, Freebody and Gates (1992) conducted a study with second grade poor readers who had good decoding skills but below-average recognition of irregular words and found that a year later, these students read regular and irregular words better than second graders with good word recognition skills but poor decoding skills. Leybaert and Content (1995) compared second grade children learning to read with whole word methods to second grade children learning to read with phonics instruction and found that the phonics-taught readers were better readers and spellers of irregular words. In 1988, Bradley (cited in Hulme & Joshi, 1998) found that metaphonological skill measured at age 6 predicted irregular word retention at age 7, even after variations in irregular word retention at 6 were considered. It is interesting to note, however, that Bradley's results showed irregular word retention at 6 did not predict

metaphonological skill at age 7. Other studies have suggested that the construction of orthographic knowledge for irregular words relies on the skill with which phonological decoding procedures are applied and that orthographic knowledge grows as the reader incorporates more and more rules as a function of reading experience (Morais, Mousty & Kolinsky, 1998).

Evidence suggests that the critical element of the developmental change in reading skill is the gradually expanding and improving memory for printed words (Ehri, 1994; Perfetti, 1992; Share, 1995). After learning grapheme-phoneme correspondences and blending procedures, this is arguably the most important change a child goes through (Reitsma, 1990). Juel and Roper-Schneider (1985) found that the types of words children first encounter influence their mental lexicons and affect their memory for printed words. Ehri and Roberts (1979) noticed that how students learn to read words influences memory for the word's spelling. In a study of first graders, experimental results indicated that students who read words in isolation produced more letters correctly than students who read words in context. If children have had repeated exposures to words with irregular patterns, they should find it easier to add those words to their sight vocabularies. However, research designed to test the reader's orthographic learning when reading irregular words is limited.

Adams established that a reader requires multiple encounters with a word before he or she can build the orthographic memory necessary to hold the word in one's sight word vocabulary (1990); Reitsma (1983a) determined that as few as four trials are sufficient for an average reader to add a word to his sight lexicon. Once the reader learns

and knows how to use syllables or word chunks, he no longer has to sound out and blend every letter; he can merely sound out the letters in the morpheme or chunk he does not recognize (Henry, 1988). Knowledge of morphemes also provides the reader with clues that can lead him or her to infer the word's meaning (Henry, 1988, 2010; Moats, 1994), which can provide aid in using context to affirm or reject the pronunciation. Skilled readers also monitor their decoding with syntactic and semantic cues (Tunmer, Herriman & Nesdale, 1988) and can use these cues to self-correct a misread word.

For additional support of word recognition, Carreker (2011) recommended analyses of word origins to help readers build orthographic memory. Research has indicated that using mnemonic strategies may help readers, particularly those with dyslexia, add words with irregular spellings to their sight word vocabularies and that structured, multi-sensory procedures are needed to help dyslexic readers learn these words (Cox, 1992; Fernald, 1943; Gillingham & Stillman, 1997). Carreker (2011) and others hypothesized that dyslexic readers in particular have difficulty learning to read irregular words because their underdeveloped phonological and linguistic awareness cripples the development of their orthographic memory. However, non-dyslexic readers with presumably well-developed phonological and linguistic skills also have difficulty learning to read irregular words.

Strong readers and spellers have well-developed phonological processing and use visual memory and orthographic processing to store the way words look in print. When reading irregular words, the reader's visual memory is crucial because it is difficult to form a substantial visual memory for irregular words. The tediousness of the task can

undermine the reader's ability to decode even phonologically sound words because irregularities can cause weak readers to begin to distrust all spelling patterns. Even if the student has strong phonological processing skills, but is unable to form a visual image of the irregular word, he cannot retain the word in long-term memory and will have to relearn it. In two studies with five-year-old children, Stuart, Masterson and Dixon (2000) found that readers who could segment initial phonemes using knowledge of letter-sound mappings learned words better with repeated exposure to text. Stuart and colleagues found that spelling regularity did not affect ease of learning and that visual memory influenced word learning for both non-segmenting and segmenting children. They concluded readers that mental representations of printed words are more easily formed by readers who could match segmenting skills to letters in printed words.

It is well established that both visual and auditory systems are involved in learning to read (Chase, 1996; Ehri & Wilce, 1985), but it has been difficult to determine which is more important (Chase, 1996). Several studies have indicated that rapid automized naming (RAN) is a skill that is theoretically and empirically associated with individual differences in orthographic processing skill (Manis, Seidenburg & Doi, 1999; Manis, Doi & Bhada, 2000). Bowers and Wolf (1993), for example, produced results that showed a strong link between RAN and orthographic processing, but other researchers, however, found that after word reading accuracy in second grade was partialed out, RAN did not predict fourth grade readers' orthographic processing skills (Torgeson et al., 1997). However, the strength of the RAN variable as a factor predicting orthographic processing performance was larger in studies where reading disabled children were disproportionately present (Wolf & Bowers, 1999).

Researchers have also explored the possibility that silent letters affect irregular word learning, as many irregular patterns contain letters that are not pronounced (i.e., *Wednesday*, *eight* and *listen*). Insufficient attention to individual letters can lead to inaccurate orthographic representations (Foorman, 1994) and visually processing every letter in a spelling is important, even for skilled readers (Adams & Bruck, 1993). Badian (2005) concluded that if orthographic imagery for the word is unstable, establishing automatic orthographic-phonological connections will be impaired. Badian drew from work conducted in the 1970s and 1980s that produced puzzling results from attempts to understand how silent and pronounced letters in irregular words are stored in orthographic memory.

Ehri and Wilce (1982) compared children's memory for silent and pronounced letters in familiar spellings of words and found that pronounced letters were recognized more accurately than silent letters, but silent letters were detected more rapidly in words than pronounced letters. Silent letters also prompted superior recall of words. They surmised that these findings most likely reflected the way silent letters were stored in long-term memory when spellings were learned under the experimental conditions that enhanced episodic memory for salient letters. Earlier, Frith (1978) found that 12-year-old good spellers detected significantly more silent than pronounced letter omissions and these findings were replicated in a second experiment. She hypothesized that silent letters are often more deeply rooted in underlying morphological spelling patterns and that violation of these morphological rules may be more easily detected than violation of phonological rules.

Frith's (1978) results contradicted earlier findings from Hatch, Polin and Part (1974) who conducted an experiment with content words and found evidence that pronounced letters were recognized more readily than silent letters in cross-out tasks. Subjects missed letters in digraphs more frequently than single pronounced letters and missed letters in unstressed syllables more than letters in stressed syllables. Hatch and colleagues (1974) agreed with previous conclusions from Corcoran (1966, 1967) that acoustic scanning might aid in the detection of pronounced letters. Venezky found that during a cross-out task, letters in function words were more frequently left unmarked than letters in content words (cited in Hatch et al., 1974). Likewise, Krueger and Shapiro (1979) found silent letters were very difficult to identify in words. However, in a study with first graders, Ehri and Roberts (1979) found that subjects could detect the omission of silent letters as well as pronounced letters. Later, Ehri (1980a) found second graders could recall pronounced letters better than silent letters.

In an effort to produce more conclusive findings about orthographic memory for irregular words, Ehri and Wilce (1982) conducted five experiments designed to test children's memory for silent and pronounced letters and concluded that children do, indeed, process silent letters differently. They proposed two interpretations of the results of these experiments. First, silent letters are stored in memory as easily as pronounced letters, so when they do gain entrance into memory, they leave a mark, so to speak. Their exceptionality is memorable, making them especially salient in orthographic representation. This is why the silent letters were recognized so quickly and prompted the superior word recall. Earlier findings that support this hypothesis indicate that speakers who become familiar with the spellings of words are under pressure to change their

pronunciations to conform to the spellings (Householder, 1971; Kerek, 1976). An alternative interpretation is that effects were a result of the episodic experiments, not the lexical storage processes in the learner's background. The silent letters may have been processed faster because of the events in the experimental task (Bjork, 1975; Ehri & Wilce, 1982). Based on this interpretation, Ehri and Wilce (1982) hypothesized that the processes involved in letter judgment tasks are not strictly visual, but rely on phonetic processes, as well, and that whether letters were silent or pronounced affected performance. They further noted that spellings stored in memory have been found to influence performance in strictly auditory word processing tasks (Ehri & Wilce, 1979, 1982; Seidenburg & Tanenhaus, 1979), which is contrary to an earlier view that visual representations of words are coded and stored separately in memory (Baron, 1977; Barron, 1978).

Ehri and Wilce (1982) pointed out that these results support the earlier findings of Corcoran (1966, 1967) and Hatch et al. (1974), indicating that acoustic scanning and visual scanning of words operate in parallel, thereby enhancing the detection of pronounced over silent letters because the pronounced letters are processed twice. This hypothesis is grounded in the Levels of Processing Theory proposed by Craik and Lockhart (1972), who found stimuli that are processed to a deeper level are more easily recalled. Ehri and Wilce noted that readers with training in and knowledge of the alphabetic system are more likely to flag irregular elements because of their exceptionality, which provides more evidence, they concluded, for the theory that orthography is grounded in sound during reading instruction and silent letters are noted as exceptions.

Because reading irregular words is a complex task, some researchers have speculated that reading irregular words demands more cognitive ability than reading regular words. Tallberg, Wenneborg and Almkvist (2006) investigated the relationship between the level of general cognitive function and the oral reading of irregular words in Swedish, which is considered to be a shallow orthography because most of the irregular words in Swedish are loan words from other languages. They conducted an experiment with forty-eight Swedish adults and found that the ability to read words that do not follow the regular rules for decoding in Swedish was positively related to general cognitive level (2006). They administered the Wechsler Adult Intelligence Scale, Revised, to each participant to determine an intelligence quotient (IQ) for each. Their findings indicated that those with higher IQs found it easier to read irregular words, while those with lower IQs found it more difficult.

Au and Lovegrove (2007) also found that higher IQs affect irregular word reading. They examined the involvement of rapid auditory and visual temporal resolution mechanisms in the reading of phonologically regular pseudo-words and English irregular words presented both in isolation and as a series of six words (2007). They conducted an experiment with seventy-nine undergraduates, who engaged in a range of reading, visual temporal, and auditory temporal tasks. The correlation analyses suggested a general timing mechanism across modalities. A majority of the statistically significant correlations were between the visual temporal measures and irregular word reading and between the auditory measures and pseudo-word reading, Au and Lovegrove acknowledged that sensory processing skills in both visual and auditory modalities accounted for some of the variance in the reading performance of these normal

undergraduates. Further, they found that IQ predicted the accuracies of irregular words presented both singly and in contiguity and that good sight word skills and spatial analysis are needed in the reading of irregular words.

The Effects of Crosschecking and Mental Markings to Read Irregular Words

When a reader encounters an unfamiliar word with an irregular spelling pattern that has more than one possible pronunciation, he must decide which pronunciation makes sense in that sentence. Word identification depends on one's ability to process the information one receives about the word's phonological (Shankweiler et al., 1999) and orthographic (Foorman, Francis, Fletcher & Lynn, 1996) structures. Share and Stanovich (1995) found that a reader needs phonological awareness, approximate pronunciations and contextual clues to accurately read unfamiliar words. Chastain (1981) found that pronunciation affects accuracy of word identification apart from orthographic regularity. When confronted with unfamiliar irregular words, readers use knowledge from oral vocabulary in combination with information obtained from partial decoding to arrive at a correct, or approximate, pronunciation (Nation & Snowling, 1998). Empirical evidence suggests that readers of deep orthographies use context but rely more heavily on orthographic properties to read unfamiliar words (Cunningham, 2006).

Visually, the reader processes each independent word part before gradually assembling them into larger units (LaBerge & Samuels, 1974). In studies that tested an orthographic learning paradigm, evidence indicated orthographic knowledge increases with repeated exposures to a word (Cunningham, 2006; Cunningham, Perry, Stanovich &

Share, 2002; Nation, Angell & Castles, 2007; Reitsma, 1983a). Ehri and Saltmarsh (1995) found that advanced beginners who practice reading words several times retained fairly complete letter information when tested three days later. However, Ehri (1991) has long maintained that the route to memory is alphabetic, not visual. She concluded that most spelling patterns are remembered because they conform to the student's knowledge of grapho-phonemic correspondences (Ehri, 2000). Share (1995) agreed with Ehri's premise and insisted that an orthographic representation cannot be established without prior experiences decoding the word.

Readers have difficulty with irregular spellings that feature nonconventional graphemes, silent letters, doubled letters, or uncommon spelling patterns because they do not conform to their understanding of the alphabetic system (Ehri, 2000). The irregularities are exceptional. If students are sifting the word's spelling through their alphabetic knowledge, some form of decoding is, indeed, occurring. This supports Ehri's theory that good readers are flagging irregular spellings for their exceptionalities. Drake & Ehri (1984) showed spellers how to create special spelling pronunciations assigning sounds to letters not pronounced distinctively in normal speech. An example is choc-o-late for the common pronunciation "choclate." They found that spellers recalled these pronounced parts better if they practiced spelling these words this way although this procedure did not help participants remember doubled letters. These results suggested that helping the reader focus on irregular elements, thereby flagging them, may be beneficial for building orthographic knowledge.

Evidence from similar studies has indicated that readers do engage in decoding when encountering irregular word elements and can benefit from instruction noting these exceptions. Crosschecking to confirm or reject the word's pronunciation is a critical subsequent step in reading irregular words. Kucer (2011) explored the nature of comprehended meanings that did not match those of the author and concluded that crosschecking for understanding should be encouraged by reading teachers. While repeated exposures to a word leads to stronger and more specific phonological and orthographic representations (Share, 1999), repeated exposures with mental marking of the irregular elements (Ehri &Wilce, 1982) followed by crosschecking for meaning in the sentence should be even more powerful for orthographic learning. More research is needed to determine the efficacy of crosschecking after reading irregular words and to investigate how and if students use mental markings to remember the exceptionalities.

Share's self-teaching hypothesis (Jorm & Share, 1983; Share, 1995) raised interesting questions about how children learn irregular words and if marking irregularities and crosschecking them against contextual information occurs. Share hypothesized that orthographic representations are constructed as a result of phonological decoding in meaningful text and that as the reader attempts to phonologically decode an unfamiliar word, and he proposed that the attempt itself functions as a self-teaching mechanism and builds orthographic knowledge (1995; 1999). According to Share's self-teaching hypothesis, phonological recoding acts as a self-teaching device or built-in teacher that enables the reader to independently develop the word-specific orthographic representations necessary for proficient reading and spelling (1995; 1999). Share (2004) theorizes that readers of deep orthographies must attend more closely to word-specific

visual orthographic information than readers in shallow orthographies. He based this theory on the orthographic depth hypothesis (Katz & Frost, 1992). Share tested his theory experimentally. In 1999, he gave second grade Hebrew-speaking children novel words to read in context. Three days later, they were more likely to select target words, such as *yait*, than words spelled differently but with the same pronunciation, such as *yate*, or visual distractors, such as *yoit*. Share (1999) concluded that these results indicated word-specific orthographic learning had taken place. Additional experiments confirmed his initial findings.

Yet questions remain. Share's experiment was limited to word learning in Hebrew. In addition, his experiment used only regular words so the dependence of irregular word learning on decoding was not addressed. The self-teaching hypothesis would predict that orthographic learning for irregular words depends on decoding, but the resulting orthographic representations might be imprecise, thus making learning regular words more effective than irregular words (Share, 1995). With two notable exceptions, i.e., Share (1999) and Reitsma (1983a), most researchers testing the effects of decoding on orthographic learning have used words presented in isolation.

Cunningham, Perry, Stanovich and Share (2002) tested the self-teaching hypothesis using English-speaking students. In their study, thirty-four second graders read ten short, expository passages that had been adapted and translated from Share's (1999) study with Hebrew-speaking students. There were two versions of each story, which differed only by homophonic pseudowords. Half of the stories contained one version, such as *stert*, while the other half of the stories contained the matching homophone, such as *sturt*. The target homophones appeared six times each in story. For

each homophonic pair, half of the participants read one homophone, such as *sturt*, and the other half of the participants saw the matching homophone, such as *stert*. During the first session, children read five stories. No help was provided if students struggled to read words in the story. Errors and decoding attempts of target words were recorded. During the second session, children engaged in three orthographic learning tasks. The first was a homophonic choice task. They were shown four versions of each pseudoword they had encountered in the text during the first session. For example, if they encountered the word *yait* in the story, they saw *yait*, as well as the matching homophone, *yate*. They also saw an alternate word, such as *yoit*, as well as a word with a transposed letter, such as *yiat*. Students were asked to circle the word from these four choices they had encountered when reading. The second task was a spelling test. The students were asked to spell the words, for example, *yait*, that they had encountered in the stories. The final task was a target word naming measure. The students were asked to read a list of words flashed on a computer screen. The list contained the target words embedded in a list of high frequency words. On the third session, students read the remaining five stories. On the fourth session, students engaged in the same three orthographic learning tasks with the new target words.

Results of the posttest measures of homophonic choice, spelling, and target word naming indicated that orthographic learning had occurred because processing of target homophones, such as *yait*, was superior to homophonic controls, such as *yate,* on the homophonic choice task. Providing further evidence, results indicated a strong correlation, r = .52, between orthographic learning and the number of target homophones correctly decoded during story reading (Cunningham et al., 2002). Cunningham and

colleagues note that subsequent experiments ruled out opposing explanations for these findings. The study also examined possible sources of variance in orthographic learning. It included tasks designed to test general cognitive ability, RAN, and orthographic discrimination. Study results led Cunningham et al. to conclude that "the development of orthographic knowledge is not entirely parasitic on decoding ability" (p. 186). Results indicating that orthographic knowledge is not completely dependent on decoding ability have raised questions about what other processes might be key components to reading unfamiliar irregular words.

As part of the self-teaching hypothesis, Share proposed that context is needed when decoding is partial, as in the case of reading irregular words (1999). Wang, Castles, Nickels and Nation (2011) investigated the effect of context on orthographic learning and examined whether there were different effects for novel words given regular and irregular pronunciations. In an experiment with second graders, they presented participants with eight novel words in stories or in lists of words. They found no significant effect of context for regular words. In orthographic decision tasks, there was a faciliatory effect of context on irregular novel word learning. Wang and colleagues (2011) concluded that these results indicate contextual information is important to orthographic learning only when words are irregular.

Further studies have investigated other questions inspired by Share's self-teaching hypothesis, which would predict that orthographic learning of regular words should be more effective than orthographic learning of irregular words. Wang, Castles and Nickels (2012) wondered, however, if the opposite might be true. They hypothesized that regular words can be easily decoded and do not require as much attention or effort to read as

irregular words and may force the reader to focus more intently on the letters and the order of the letters of the word. Therefore, they suggested that phonological decoding might result in greater orthographic learning for irregular words than regular words. Wang et al. (2012) cited cross-linguistic studies indicating that orthographic learning may be less efficient in writing systems with regular orthographies than in writing systems that are less regular. Their proposition was supported by results from Share (2004), who found no evidence of orthographic learning in an experiment with first graders in Hebrew, a shallow orthography, and Cunningham (2006), who found orthographic learning in an experiment with first graders in English, a deep orthography.

Wang et al. (2012) also proposed that an untested prediction of Share's theory is that there should be an effect of word regularity on the number and quality of word-specific orthographic representations children acquire. They conducted an experiment with thirty-four English-speaking second graders, who were given the pronunciations and meanings for eight novel words that they later encountered in short stories. Half of the words were given regular and half were given irregular pronunciations. Lexical decision and spelling tasks administered ten days later indicated that orthographic representations for regular words were stronger and more extensive than those for the irregular words. Wang et al. concluded that these results were the first to demonstrate that irregular words are not only decoded less accurately, but also encoded less well.

Most studies examining regularity effects have done so during read-aloud tasks. A handful of studies investigated lexical decisions instead and found a small regularity effect during experiments with children from nine to twelve years old (Barron, 1980; Coltheart et al., 1986; Schlapp & Underwood, 1988; Waters et al., 1984). Schmalz,

Marinus and Castles (2013) examined regularity effects in a lexical decision task to investigate the extent to which children continue to be influenced by phonological factors when recognizing words as they progress in reading. They conducted an experiment with sixty children in third and fourth grades, presenting them with sixty words and sixty nonword foils. Participants made go/no-go lexical decisions on high- and low-frequency regular and irregular words that had been matched for consistency. They pressed a spacebar when they saw a real word and waited without action for nonwords to disappear. The results showed regularity effects in accuracy for low-frequency words, indicating that the children were using decoding strategies to recognize unfamiliar words. The size of this effect was correlated with measures of reading ability. This supports earlier findings by Waters et al. (1984) that regularity effects in lexical decisions for children are more robust for low-frequency words. No regularity effects on accuracy for high-frequency words or on response times for either word type were found. Schmalz et al. (2013) concluded that these findings suggest that even 8-year-old children are already relying predominantly on a direct lexical strategy in their silent reading of familiar words.

The paucity of research that has examined the role of context and how it interacts with word regularity in orthographic learning has left many questions unanswered. While studies have indicated readers can rely on contextual guessing to read words (Goodman, 1971, 1976; Tunmer & Chapman, 1998), there is little experimental evidence to indicate contextual information facilitates orthographic learning (Share, 2009) and many experiments using the self-teaching paradigm did not present words in context (Cunningham et al., 2002; Share, 1999, 2004). Evidence for a positive effect of context on word learning is weak in studies with manipulated context. For instance, Nation,

Angell and Castles (2007) conducted an experiment with second graders and found no difference between nonword learning in context and nonword learning in isolation. In an experiment using real words with first graders, Cunningham (2006) found participants decoded more accurately when words were presented in context but found no effect of context when measuring orthographic learning using orthographic choice and spelling tasks. Several studies have yielded findings that indicate context might even have a negative effect on orthographic learning because it can draw attention away from target words (Share, 1995, 1999; Landi et al., 2006). However, for contextual information to assist the reader in confirming or rejecting a pronunciation, the reader must have oral vocabulary knowledge of the words. Some of these studies did not completely control for pre-existing oral vocabulary knowledge or the lack thereof (Cunningham, 2006; Landi et al., 2006). Clearly, more research is needed with carefully designed experimental studies to investigate the effect of context and crosschecking on orthographic learning when reading irregular words.

Learning to Spell Irregular Words

That a connection exists between reading and spelling is obvious, as the two rely on the same underlying alphabetic principle. “Spelling and reading build and rely on the same mental representation of a word. Knowing the spelling of a word makes the representation sturdy and accessible for fluent reading” (Snow et al., 2005, p. 86). However, while learning to read words with irregular spellings can be difficult for both skilled and unskilled readers, learning to spell irregular words is even more trying for readers and spellers of any skill level because it requires not only recognizing the visual

pattern but producing it as well. Researchers have noted that spelling is a cognitive linguistic process, which is indeed more difficult to master than reading (Frith, 1980; Joshi et al., 2008/2009). While reading only requires visual recognition, spelling demands simultaneous integration of syntactic, phonological, morphological, semantic and orthographic knowledge (Frith, 1980; Moats, 1995; Smith, 1980) in order to recall the complete spelling (Frith & Frith, 1990; Fulk & Storman-Spurgin, 1995). Ehri (2000) noted that "failure to remember one or two letters dooms a perfect spelling, but not necessarily an accurate reading" (p. 24). Remembering each letter can be tricky because sound-to-spelling translations are less dependable than spelling-to-sound translations (Adams, 1990). While Frith (1980) found that spelling skills were highly correlated with reading skills, subsequent studies have indicated the correlation is much lower in less skilled readers and spellers (Ehri, 2000; Greenberg, Ehri & Perin, 1997).

Becoming a proficient speller means changing one's use of phonological and orthographic information, a tall task for students who have phonological or orthographic deficits or who have difficulty developing or processing the visual representations. Dealing with the unpredictable information provided by irregular words confounds the situation considerably. Children who have difficulty developing visual-spelling representations may be skilled readers, but not skilled spellers because they cannot process or recall all of the orthographic information necessary to write a word. Studies analyzing the types of errors young spellers make have indicated that children move from concrete phonemic analysis to a more abstract linguistic representation in building the orthography (Notenboom & Reisma, 2003; Schlagall, 2001). Younger spellers might find spelling irregular words especially troublesome as they have less knowledge of language

structure, less consolidated concepts of words and less automaticity for accessing orthographic knowledge (Hilte & Reitsma, 2006). In addition, for spellers context provides no assistance because contextual clues do not help affirm choices as in the case of reading (Fulk & Stormont-Spurgin, 1995).

Our current understanding of how children learn to read and spell words has led to the conclusion that less skilled readers might need practice with spelling pronunciations more than skilled readers because they are not as adept at transferring orthographic knowledge gained from reading to the process of spelling. And while the correlations between reading and skill are low for unskilled readers, instruction in spelling patterns reinforces instruction in phonics (Adams, 1990). Most spelling instruction today involves little more than memorizing word lists (Joshi et al., 2008/2009), a fact lamented by Moats, who pointed out that this view practice ignores the impact that effective spelling instruction can have on learning to read (2005; 2006). Ehri and Rosenthal (2007) found that learning to spell words facilitated learning to pronounce words and derive word meanings. However, even Moats (2005/6) seems to accept the theory that irregular words must be merely memorized through repeated exposures. "Given English's complexity, teachers cannot hope to cover all of the rules of spelling. Instead, they should focus on teaching the ways in which English spelling is regular and predictable, as well as helping students memorize the most common irregular words" (p. 22).

Special strategies are needed to help children build orthographic knowledge for words with irregular spellings. Explicit instruction is necessary for children to learn to spell (Brady & Moats, 1997; Joshi et al., 2008/2009; Moats, 1995), and this principle

most likely applies to learning to spell irregular words in particular. Experimental research has indicated that some strategies for teaching spelling are more effective than others. Several researchers have found that providing students with spelling pronunciations, such as teaching them to pronounce the word Wednesday as /Wed-nes-day/, instead of how we usually pronounce it, /wenzde/, is more effective than offering a standard, or correct, pronunciation for both students who are typical and students who qualified for special education services (Hilte, Bos & Reitsma, 2005; Schiffelers, Bosman & van Hell, 2002; Hilte & Reitsma, 2006). Teaching these types of special pronunciations that follow known letter-sound correspondence patterns, rather than the word's actual irregular pronunciation, has been shown to help students spell irregular words. Ormrod and Jenkins (1989) studied the effects of seven strategies students often use when trying to remember spellings of difficult words. They found that providing spelling pronunciation was most effective, particularly for skilled spellers. This confirmed earlier findings by Drake and Ehri (1984), who found that poor spellers are unlikely to think of strategies to use and are less likely to adopt a spelling pronunciation strategy on their own.

Holmes and Malone (2004) found that when poor spellers do adopt a spelling pronunciation strategy, they often form the spelling incorrectly. However, Reitsma and Hilte (2006) conducted a four-week study with third, fifth and sixth grade Dutch-speaking children using computer-based training to examine whether practicing spelling pronunciations or previewing the spelling patterns was more effective for helping skilled and less skilled spellers of various ages learn to spell words with orthographically unpredictable patterns. Pretests determined which students were skilled spellers and

which were less skilled spellers and students were separated into these two groups, according to the pretest results. Treatment consisted of three conditions, visual preview, spelling pronunciation, and normal pronunciation, which all students received during six sessions. Students practiced spelling eighteen irregular words, all loan words from either English or French, in each session, six words for each condition.

In the visual preview condition students read target words flashed on a computer screen. After studying the word, the word disappeared from the screen and students typed the spelling from memory. In the spelling pronunciation condition, students listened to the computer pronounce the target words. Each word was pronounced with a special pronunciation designed to facilitate spelling, such as /Wed-nes-day/, then pronounced correctly, /Wenzde/. Students then spelled the word from memory by typing it. In the normal pronunciation condition, students heard the word pronounced correctly by the computer, then spelled the word from memory by typing it. Posttests were given immediately and one month after treatment. Hilte and Reitsma (2006) found that results indicated spelling pronunciation and visual preview were both statistically significantly more effective than normal pronunciation. There was no statistically significant difference between spelling pronunciation and visual preview. Both were effective regardless of age or spelling ability, although less skilled spellers seemed to benefit more from visually examining the word rather than practicing with the spelling pronunciation (2006).

According to the cognitive neuropsychological dual route models of reading and spelling, spelling involves both lexical and sub-lexical processing routes. Brunsdon,

Coltheart and Nickels (2005) explained that one lexical route in processing involves the retrieval of whole-word orthographic information from the orthographic output lexicon and allows efficient spelling of familiar words, both regular and irregular. When skilled readers hear a word, it activates the phonological input lexicon so they can access its meaning from the semantic system. They then are able to retrieve the word's written form from the orthographic output lexicon, which makes it available for writing via the graphemic output buffer. This buffer temporarily houses a representation of the whole word in short-term memory during the physical or oral process of spelling the word. A second route is the sublexical spelling procedure in which unfamiliar words, nonwords and familiar words with regular spellings can be spelled when the reader applies phoneme-grapheme conversion rules. A third possible route may involve spelling without lexical access to the semantic system (Brunsdon et al., 2005).

Ehri maintained that the route to memory, for both reading and spelling, is primarily alphabetic and that the letters conform to knowledge of grapho-phonemic connections or spelling patterns. "Unexpected letters in spellings may be retained in representations, but securing these letters in memory is much harder" (Ehri, 2000 p. 23). When unexpected letters or unpredictable patterns are encountered, they are sifted through the student's alphabetic knowledge (Ehri, 2000). Hilte and Reitsma (2011) asked if the connection to meaning during spelling instruction is might be beneficial for helping students remember and store a word's phonological-orthographic information. They grounded their research in assumptions based on Rumelhart's (DATE) parallel processing theory, which proposed that all three lexical processes for accessing meaning, phonology, and orthography are activated simultaneously. Their results indicated the semantic

descriptions were more beneficial than neutral descriptions immediately and after one month of training and that activating the semantic properties of a word facilitates learning the word's spelling. Hilte and Reitsma (2011) noted that the word meanings used in their study were already familiar to the students and that the activation of meaning helped children focus on the word identity with all lexical properties. They pointed out that while meaning itself does not directly help young spellers map out the phoneme-grapheme correspondences, it does contribute to the integration of the word-specific phonologic-orthographic association practice during spelling. They concluded that the co-occurrence of the three components in spelling exercises is the critical factor in word learning (2011).

Working from Ehri's Theory that readers mentally mark irregular elements of words when reading, Murray and Steinen (2011) experimented with a process called wordmapping, in which students engaged in a scaffolded system of segmentation, counting syllables, identifying phonemes and marking irregular elements when learning to spell irregular and multi-syllable words. In a study testing a wordmapping instructional treatment against a vocabulary teaching control, they found that students who received instruction in wordmapping made significantly more gains on a spelling test than the vocabulary group. Murray and Steinen concluded that "…by guiding their mapping of spelling elements to focus study on the anomalies in words, the students improved their spelling, not only in terms of better learning of words under study but also for gaining spelling power with untaught words, as evident in improvement on a standardized spelling test" (2011, p. 5). If physically marking irregular elements leads to greater gains

in spelling, it seems plausible that mentally marking irregular elements can potentially lead to greater gains in reading.

Inspired by these results, the current study was designed to continue examining how children learn to read and spell irregular words. While Murray and Steinen tested the effects of wordmapping on spelling, this study examined the extent to which decoding and crosschecking help children read irregular words. The experimental group received instruction in decoding and crosschecking to confirm or reject the pronunciation while reading short stories containing target irregular words. One control group read the same stories, receiving the same exposure to the target words, but with no instruction. A second control group received only vocabulary instruction in target word meanings. Print was not used. Pretest and posttest scores were compared to determine which group made the greatest gains in word recognition and vocabulary knowledge of target words. The following chapter will explain the methods used to conduct this study.

Chapter III.

Methodology

This chapter describes the methodology of the study, which was designed to test the hypothesis that when reading irregular words, readers use decoding and crosschecking of irregular elements to store a complete, or near complete, entry in their mental lexicons. The research questions that guided the study are restated. The experimental design is explained. The participants and the instruments used in the study are described, study procedures are explained, and scoring and analyses of data resulting from administration of the instruments are discussed.

Participants

Participants were forty-three first and second grade students enrolled in a large elementary school serving children in pre-kindergarten through third grade. This affluent suburban elementary school is located in the southeastern United States. The number of students in the school who received free or reduced lunches was below ten percent of the total school population. Twenty-three participants were female, and twenty were male. Thirty-four were Caucasian, five were Asian and four were African American. Five were considered to be English Language Learners (ELL) and received services to support language and literacy learning throughout the school year. None of the participants received special education services.

External validity is the extent to which the results of a study can be generalized from a sample to a population (Cresswell, 2003). Because the sample represented a range

of average students that included males and females, English Language Learners (ELLs), and a range of ethnicities with Caucasian, African American, and Asians, the results should be generalizable to other children of similar ages, academic skills and race/ethnicities. Therefore, threats to external validity should be low.

Participants were randomly selected and randomly assigned, which protected against selection bias. I followed a carefully written script when administering each treatment, which further protected against selection bias. Because participants were selected from thirteen different classrooms, received one of three types of treatment, and were not told which type they received, they did not have opportunities to affect other participants' performance by discussing differences for treatment and control groups. Furthermore, it is highly unlikely a first grade reader would initiate a discussion about attempts to decode and crosscheck when reading *marina* with a fellow participant.

Recruiting

Participants were randomly selected from all regular education students not considered to be at-risk for reading failure in the school's first and second grade classrooms. Parent permission letters were sent home with fifty-five students in take-home folders. All fifty-five permission letters were signed and returned promptly. An example of the permission letter is included in the appendices. The fifty-five students with parents' permission to participate were given two screening assessments. A modified version of The Names Test (Duffelmeyer et al., 1994; Cunningham, 1990) was administered to determine if each student had sufficient phonics knowledge to notice irregular elements in words (Ehri, 1998a). If students could accurately read most of the

names, which contained all regular vowel correspondences, I considered them able to decode most words with common spellings and decided that they should have enough phonics knowledge to become aware of phonetically irregular words. Because I designed the study for beginning readers, I administered Qualitative Reading Inventory, 5th Edition (Leslie & Caldwell, 2010) graded word lists to each student in order to eliminate those reading below a first grade independent level or above a second grade instructional level. Reliability and validity for these assessments were provided in research articles for The Names Test (Cunningham, 1990; Duffelmeyer et al., 1994) and in the assessment manual for the word lists (Leslie & Caldwell, 2010).

Screening assessments also included an examiner-created vocabulary usage test, assessing the participants' knowledge of the target word meanings, and an examiner-created target word reading measure, assessing the participants' ability to read the target words. Nine potential participants were eliminated during screening procedures because they were reading above a second grade instructional level or could read more than half of the target words. The remaining forty-six participants were randomly assigned to one of three groups. Three additional participants were eliminated during the study because of absences.

Instrumentation

To determine the effect of the treatment, I designed two pretest measures and three posttest measures for this study. Before the study began, it was important to determine if participants could read the target words and if they had prior knowledge of the target word meanings. If a participant could read more than half of the target words,

he or she was eliminated from the study. The study was designed to determine if crosschecking was helpful when reading irregular words, so prior knowledge of the target word meanings was important for using context to crosscheck when decoding was partial (Share & Stanovich, 1995). I also needed to establish prior knowledge of target word meanings so that I could compare pretest and posttest scores to see which groups increased in knowledge of word meanings during the study.

Pretest measures of the target words included a test of accurate and automatic word recognition and a test of vocabulary usage. These are included in the appendices. Word recognition was assessed by having students read target words from a flash presentation on a laptop. Target words were flashed for one second, and the student's response was recorded. The short duration of the flash was designed to indicate if the student could read the words automatically, upon sight. I developed a vocabulary usage test designed to measure the student's prior knowledge of target word meanings. The test followed a fill-in-the-blank through multiple-choice format and featured sentences that provided rich context for target words. For example, one item was, *A baby ____ swam behind its mother swan.* The choices were *a) duckling b) swanlet c) cygnet.* The test was read aloud to participants, who read along on their own copies. They circled the correct answer from multiple-choice options. Posttest measures included a flash presentation of target words at both one-second and three-second intervals to determine if students could read words automatically, one-second exposure, or with more time, three-second exposure. The vocabulary usage posttest was similar to the pretest but used different sentences and questions. For example, *The swan led her ____ across the pond.*

a) swanlets b) victuals c) cygnets. This time, the test was not read aloud to students. They read it silently and responded to the items.

Validity & Reliability of Instruments

The pretests and posttests assessing identification of target irregular words used flash presentations of the target words. Students read from a power point presentation flashing words at either one or three-second intervals. As participants read the words aloud, I recorded their answers. Because the presentation was so rapid, I usually only had time to record responses as correct or incorrect. When possible, I recorded the student's incorrect attempt. I assumed that threats to content validity would be extremely low because the instruments assessed precisely what I wanted to know – can the participant read these particular irregular words. However, the method of delivery posed a slight threat to convent validity. For pretests and posttests I used a flash presentation to display target words in isolation on a computer screen, yet during the study the participants encountered all target words on a printed page within connected text. Reading on a computer screen is a different experience from reading on a printed page. Likewise, reading words in isolation is quite different from reading words with the benefit of context. However, this particular school has integrated a tremendous amount of technology into each classroom's daily routine and the participants were well accustomed to reading on a screen. These students spend as many minutes each day reading text on a device as reading printed text, so this threat should have been reduced. Threats to construct validity should be low as these instruments measure concrete skills (word identification skills) rather than hypothetical concepts or constructs (Cresswell, 2003).

Threats to concurrent validity are high because these instruments were not correlated with similar, validated instruments.

The vocabulary usage pretest and posttest were designed to test the participants' knowledge of target word meanings. This was crucial because knowledge of word meanings impacted the reader's ability to use crosschecking to read the word within connected text. The test was designed in a multiple-choice format. The pretest followed a fill-in-the-blank through multiple-choice format and featured sentences that provided rich context for target words. The posttest was similar, using different sentences and answer choices for each target word. Threats to concurrent validity should be fairly low as it was correlated with the easyCBM vocabulary assessment (Alonzo, Anderson, Park & Tindal, 2012), a similar, valid and reliable instrument. Because it was designed in a similar format to the easyCBM vocabulary test, threats to content validity should be reduced. However, this instrument was not pilot tested and may not be sensitive enough to accurately indicate word knowledge. The context provided in the sentences may have been so rich that students were able to determine the answer by a process of elimination but did not know the word meaning prior to the test. It is also possible that students took advantage of the multiple-choice format and merely guessed at correct answers. For these two instruments, content validity is the most difficult to prove. The threat to construct validity for these instruments is relatively low.

Research Questions

This study was designed to investigate the following questions:

1) To what extent is there a difference in scores for a one-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant?
2) To what extent is there a difference in scores for a three-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant?
3) To what extent is there a difference in pretest and posttest scores on vocabulary knowledge for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on vocabulary knowledge of target words are held constant?

Research Design

The following null hypotheses were tested.

There is no statistically significant difference in scores for a one-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant.

There is no statistically significant difference in scores for a three-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant.

There is no statistically significant difference in scores on vocabulary knowledge for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on vocabulary knowledge of target words are held constant.

For this study, I selected forty words with irregular spellings thought to be on a second or third grade vocabulary level. The words were divided into five groups based on semantic relationships. I wrote one story for each thematically-related group of words, carefully controlling the vocabulary so that target words were only encountered once in

the story and never in the other four stories. Adequate context was provided for participants to be able to use crosschecking to determine the target word if they could not automatically read the word, but knew the word's meaning.

Target words were chosen because of their irregular spelling elements. Irregular elements are defined as spelling features that do not follow conventional rules because they have unusual letter-sound correspondences that make them difficult to decode (Carnine, Silbert & Kame'enui, 1997). For example, give, of, and was are considered irregular words because their spellings do not follow predictable rules. Based on phonics rules, we would pronounce these words as /g/ /I/ /v/, /o/ /f/ and /w/ /a/ /z/, respectively. However, they are not pronounced according to conventional phonics rules. Many words are irregular because of tricky silent letters, such as **g**naw and depo**t**. I used various resources and lists of irregular words to compile my target word list, including *The Reading Teacher's Book of Lists* (Fry, Kress & Fountoukidis, 2000) and *Multisensory Teaching of Basic Language Skills* (Birsh, 2011). Irregular elements included silent letters and uncommon vowel correspondences and consonant clusters. Words were selected based on thematic relationships. For many months, when reading with first grade students during my normal duties as a literacy coach, I paid close attention to students as they encountered irregular words and noticed that certain words seemed particularly troublesome. My original word lists contained the following words. However, I selected twelve average first grade students who were not included in the study to read these words and realized some of the words were easy for these first graders to read. These words were eliminated and replaced by unfamiliar words. Eliminated words are indicated by the strike through.

Set 1: marina, dinghy, ~~water~~, voyage, island, salmon, freighter, wharf

Set 2: ~~country~~, trough, calf, predator, cygnet, machine, ~~breakfast~~, fierce

Set 3: ~~village,~~ antiques, ~~castle~~, despot, rough, ~~fruit~~, autumn, ~~people~~

Set 4: ~~Christmas~~, ~~February~~, ~~neighbors~~, special, ~~answered~~, ~~clothes~~, ~~radio~~, ~~trouble~~

Set 5: steak, dough, ~~squash~~, spinach, pecan, ~~honey~~, ~~biscuit,~~ ~~vegetable~~

After eliminating the words above, I selected more difficult words and asked the same twelve students to read the new words. Almost all were unable to do so. Screening assessments conducted during the study also indicated that these words were unfamiliar to participants. The following revised target word lists were used in the study:

Set 1: marina, dinghy, voyage, recede, island, salmon, freighter, wharf

Set 2: phantom, debut, brooch, orchid, guide, chorus, routine, bouquet

Set 3: colonel, antiques, despot, rough, monarch, seize, scheme, chaos

Set 4: trough, gnaw, cygnet, predators, machine, fierce, gauge, weigh

Set 5: special, bologna, victuals, spinach, steak, dough, pecan, meringue

Each set of words became part of a short story written on a lower second grade reading level, which was slightly frustrating to the participants selected. I ran readability tests on each story using The Readability Test Tool available at www.read-able.com. The readability results are included in the appendices. Set 1 became *Summer At The Sea*, Set 2 became *My Sister's Big Night*, Set 3 became *The Old Man and the Bee*, Set 4 became *Farmer Brown Loves His Job* and Set 5 became *A Birthday Meal For Mom*. Each story contained a simple story line children could easily follow. Context provided opportunities

for readers to crosscheck to infer unfamiliar target words. For example, *We see a freighter with its heavy load churning slowly through the waves.*

Procedures

Because this was an experimental study, random assignment was used. Participants were randomly assigned to one of three groups. The irregular word reading with instruction group was the experimental group, the irregular word reading with no instruction was one control group, and the oral vocabulary group was a second control group. To ensure random assignment, each participant was randomly assigned a number from 01 to 46. Numbers were entered into www.random.org, a free web-based program that generates random assignment for experimental studies. Random.org randomly assigned participants to one of three groups.

Treatment Group: Irregular Word Reading With Instruction

The irregular word reading with instruction group, or experimental group, received instruction in decoding and crosschecking while reading the five stories containing target words. I worked with students individually for about twelve minutes a day for five days. Students came to my office one at a time during their independent reading time in their classrooms. Each lesson began with a brief book talk, setting the purpose for reading and promoting interest in the story. For example: In *The Old Man and the Bee*, you will read about a very old man who outwits a very mean king. Let's read to find how and why this man decides to trick the evil ruler. The participant was then instructed to read the story. If he paused for more than three seconds or misread a

target word, I provided help using this four-step conditional scaffold: 1) wait and write miscue notes, 2) send the reader on to finish the sentence and think about what word might make sense, 3) direct cover-ups so that the word could be uncovered and sounded out, 4) provide the word and word meaning as necessary. At times, I gave limited explanations of word origins. For example, because 'debut' seemed most unusual to the participants, I explained that it is a French word and the French root is responsible for the e = /A/ and silent t. After pausing or receiving help on a target word, the student was always directed to re-read the sentence to get back into the story. After reading, students were asked closed and open-ended questions about the story. For example, questions from *My Sister's Big Night* were, *What is this story mainly about? How do we know that this was a special night for the family? What evidence supports your answer? Did the sister practice her part in the ballet many times? How do you know*?

Control Group 1: Irregular Word Reading With No Instruction

This group followed procedures similar to those in the experimental group. Students came to my office and I worked with them individually for about twelve minutes a day for five days. Participants read the same stories, one each day, as students in the experimental group. However, if a student paused for more than three seconds while reading a target word, I provided the word and the student continued reading. I did not offer any instruction and did not prompt students to re-read the sentence after miscues. After each reading I asked students the same closed and open-ended questions about the story that I asked the students in the experimental group.

Control Group 2: Oral Vocabulary Instruction

The vocabulary control received quite different instruction. I worked with students individually for about twelve minutes each day for five days. Each day, students were instructed in word meanings for the day's eight target words. I taught word meanings using pictures and oral explanations. For each target word, I explained the meaning in child-friendly terms and showed a representative picture via a power point presentation. After introducing all eight words, I displayed each picture again and asked the student to identify each picture and use the target word in a sentence. Print was not used and instruction was delivered through oral exchange and pictures only.

Chapter IV.

Results

This chapter describes the statistical procedures used to analyze the data collected in the study and presents the results of the analyses.

Data Analysis

Two one-way analyses of covariance (ANCOVA) procedures were used to analyze the data. Because pretest and posttest scores were compared, ANCOVA were used to evaluate the differences among the three groups (irregular word reading with instruction, irregular word reading with no instruction, and oral vocabulary instruction) on the dependent variable, the posttest scores, while statistically controlling for the covariate, the pretest scores (Green & Salkind, 2008). For all F tests, partial η2 (eta squared) is included as a measure of effect size. Partial η2 indicates the proportion of variance in the dependent variable that is explained by the independent variable. When using partial η2, 0.01 is considered a small value, 0.06 a moderate value, and .14 a large value. These values differ somewhat from the standard values of 0.2 for small, 0.5 for moderate, and 0.8 for large effect sizes used with other statistics (Green & Salkind, 2008).

One-Second Reading of Irregular Words

The following null hypothesis was tested. There is no statistically significant difference in scores for a one-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of

target words are held constant.

A full model ANCOVA was conducted to compare posttest scores for one-second word reading of irregular words across all three groups. The independent variable was group (irregular word reading with instruction, irregular word reading with no instruction, and oral vocabulary instruction), the dependent variable was the automatic word recognition posttest, and the covariate was the pretest (word recognition of target words). There were no statistically significant differences among pairs. There was no group effect, $F(2, 39) = 2.33$, $p = .11$, partial $\eta 2 = .11$. A Bonferroni adjustment for Type I error also found no statistically significant differences among pairs. The experiment failed to reject the null hypothesis. The adjusted means are presented in Table 1.

Table 1

Adjusted Group Means for One-Second Irregular Word Reading Measure

Group	Mean	Std. Deviation	N
irregular reading with instruction	16.33	10.266	15
irregular reading with no instruction	16.60	9.977	15
oral vocabulary instruction	22.85	7.658	13
Total	18.40	9.688	43

Three-Second Reading of Irregular Words

The following null hypothesis was tested. There is no statistically significant difference in scores for a three-second read on irregular word reading for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on reading ability of target words are held constant.

A full model ANCOVA was conducted to compare irregular words read correctly in three seconds on the posttest across all three groups. The independent variable was group (irregular word reading with instruction, irregular word reading with no instruction, and oral vocabulary instruction), the dependent variable was the word recognition posttest, and the covariate was the pretest (word recognition of target words). There were no statistically significant differences among pairs at the .05 alpha level. The experiment failed to reject the null hypothesis. However, it is noteworthy to mention that group differences were statistically significant at the .09 level, $F(2, 39) = 2.57$, $p = .09$. The adjusted means are presented in Table 2.

Table 2

Adjusted Groups Means for Three-Second Irregular Word Reading Measure

Group	Mean	Std. Deviation	N
irregular word reading with instruction	22.27	9.407	15
irregular word reading with no instruction	21.00	9.016	15
oral vocabulary instruction	25.46	7.677	13
Total	22.79	8.768	43

Vocabulary Knowledge

The following null hypothesis was tested. There is no statistically significant difference in scores on vocabulary knowledge for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language when pretest scores on vocabulary knowledge of target words are held constant.

A one-way analysis of variance (ANOVA) statistical procedure was conducted to test the difference in the pretest and posttest scores on the vocabulary test among groups. No statistically significant differences were revealed among the three groups, students who received instruction in decoding and crosschecking, students who received no instruction in

decoding and crosschecking, and students who received only oral vocabulary instruction in target word language. The experiment failed to reject the null hypothesis. The mean scores and deviations are reported by group in Table 3.

Table 3

Group Means for Vocabulary Knowledge

Group	Mean	Std. Deviation	N
irregular word reading with instruction	7.40	7.935	15
irregular word reading with no instruction	5.60	6.345	15
oral vocabulary instruction	7.92	5.139	13
Total	6.93	6.555	43

Spelling Effects

The following null hypothesis was tested. There is no statistically significant difference in scores on spelling ability for a) students who received instruction in decoding and crosschecking, b) students who received no instruction in decoding and crosschecking, and c) students who received only oral vocabulary instruction in target word language.

A one-way analysis of variance (ANOVA) statistical procedure was conducted to test the difference in spelling posttest scores among the three groups. There were no statistically significant differences in spelling posttest scores. The experiment failed to reject the null hypothesis. The group means are reported in Table 4.

Table 4

Group Means for Spelling Posttests

Group	Mean	Std. Deviation	N
irregular word reading with instruction	150.33	34.842	15
irregular word reading with no instruction	168.47	39.284	15
oral vocabulary instruction	167.69	31.143	13
Total	161.91	35.634	43

Differences in Pretest Scores

While statistically significant differences between pretest and posttest scores were not found, a one-way analysis of variance (ANOVA) did indicate statistically significant differences among pretest scores for target word recognition. Students randomly assigned to the experimental group had significantly less prior knowledge of target words than students in the oral reading or vocabulary groups, $F(2, 40) = 5.81$, $p = .006$. Students in the experimental group also had less

prior knowledge of target word meanings, measured by the pretest of vocabulary knowledge, than either the no instruction or vocabulary control groups, although these differences were not statistically significant. The means are reported in Table 5.

Table 5

Group Means for Pretest Differences in Word Recognition

Group	Mean	Std. Deviation	N
Irregular word reading with instruction	28.87	7.972	15
irregular word reading without instruction	30.53	5.643	15
oral vocabulary instruction	33.62	4.331	13
Total	30.88	6.400	43

Chapter V.

Discussion

This chapter presents a discussion of the study's results, the implications of the results, and the limitations of the study. The chapter concludes with recommendations for further research to examine irregular word learning.

Summary of the Results

The purpose of this study was to test the theory of irregular word reading proposed by Murray and Steinen (2011) and based on evidence found by Ehri and Wilce (1982) and Sh are's Self-Teaching hypothesis (1995, 1999). This theory suggests that readers of irregular words learn to use phonological decoding and crosschecking to prompt mental markings of irregular elements and store a complete, or near complete, entry in their sight word lexicons. To test this theory, a study was designed using one experimental group, irregular word reading with instruction in decoding and crosschecking, and two control groups, one with irregular word reading but no instruction and the other with oral vocabulary instruction and no reading instruction. First and second grade students were randomly assigned to one of these three groups. Participants in the experimental group read experimenter-created stories containing target irregular words for five days. When a participant in this group encountered an unfamiliar irregular word, the experimenter prompted the students to attempt to decode it and then use crosschecking to confirm or reject the pronunciation. After each prompting, the student was instructed to reread the sentence to get back into the story. Participants in the group with irregular word reading but no instruction read the same texts under the same conditions as the experimental group but received no scaffolding. Participants in the vocabulary group received only oral vocabulary instruction in the target words meanings. They had no exposure to the printed words. A pretest-posttest design was used. All participants were administered the same examiner-created pretests assessing their ability to read

the target words and their knowledge of target word meanings. Examiner-created posttests assessing ability to read target words and knowledge of target word meanings were also administered.

The tests were scored and several analyses of covariance (ANCOVAs) were conducted for the pretest-posttest measures. ANCOVAs were used because this type of analysis evaluates whether the means on the dependent variable (posttest scores) are the same across groups (irregular word reading with instruction in decoding and crosschecking, irregular word reading with no instruction in decoding and crosschecking, and oral vocabulary instruction) while adjusting for the covariate (pretest scores). The results of the ANCOVA indicate whether the adjusted group means differ significantly from one another. The findings of the study indicate that there were no statistically significant differences in one-second irregular word reading pretest and posttest scores across groups. There were no statistically significant differences in three-second irregular word reading across groups at the .05 alpha level. However, group differences were statistically significant at the .09 level.

A one-way ANOVA was conducted to determine if there were statistically significant differences between vocabulary pretest and posttest scores across groups. There were no statistically significant differences, $F(2, -.025) = .48$, $p < .62$. Spelling results on the posttest measure were compared using a one-way ANOVA. There were no statistically significant differences in scores across groups. A one-way ANOVA indicated statistically significant differences in pretest scores for target word recognition. Students randomly assigned to the experimental group had significantly less prior knowledge of target words than students in the oral reading or vocabulary groups, $F(2, 40) = 5.81$, $p = .006$.

Limitations

The experimenter-created instruments proved not sensitive enough to indicate statistically significant differences in student learning. Future studies should include instruments created to measure automatic word recognition with target words in isolation and with words in context. In addition, the length of the study was too brief and the scaffolding provided to the experimenter group was not strong enough to prompt mental markings of irregular elements. More time was needed to allow participants in the experimenter group more exposures to target words within context and more intense instruction in decoding and crosschecking to confirm or reject the pronunciation. A future study should take place over several weeks and offer participants more time and more exposures to target irregular words.

Testing was a threat to internal validity. I administered pretests and posttests for word reading ability and vocabulary knowledge of target words. I should have also administered a spelling pretest. The instruments did not prove sensitive enough to detect differences in orthographic learning for the three groups.

Data analysis suggests student history may have affected validity. The participants were all beginning readers with no direct instruction in these particular irregular words in the classroom. However, pretest scores indicated that students in the experimental group had less prior knowledge of word meanings and read fewer of the target words before the study than students in the two control groups. It is also possible that the pretests and posttests measuring vocabulary knowledge of these words were perhaps not sensitive enough to accurately indicate each student's actual knowledge of these words. Students might have taken advantage of the multiple-choice format to guess at word meanings. In order to be able to use contextual evidence to confirm or reject a pronunciation by crosschecking, knowledge of word meanings was necessary.

Need for Future Research and Implications

Although the experimental group did not achieve statistically significantly different results from the control groups, the evidence from previous studies that students engage in a rigorous process of decoding and crosschecking to read irregular words remains compelling. More research is needed, both quantitative and qualitative, to examine this type of word learning. It is possible that participants in this study stored partial entries of the target words in their lexicons. Study instruments only measured complete entries, assessing if students could read target words correctly and rapidly. Points were not given for partial pronunciations and time was not granted for students to attempt to decode. Recalling Reitsma's (1983a) finding that good readers need at least four exposures to a new word before they can add the word their lexicons, it is possible that this study limited word exposures too much for orthographic learning to occur. The study controlled exposure in context to a mere single exposure and assessed word reading in isolation. This may have been insufficient exposure for students to completely store entries of the target words in their lexicons. Share (1995, 1999) and Wang et al. (2011) found evidence that context makes the difference when reading irregular words. In a future study, students should receive exposure to target words within context four to six times. Subsequent studies should also include instruments that measure decoding attempts on the posttest to indicate if decoding strategies were being used and if a partial entry had been stored. They should also include instruments that test target word reading in context as well as in isolation. Measures should offer students time to use decoding and crosschecking if necessary to attempt a pronunciation. More research is needed to examine how students attempt to read target irregular words after exposure in context offers opportunities for phonological decoding, mental marking of the irregular elements, and crosschecking.

Earlier findings by Share (1995, 1999), Ehri and Wilce (1982), and Wang, Castles, Nickels, and Nation (2011) have yielded enough evidence for researchers to continue to examine how children learn to read irregular words. Research is needed to examine the effects of teaching methods that include prompting readers to employ phonological decoding and crosschecking when reading unfamiliar irregular words. Further research is needed to examine which types of irregular words prove more troublesome or lend themselves less well to phonological decoding and crosschecking. For example, words of French origin tend to have unexpected silent letters. For instance, debut would be pronounced /d/ /e/ /b/ /u/ /t/ if it followed English patterns, but, as a French loan word, is pronounced /d/ /A/ /b/ /yoo/. Research may be conducted to determine if words from French and other languages with different phonological patterns and correspondences than English are more challenging to beginning readers than phonologically regular English words with silent letters.

In summary, the theory that readers use phonological decoding to attempt a pronunciation of an unfamiliar irregular word, mentally mark the irregularity, then use crosschecking to confirm or reject the pronunciation, remains unproven. However, important evidence exists to support this theory, and many research questions related to learning to read irregular words remain unanswered. A stronger and longer study, redesigned to provide more explicit scaffolding in decoding and crosschecking and more opportunities to read target words within context and measured with more sensitive instruments, may yield more telling insights into how readers read and spell irregular words.

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APPENDIX A

Informed Parent Consent/Student Assent

AUBURN
UNIVERSITY

COLLEGE OF EDUCATION
CURRICULUM AND TEACHING

DO NOT AGREE TO PARTICIPATE UNLESS AN APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.

PARENT PERMISSION/CONSENT

for a Research Study entitled

"Intentional Orthographic Learning: Testing the Theory That Readers Decode, Crosscheck, and Mentally Mark Irregular Elements to Read Irregular Words"

March 26, 2013

Dear Parents/Guardians,

Your child is invited to participate in a research study to test the theory that young readers use decoding strategies, rather than rote memorization, to read words with irregular spellings. The study is being conducted by Vestavia Hills Elementary West reading coach Lorie Johnson, a Ph.D candidate in Reading Education, under the direction of Dr. Bruce Murray, associate professor in Reading Education in Auburn University's Department of Curriculum & Teaching. Your child was selected as a possible participant because he/she is in Kindergarten, first or second grade and is therefore a beginning reader. Since your child is younger than 18 years old, we must have your permission to include him/her in the study.

What will be involved if your child participates? If you decide to allow your child to participate in this research study, your child will meet with Ms. Johnson for 15 minutes a day for **one week** during his/her independent reading time at school. Students who participate will be randomly assigned to one of three groups: an oral reading group, a decoding group or a vocabulary group. Depending on which group your child is randomly assigned to, he/she will either practice reading a passage, practice reading a passage with guided feedback (meaning Ms. Johnson will remind the student to use decoding strategies while reading) or learn new vocabulary words. Participants in all three groups will encounter words with irregular spellings while reading and learning vocabulary.

5040 HALEY CENTER
AUBURN, AL 36849-5212

TELEPHONE:
334-844-4434

FAX:
334-844-6789

www.auburn.edu

Parent/Guardian Initials _____

One day prior to the five-day sessions, Ms. Johnson will give pretests to determine if the student can read a list of words with irregular spellings and if the student knows the meanings of the words. At the conclusion of the five-day study, Ms. Johnson will give posttests to determine if the student is able to read the irregular words and if the student knows the word meanings. Your child's total time commitment will be approximately two hours over a seven-day period.

Are there any risks or discomforts? The risks associated with participating in this study are minimal. Ms. Johnson will schedule her time with your child so that he/she does not miss regular classroom instruction. One possible risk is a breach of confidentiality. To minimize this risk, Ms. Johnson has put safeguards in place to protect your child's identity and data. Each participant will be assigned a number. That number, rather than your child's name, will be used when collecting data. All data will be collected confidentially. Ms. Johnson will not share the individual results with anyone. She will share data connected to participant numbers with her dissertation committee (they will not know the actual identity of any child who participates). Only the identifying numbers will be used, rather than names, when data is analyzed. The code linking numbers to names will be kept in a locked filing cabinet separate from the data.

Are there any benefits to your child or others? If your child participates in this five-day study, he/she might benefit from the extra time reading or learning vocabulary with a certified reading specialist. The results of this study will provide insight into how young children learn to read words with irregular spellings. The results could potentially impact how teachers teach children to read irregular words. However, I cannot promise that your child, or others, will benefit from participating in this study.

Participants will not receive tangible compensation for participating.

Participating does not involve any costs.

If you (or your child) change your mind about your child's participation, your child can be withdrawn from the study at any time. Your child's participation is completely voluntary. If you choose to withdraw your child, your child's data can be withdrawn as long as it is identifiable. Your decision about whether or not to allow your child to participate or to stop participating will not jeopardize you or your child's future relations with Auburn University, the Department of Curriculum & Teaching, Ms. Johnson, or Vestavia Hills City Schools.

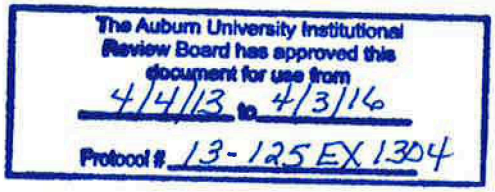
If you (or your child) have questions about this study, please ask them now by contacting Ms. Johnson by email at johnsonlb@vestavia.k12.al.us or by phone at (205) 402-5151. Or, contact her faculty advisor, Dr. Bruce Murray, by email at murraba@auburn.edu or by phone (334) 844-6934. A copy of this document will be given to you to keep.

If you have any questions about your child's rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334) 844-5966 or email at hsubjec@auburn.edu or IRBChair@auburn.edu.

Parent/Guardian Initials _____

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH FOR YOUR CHILD TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW YOUR CHILD TO PARTICIPATE.

Parent/Guardian Signature	Investigator obtaining consent Date
Parent/Guardian Printed Name	Investigator's Printed Name
Date	
Child's Name	



Parent/Guardian Initials _____

APPENDIX B

Target Word List

marina

dinghy

recede

voyage

island

salmon

freighter

wharf

orchid

bouquet

debut

chorus

guide

brooch

routine

phantom

steak

dough

meringue

spinach

pecan

bologna

monarch

antiques

scheme

despot

rough

colonel

autumn

seize

trough

gauge

predator

cygnet

machine

fierce

gnaw

weigh

special

victuals

APPENDIX C

Screeners

First Names Test: Version 1

Directions: Pretend you are a teacher who must read a list of names of students in your class. Read the names as if you were taking attendance. I can't help you in any way. Make a guess if you are not sure.

Name _____ Grade ____ Teacher _____ Date _____

Matt Scott	Chuck Tweed	Brook Spoils	Neal Stark
Jen Vance	Jane Spry	Liz Shaw	Rob Floyd
Tim Claud	Glen Wright	June Paul	Jill Broon
Todd Ricks	Drew Burns	Grace Snow	Scout Dean
Gus Blain	Meg Gray	Hope Bork	Joan Price

Cunningham, P. (1990). The Names Test: A quick assessment of decoding ability. *The Reading Teacher, 44,* 124-129.

Duffelmeyer, F. A., Kruse, A. E., Merkley, D. J., & Fyfe, S. A. (1994). Further validation and enhancement of the Names Test. *The Reading Teacher, 48*, 118-128.

Qualitative Reading Inventory 5
Modified Word Lists

Examiner Word Lists

First Grade	Identified	Second Grade	Identified
bear		morning	
father		tired	
find		shiny	
sound		old	
friend		trade	
song		promise	
thought		pieces	
run		suit	
enough		push	
brain		though	
air		begins	
knew		food	
put		light	
heard		visit	
afraid		clue	
wind		breathe	
choose		insects	
without		weather	
move		noticed	
then		money	
Total Correct		Total Correct	
18-20: Independent	14-17: Instructional		Below 14: Frustration

APPENDIX D

Pretests

Examiner Copy – Pretest of Target Words

Participant_____

Date_____

marina		orchid	
dinghy		bouquet	
recede		debut	
voyage		chorus	
island		guide	
salmon		brooch	
freighter		routine	
wharf		phantom	

steak		scheme	
dough		despot	
meringue		rough	
spinach		colonel	
pecan		autumn	
bologna		seize	
monarch		trough	
antiques		gauge	

predator	
cygnet	
machine	
fierce	
gnaw	

weigh	
special	
victuals	

Total Correct_____

Vocabulary Pre-Test

Participant _____ Date Administered _____

1. Which of these is a king or queen?
   a) monarch b) prince c) president

2. Our house is filled with old furniture from long ago because my mother collects

   a) schemes b) antiques c) troughs

3. Fall is my favorite time of year. This means I like the season of

   a) autumn b) spring c) winter

4. The opposite of smooth is

   a) hard b) soft c) rough

5. We might call a ruler with total power a

   a) queen b) despot c) prince

6. Jill and Sally made up a plan to earn money by selling lemonade. Their _____

   worked. They earned $10 each.

   a) promise b) scheme c) hope

7. An Army officer of high rank might be a

   a) queen b) colonel c) ruler

8. If I suddenly grabbed your dollar, I would _____ it.
a) seize b) hold c) touch

9. On the farm, the pigs ate out of the

a) floor b) stove c) trough

10. A baby _____ swam behind its mother swan.

a) duckling b) swanlet c) cygnet

11. Jim stood on a scale at the doctor's office to _____ himself.

a) weigh b) seize c) despot

12. I watched my dog _____ on his favorite bone.

a) gnaw b) sit c) sleep

13. A lion is a _____ because he hunts and eats other animals.

a) bully b) friend c) predator

14. The Little Scarecrow Boy made six fierce faces to scare the crows. "Fierce" means

a) sad b) ferocious c) funny

15. I invented a _____ to pick up trash.

a) machine b) plant c) animal

16. A rain _____ can be used to measure how much it has rained.

a) thermometer b) machine c) gauge

17. A _____ has a place to dock small boats.

a) marina b) parking lot c) river

18. The two boys rowed the _____ down the river.

a) ship b) dinghy c) submarine

19. A long journey, especially by sea, is called a

a) voyage b) vacation c) picnic

20. A piece of land totally surrounded by water is called a(n):

a) volcano b) state c) island

21. We waited for the flood waters to _____ from our yard.

a) repair b) recede c) relate

22. My favorite kind of fish to eat is

a) salmon b) ham c) pork

23. The men loaded tons of coal onto the

a) dinghy b) freighter c) submarine

24. Ships land and wait at the _____

a) park b) dinghy c) wharf

25. Kim gave her mom a _____ of roses on Mother's Day.

a) brooch b) bouquet c) chorus

26. Sally was very nervous when she made her _____ as a dancer.

a) bouquet b) despot c) debut

27. When John gave his grandmother an _____, she put it in a vase.

a) orchid b) apple c) earring

28. I loved hearing the school _____ sing Christmas songs.

a) music b) choir c) church

29. My grandmother wore a beautiful _____ pinned to her dress every Sunday.

a) necklace b) brooch c) earring

30. The Boy Scouts followed a _____ through the woods to the campground.

a) guide b) doctor c) dentist

31. Something that seems to be there but isn't really, like a ghost, is a

a) cygnet b) phantom c) despot

32. The ballerina practiced her _____ over and over until it was perfect.

a) guide b) brooch c) routine

33. My mom fixed a _____ dinner for my birthday.

a) routine b) guide c) special

34. I helped knead the _____ before we poured it into pan to bake into bread.

a) victuals b) dough c) spinach

35. Instead of lettuce, I eat _____ in salads.

a) dough b) spinach c) carrots

36. A crunchy nut is a

a) bologna b) pecan c) meringue

37. Another name for food is

a) special b) dough c) victuals

38. Chocolate pie with _____ on top is yummy!

a) bologna b) victuals c) meringue

39. Everyday, my mom packs a _____ sandwich for my lunch.

a) victuals b) bologna c) spinach

40. We ate juicy _____ and baked potatoes for supper last night.

a) special b) pecans c) steak

APPENDIX E

Posttests

Posttest – Word Recognition & Automaticity

Participant _____ Date _____

	1 sec.	3 sec.		1 sec.	3 sec.
marina			pecan		
dinghy			bologna		
recede			monarch		
voyage			antiques		
island			scheme		
salmon			despot		
freighter			rough		
wharf			colonel		
orchid			autumn		
bouquet			seize		
debut			trough		
chorus			gauge		
guide			predator		
brooch			cygnet		
routine			machine		
phantom			fierce		
steak			gnaw		

dough			weigh		
meringue			special		
spinach			victuals		
chaos			depot		

Vocabulary Posttest

Participant _____ Date Administered _____

1. A king is sometimes called a
   a) president b) monarch c) governor

2. The museum is filled with _____ from the 1800s.

   a) antiques b) victuals c) despots

3. Each _____, I love the cool air and bright red leaves.

   a) autumn b) spring c) winter

4. We have had storms all day. I hope tomorrow the weather is not as

   a) gentle b) smooth c) rough

5. We might call a cruel ruler a

   a) president b) despot c) senator

6. My brother and I planned a _____ to get our parents to buy us a dog.

   a) victuals b) scheme c) dinghy

7. Her dad is a _____ in the Army.

   a) colonel b) ruler c) king

8. The bully loved to _____ pencils from kids in the class.
a) seize b) give c) sharpen

9. The farmer poured scraps into the _____ for the pigs to eat.

a) cargo b) trough c) freighter

10. The swan led her _____ across the pond.

a) swanlets b) victuals c) cygnets

11. The vet put my dog on a scale to _____ it.

a) seize b) feed c) weigh

12. The puppy could _____ on his bone for hours.

a) gnaw b) bury c) stand

13. The farmer protected his farm animals from _____ like wolves.

a) friends b) freighters c) predators

14. The very angry mom looked at her son with a _____ look.

a) sad b) fierce c) happy

15. He used a _____ to harvest the corn.

a) plant b) machine c) freighter

16. The car had a _____ to let us know when to add oil.

a) meter b) machine c) gauge

17. We leave our boat at the _____.

a) marina b) parking lot c) restaurant

18. I can row the _____ to the island by myself.

a) freighter b) wharf c) dinghy

19. The explorers sailed on a long _____ to look for gold.

a) voyage b) volcano c) picnic

20. We had to drive across a bridge to get from the main land to the _____.

a) cargo b) wharf c) island

21. We saw the water _____ after the flood.

a) relate b) recede c) reflex

22. I went fishing for _____ with my dad.

a) salmon b) ham c) pork

23. The _____ carried a heavy load from port to port.

a) dinghy b) freighter c) submarine

24. The _____ was busy with freighters unloading cargo.

a) park b) dinghy c) wharf

25. My dad gave my mom a _____ of roses on her birthday.

a) chorus b) debut c) bouquet

26. We saw my friend make her _____ as a singer.

a) bouquet b) despot c) debut

27. I put the _____ in a vase.

a) orchid b) victuals c) brooch

28. The school _____ has been practicing for its Christmas program.

a) chorus b) debut c) brooch

29. The beautiful _____ sparkled on my mother's coat.

a) brooch b) flower c) earring

30. The lady used her seeing-eye dog as a _____.

a) guide b) debut c) routine

31. In _____ of the Opera, a ghost haunts an opera.

a) Cygnet b) Phantom c) Despot

32. My afternoon _____ never changes. I do my homework, play outside, then eat supper.

a) guide b) special c) routine

33. My best friend gave me a _____ book for my birthday.

a) routine b) guide c) special

34. The chef tossed the pizza _____ into the air.

a) victuals b) dough c) special

35. My mom says _____ is good for me and I have to eat it every night.

a) dough b) spinach c) sugar

36. My grandmother makes the best _____ pie!

a) bologna b) pecan c) dough

37. The restaurant served the fanciest _____ I had ever eaten.

a) routine b) victuals c) guide

38. My favorite pie is lemon _____.

a) steak b) victuals c) meringue

39. I am tired of _____ sandwiches. I want ham instead.

a) victuals b) bologna c) pecan

40. My dad grilled a juicy _____ for a special supper.

a) bean b) pecan c) steak

APPENDIX F

Spelling: Scoring Guide

Spelling Measure (Posttest)
Steinen-Murray Accuracy Method

Participant _____ Date_____

Target Word	# of correct ordered letters	bonus point for standard spelling	Total Points
marina			
dinghy			
recede			
voyage			
island			
salmon			
freighter			
wharf			
monarch			
antiques			
scheme			
despot			
rough			
colonel			
autumn			

seize			
orchid			
bouquet			
debut			
chorus			
guide			
brooch			
routine			
phantom			
trough			
gauge			
predator			
cygnet			
machine			
fierce			
gnaw			
weigh			
steak			
dough			
meringue			
spinach			
bologna			

victuals			
pecan			
special			

APPENDIX G

Variable Glossary

Groups

Experimental Group – the treatment group, received instruction in decoding and crosschecking

Oral Reading Control – a control group, similar procedures as experimental group but received no instruction in decoding and crosschecking

Vocabulary Control – a second control group, received only oral vocabulary instruction in 40 target word meanings, print was not used

Measures

Pretarget1 – target word reading measure pretest, students read the 40 target irregular words used in the study

Posttarget1 – target word reading measure posttest, a one-second read of target words to measure if students could read the words automatically upon sight (automaticity), students read the same 40 irregular words used in the study on a powerpoint presentation designed to display each word for one second

Posttarget2 – target word reading measure posttest, a three-second read of target words to measure if the students could read the words accurately with more time, students read the same 40 irregular words they had just been shown for one second, this time they were shown each word for three seconds via powerpoint presentation

Prevocabulary test – a multiple choice vocabulary measure, measured students' knowledge of the meanings of the 40 target words

Postvocabulary test – a multiple choice measured students' knowledge of the meaning of the 40 target words, same format as pretest with different questions

Spellingpost – a spelling test measuring spelling ability of the 40 target words

APPENDIX H

Experimenter-created stories used for experimental and oral reading control groups

A Birthday Meal for Mom

Today is my mom's birthday. My dad and I will make her a special meal. It will be a surprise. First, we check to see what we have on hand. I found lunch meat, but my dad said bologna sandwiches aren't good enough for a birthday meal. We need fancy victuals for this! What else do we have? I find plenty of spinach for a salad. My dad says that will go well with a juicy steak. Perfect! Dad begins to cook the meat and I make the salad. Next, we decide to make rolls. I roll out the dough, cut out each one, and bake them. Finally, my dad bakes two pies. He bakes a pecan pie for me, and a lemon meringue pie for my mom. That is her favorite. I am getting hungry now. I carefully set the table. I stack presents on the table near her seat. Now, we are ready. The food smells good! We call mom into the dining room. She is surprised! My mom loves the pie and the meal, and we do, too. Happy birthday, mom!

Participant_____ **Date_____**

Book Talk: *Have you ever helped prepare a birthday meal for someone? In this story, A Birthday Meal for Mom, a little girl and her dad prepare a very special birthday celebration. Let's read to find out about their special surprise.*

A Birthday Meal for Mom

Today is my mom's birthday. My dad and I will make her a special meal. It will be a surprise. First, we check to see what we have on hand. I found lunch meat, but my dad said bologna sandwiches aren't good enough for a birthday meal. We need fancy victuals for this! What else do we have? I find plenty of spinach for a salad. My dad says that will go well with a juicy steak. Perfect! Dad begins to cook the meat and I make the salad. Next, we decide to make rolls. I roll out the dough, cut out each one, and bake them. Finally, my dad bakes two pies. He bakes a pecan pie for me, and a lemon meringue pie for my mom. That is her favorite. I am getting hungry now. I carefully set the table. I stack presents on the table near her seat. Now, we

are ready. The food smells good! We call mom into the dining room. She is surprised! My mom loves the pie and the meal, and we do, too. Happy birthday, mom!

Miscue Analysis:

Comprehension Assessment

1. What did the father and child prepare for the mother's birthday meal?

2. Was the mom in the story surprised by the dinner? How do you know?

3. What made this a special meal?

Farmer Brown Loves His Job

Farmer Brown works very hard, but he loves his job. His farm is in the country. He needs a lot of land for his animals. He needs a place to grow crops, too. Farmer Brown's day begins before the sun rises. He must get up very early because he has so much to do. First, he puts food into the trough so the pigs can eat breakfast. Next, he milks the cows and feeds them. Then, he feeds the chickens. Yummy! The chickens cluck happily. He tosses the farm dog a new bone to gnaw. Then he walks down to the pond to feed the ducks and swans. He sees the mother swan with her tiny new cygnet following close behind her. Farmer Brown takes very good care of his animals. He keeps them safe from predators, such as fierce wolves, so they will not be harmed. He spends most of the day working in the fields. He uses a machine to water his crops. He checks a gauge to measure how much water the crops have received. After the crops are harvested, he uses a scale to weigh the harvest. After the harvest, he stores the food in a

nearby depot. Farmer Brown will tell you that he works hard every day, but he loves his job.

Participant_____ **Date_____**

Book Talk: *Have you ever visited a farm? In Farmer Brown Loves His Job, we will learn what this farmer does each day. Let's read to learn why he loves his job.*

Farmer Brown Loves His Job

Farmer Brown works very hard, but he loves his job. His farm is in the country. He needs a lot of land for his animals. He needs a place to grow crops, too. Farmer Brown's day begins before the sun rises. He must get up very early because he has so much to do. First, he puts food into the **trough** so the pigs can eat breakfast. Next, he milks the cows and feeds them. Then, he feeds the chickens. Yummy! The chickens cluck happily. He tosses the farm dog a new bone to **gnaw**. Then he walks down to the pond to feed the ducks and swans. He sees the mother swan with her tiny new **cygnet** following close behind her. Farmer Brown takes very good care of his animals. He keeps them safe from **predators**, such as **fierce** wolves, so they will not be harmed. He spends most of the day working in the fields.

He uses a **machine** to water his crops. He checks a **gauge** to measure how much water the crops have received. After the crops are harvested, he uses a scale to **weigh** the harvest. After the harvest, he stores the food in a nearby **depot**. Farmer Brown will tell you that he works hard every day, but he loves his job.

Miscue Analysis:

Comprehension Questions

1. According to this passage, what does Farmer Brown do first in the morning?

2. According to the passage, what does Farmer Brown spend most of his time doing?

3. Why do you think Farmer Brown enjoys his job?

My Sister's Big Night

I am so excited. Tonight, I will attend my first musical. My older sister is a ballet dancer. She will dance in Phantom of the Opera. She has never danced on stage in front of people before. It is her dancing debut. We are all dressed up. My mom pinned a very old and fancy brooch to her dress. She took a small orchid out of a vase and pinned it to my dress. My dad is wearing his best suit. When we arrived at the auditorium, a guide helped us find our seats. The lights dimmed. The music began to play. The chorus began to sing. The dancers began to dance. It was amazing! I looked for my sister. She had practiced her ballet routine for weeks. I knew she would not make a mistake. I was right. She was perfect! When it was over, my parents handed my sister a bouquet of roses. It was a night we will never forget.

Participant_____ **Date**_____

Book Talk: *Have you ever seen (or danced in) a ballet? My Sister's Big Night is about a little girl who goes with her parents to a big auditorium to watch her older sister dance in a famous musical. Let's read more about this special night!*

My Sister's Big Night

I am so excited. Tonight, I will attend my first musical. My older sister is a ballet dancer. She will dance in **Phantom** of the Opera. She has never danced on stage in front of people before. It is her dancing **debut**. We are all dressed up. My mom pinned a very old and fancy **brooch** to her dress. She took a small **orchid** out of a vase and pinned it to my dress. My dad is wearing his best suit. When we arrived at the auditorium, a **guide** helped us find our seats. The lights dimmed. The music began to play. The **chorus** began to sing. The dancers began to dance. It was amazing! I looked for my sister. She had practiced her ballet **routine** for weeks. I knew she would not make a mistake. I was right. She was perfect! When it was over, my parents handed my sister a **bouquet** of roses. It was a night we will never forget.

Miscue Analysis:

Comprehension Assessment

1. What is this story mainly about?

2. How do we know that this was a special night for the family? What evidence in the story supports your answer?

3. Did the sister practice her part in the ballet many times? How do you know that?

Summer at the Sea

Each summer, my brother, Jim, and I visit our Nana and Papa. They live in a small house by the sea. We look forward to our visit to their home all year. Our visits there are fun and exciting! Their house is near a marina. They park their boats there. So do many other people. When we visit, Papa lets Jim and me take his dinghy out on the water. It is so small we can paddle it by ourselves. We pretend we are going on a great voyage to a land far away. We paddle over to a small island. We love to spend hours fishing there. We hunt for seashells and watch the waves roll in and recede. When we are tired, we paddle back home.

For supper, Nana serves us salmon that Papa caught. Later, Papa walks with us to the dock and we watch boats of all sizes sail up and down the water. We see a freighter with its heavy load churning slowly through the waves. They are headed to a nearby wharf to unload their heavy cargo. We see a bright ferry, filled with people, spinning happily along. We see boats filled with fishermen, returning from a busy day at sea. We return home tired, but happy. We love our visits to the sea.

Participant_____ **Date_____**

Book Talk: *In Summer at the Sea, you will read about two brothers who spend every summer with their grandparents, who live near the sea. Let's read to learn about their summer adventures on the ocean!*

Summer at the Sea

Each summer, my brother, Jim, and I visit our Nana and Papa. They live in a small house by the sea. We look forward to our visit to their home all year. Our visits there are fun and exciting! Their house is near a **marina**. They park their boats there. So do many other people. When we visit, Papa lets Jim and me take his **dinghy** out on the water. It is so small we can paddle it by ourselves. We pretend we are going on a great **voyage** to a land far away. We paddle over to a small **island**. We love to spend hours fishing there. We hunt for seashells and watch the waves roll in and **recede**. When we are tired, we paddle back home.

For supper, Nana serves us **salmon** that Papa caught. Later, Papa walks with us to the dock and we watch boats of all sizes sail up and down the water. We see a **freighter** with its heavy load churning slowly through the waves. They are headed to a nearby **wharf** to unload their heavy cargo. We see a bright ferry, filled with people, spinning happily along. We see boats filled with fishermen, returning from a busy day at sea. We return home tired, but happy. We love our visits to the sea.

Miscue Analysis:

Comprehension Assessment

1. What do the brothers do when they visit the island?

2. When the grandfather takes the two boys to the dock after supper, what do they see?

3. What is a freighter?

The Old Man and the Bee

Long ago, an old man lived in a small village. For years he had been a colonel in the Army. Now he was very old. He loved very old furniture. His small house was filled with antiques that were much older than he was. The village was part of a kingdom ruled by a mean king. He was a despot. He made life very rough for the people who lived there. The king made them walk to his castle each morning and bring him food from their gardens. This was hard for them. They had to carry food to him even when the weather was terrible. They were very sad. Each morning, year after year, the old man would pick the best fruit from his garden. Then he would walk up the hill near his house and take the fruit to the evil monarch, who would quickly seize it from his hands.

The old man loved autumn best. The trees were filled with color and the air was crisp. It made his walk to the castle seem shorter. One fall morning, the old man thought of a scheme. He picked a bright, red apple for the king. A bee was on the apple. When the old man gave the apple to the king, the bee buzzed into the king's face! It stung the king's hand! The king cried out in pain. There was

chaos in the castle! From that day on, the old man never had to bring the king food again. For the rest of his days, he ate his own food and lived happily ever after.

Participant_____ **Date**_____

Book Talk: *In The Old Man and the Bee, you will read about a very old man who outwits a very mean king. Let's read to find out how and why he decides to trick the evil ruler.*

The Old Man and the Bee

Long ago, an old man lived in a small village. For years he had been a **colonel** in the Army. Now he was very old. He loved very old furniture. His small house was filled with **antiques** that were much older than he was. The village was part of a kingdom ruled by a mean king. He was a **despot**. He made life very **rough** for the people who lived there. The king made them walk to his castle each morning and bring him food from their gardens. This was hard for them. They had to carry food to him even when the weather was terrible. They were very sad. Each morning, year after year, the old man would pick the best fruit from his garden. Then he would walk up the hill near his house and take the fruit to the evil **monarch**, who would quickly **seize** it from his hands.

The old man loved autumn best. The trees were filled with color and the air was crisp. It made his walk to the castle seem shorter. One fall morning, the old man thought of a **scheme**. He picked a bright, red apple for the king. A bee was on the apple. When

the old man gave the apple to the king, the bee buzzed into the king's face! It stung the king's hand! The king cried out in pain. There was **chaos** in the castle! From that day on, the old man never had to bring the king food again. For the rest of his days, he ate his own food and lived happily ever after.

Miscue Analysis:

Comprehension Assessment

1. What do we know about the old man in this story?

2. How did the old man in the story trick the king?

3. Would you want to live in this village? Why?

APPENDIX I

Story Information

A Birthday Meal for Mom

Today is my mom's birthday. My dad and I will make her a **special** meal. It will be a surprise. First, we check to see what we have on hand. I found lunch meat, but my dad said **bologna** sandwiches aren't good enough for a birthday meal. We need fancy **victuals** for this! What else do we have? I find plenty of **spinach** for a salad. My dad says that will go well with a juicy **steak**. Perfect! Dad begins to cook the meat and I make the salad. Next, we decide to make rolls. I roll out the **dough**, cut out each one, and bake them. Finally, my dad bakes two pies. He bakes a **pecan** pie for me, and a lemon **meringue** pie for my mom. That is her favorite. I am getting hungry now. I carefully set the table. I stack presents on the table near her seat. Now, we are ready. The food smells good! We call mom into the dining room. She is surprised! My mom loves the pie and the meal, and we do, too. Happy birthday, mom!

Word Count: 184 words
Readability Indices

Flesch Kincaid Reading Ease	97.8
Flesch Kincaid Grade Level	1.5
Gunning Fog Score	3.8
SMOG Index	2.9
Coleman Liau Index	6
Automated Readability Index	-0.3

Text Statistics

No. of sentences	25
No. of words	184
No. of complex words	4
Percent of complex words	2.17%
Average words per sentence	7.36
Average syllables per word	1.20

Farmer Brown Loves His Job

Farmer Brown works very hard, but he loves his job. His farm is in the country. He needs a lot of land for his animals. He needs a place to grow crops, too. Farmer Brown's day begins before the sun rises. He must get up very early because he has so much to do. First, he puts food into the **trough** so the pigs can eat breakfast. Next, he milks the cows and feeds them. Then, he feeds the chickens. Yummy! The chickens cluck happily. He tosses the farm dog a new bone to **gnaw**. Then he walks down to the pond to feed the ducks and swans. He sees the mother swan with her tiny new **cygnet** following close behind her. Farmer Brown takes very good care of their animals. He keeps them safe from **predators**, such as **fierce** wolves or smart foxes, so they will not be harmed. He spends most of the day working in the fields. He uses a **machine** to water his crops. He checks a **gauge** to measure how much water the crops have received. After the crops are harvested, he uses a scale to **weigh** the harvest. Farmer Brown will tell you that he works hard every day, but he loves his job.

Word Count: 210
Readability Indices

Flesch Kincaid Reading Ease	98.4
Flesch Kincaid Grade Level	2
Gunning Fog Score	5.1
SMOG Index	3.6
Coleman Liau Index	7.4
Automated Readability Index	2.1

Text Statistics

No. of sentences	21
No. of words	210
No. of complex words	6
Percent of complex words	2.86%
Average words per sentence	10.00
Average syllables per word	1.16

My Sister's Big Night

I am so excited. Tonight, I will attend my first musical. My older sister is a ballet dancer. She will dance in **Phantom** of the Opera. She has never danced on stage in front of people before. It is her dancing **debut.** We are all dressed up. My mom pinned a very old and fancy **brooch** to her dress. She took a small **orchid** out of a vase and pinned it to my dress. My dad is wearing his best suit. When we arrived at the **auditorium**, a **guide** helped us find our seats. The lights dimmed. The music began to play. The **chorus** began to sing. The dancers began to dance. It was amazing! I looked for my sister. She had practiced her ballet routine for weeks. I knew she would not make a mistake. I was right. She was perfect! When it was over, my parents handed my sister a **bouquet** of roses. It was a night we will never forget.

Word Count: 163
Readability Indices

Flesch Kincaid Reading Ease	96.9
Flesch Kincaid Grade Level	1.5
Gunning Fog Score	3.6
SMOG Index	3
Coleman Liau Index	6.8
Automated Readability Index	0.3

Text Statistics

No. of sentences	23
No. of words	164
No. of complex words	4
Percent of complex words	2.44%
Average words per sentence	7.13
Average syllables per word	1.21

Summer at the Sea

Each summer, my brother, Jim, and I visit our Nana and Papa. They live in a small house by the sea. We look forward to our visit to their home all year. Our visits there are fun and exciting! Their house is near a **marina**. They park their boats there. So do many other people. When we visit, Papa lets Jim and me take his **dinghy** out on the water. It is so small we can paddle it by ourselves. We pretend we are going on a great **voyage** to a land far away. We paddle over to a small **island**. We love to spend hours fishing there. We hunt for seashells and watch the waves roll in and **recede**. When we are tired, we paddle back home.

For supper, Nana serves us **salmon** that Papa caught. Later, Papa walks with us to the dock and we watch boats of all sizes sail up and down the water. We see a **freighter** with its heavy load churning slowly through the waves. They are headed to a nearby **wharf** to unload their heavy cargo. We see a bright ferry, filled with people, spinning happily along. We see boats filled with fishermen, returning from a busy day at sea. We return home tired, but happy. We love our visits to the sea.

Word Count: 220

Readability Indices

Flesch Kincaid Reading Ease	93.6
Flesch Kincaid Grade Level	2.7
Gunning Fog Score	4.7
SMOG Index	3.1
Coleman Liau Index	7.3
Automated Readability Index	2

Text Statistics

No. of sentences	22
No. of words	220
No. of complex words	4
Percent of complex words	1.82%
Average words per sentence	10.00
Average syllables per word	1.22

The Old Man and the Bee

Long ago, an old man lived in a small village. For years he had been a **colonel** in the Army. Now he was very old. He loved very old furniture. His small house was filled with **antiques** that were much older than he was. The village was part of a kingdom ruled by a mean king. He was a **despot**. He made life very **rough** for the people who lived there. The king made them walk to his castle each morning and bring him food from their gardens. This was hard for them. They had to carry food to him even when the weather was terrible. They were very sad. Each morning, year after year, the old man would pick the best fruit from his garden. Then he would walk up the hill near his house and take the fruit to the evil **monarch,** who would quickly **seize** it from his hands.

The old man loved **autumn** best. The trees were filled with color and the air was crisp. It made his walk to the castle seem shorter. One fall morning, the old man thought of a **scheme**. He picked a bright, red apple for the king. A bee was on the apple. When the old man gave the apple to the king, the bee buzzed into the king's face! It stung the king's hand! The king cried out in pain. From that day on, the old man never had to bring the king food again. For the rest of his days, he ate his own food and lived happily ever after.

Word Count: 262

Readability Indices

Flesch Kincaid Reading Ease	100.3
Flesch Kincaid Grade Level	1.9
Gunning Fog Score	4.8
SMOG Index	2.9

Coleman Liau Index	6.6
Automated Readability Index	1.7

Text Statistics

No. of sentences	25
No. of words	262
No. of complex words	4
Percent of complex words	1.53%
Average words per sentence	10.48
Average syllables per word	1.13

APPENDIX J

Vocabulary Treatment

Vocabulary Day 1

> Introduce Target Words (display power point with pictures of each target word on an iPad).

For each word:

* Point to the picture and say the target word.
* Ask the child to repeat the word.
* Give the student-friendly definition and use the word in a sentence (see below).
* Repeat the target word.

> After introducing each word, review each power point slide. Point to the picture and say the target word. Ask the child to use the word in a sentence.

> Finally, ask the child to find the target word that fits each sentence (see next page). Allow the child to scroll through the pictures on the iPad to find the target word that best completes each sentence.

Target Word	**Student-Friendly Definition**	**Example sentence**
Day 1		
marina	a dock to anchor boats	My dad parks our boat at the city marina.

dinghy	a small rowboat	My brother and I rowed our dinghy to the nearby island.
recede	to move back	We waited for the flood waters to recede.
voyage	a journey, usually by water, from one place to another	The Pilgrims sailed on a long voyage to come to America.
island	an area of land surrounded by water	An island is surrounded by water.
salmon	a type of fish	Salmon is my type of fish to eat.
freighters	a ship that carries goods (freight)	The large freighter carried oil from Alaska to Russia.
wharf	a place where ships load and unload goods	The wharf was bustling with men unloading the cargo from big freighters.

Which word best completes each sentence?

A very heart-healthy type of fish to eat is _____. (salmon)

The huge ship unloaded its cargo at the _____. (wharf)

A piece of land surrounded on all sides by water is an _____. (island)

Christopher Columbus sailed on a very long _____ to discover a new land. (voyage)

The large _____ carried cargo across the ocean. (freighter)

We leave our boat at the _____ when we are not using it. (marina)

We watched the ocean tide roll in, then _____ or go back. (recede)

We only need a _____ , or very small boat, to row to the nearby island. (dinghy)

Vocabulary Day 2

> Introduce Target Words (display power point with pictures of each target word on an iPad).

For each word:

* Point to the picture and say the target word.
* Ask the child to repeat the word.
* Give the student-friendly definition and use the word in a sentence (see below).
* Repeat the target word.

> After introducing each word, review each power point slide. Point to the picture and say the target word. Ask the child to use the word in a sentence.

> Finally, ask the child to find the target word that fits each sentence (see next page). Allow the child to scroll through the pictures on the iPad to find the target word that best completes each sentence.

Target Word	**Student-Friendly Definition**	**Example sentence**
Day 2		
gauge	an instrument for measuring	We used a gauge to see how many inches it rained this week.
trough	a long, shallow container that holds water or food for animals	The pigs ate hungrily from the scraps poured into the trough.
weigh	to learn how heavy something is	The vet placed my dog on a scale to weigh him.
predators	animals that kill and eat other animals	Wolves are predators; they eat small animals.

cygnet	a baby swan	The swan led her cygnets around the pond.
machine	a combination of parts that use force, motion and energy to do desired work	A bulldozer is a machine.
gnaw	to chew on something	My dog likes to gnaw on his bone.
fierce	Very unfriendly, aggressive, threatening	The wind was so fierce I decided to stay inside.

Which word best completes each sentence?

Wolves, foxes and lions hunt and eat smaller animals. They are _____. (predators)

Very bad, threatening weather can be described as _____. (fierce)

My dog can _____ on her bone for hours. (gnaw)

People have invented different kinds of _____ to do their work for them. (machines)

A baby swan is called a _____. (cygnet)

My mom's car has a _____ that lets her know when it is time to add gasoline. (gauge)

When I visit the doctor, the nurse always asks me to stand on the scale and _____ myself. (weigh

Vocabulary Day 3

> Introduce Target Words (display power point with pictures of each target word on an iPad).

For each word:

* Point to the picture and say the target word.
* Ask the child to repeat the word.
* Give the student-friendly definition and use the word in a sentence (see below).
* Repeat the target word.

> After introducing each word, review each power point slide. Point to the picture and say the target word. Ask the child to use the word in a sentence.

> Finally, ask the child to find the target word that fits each sentence (see next page). Allow the child to scroll through the pictures on the iPad to find the target word that best completes each sentence.

Target Word	**Student-Friendly Definition**	**Example sentence**
Day 3		
monarch	a king or queen	Queen Elizabeth is the ruling monarch in England.
antiques	objects, such as furniture or art, from an earlier time	I collect antiques from the 1800s.
scheme	a plan, especially a sneaky or secret one	The two brothers came up with a scheme to earn money for the school trip.
despot	a rule with total power	The despot was a harsh ruler and

		everyone was afraid of him.
rough	difficult, harsh	People who live in the Northeast are used to rough winters.
colonel	an officer in the Army, Air Force or Marines	Her dad is a colonel in the Army.
autumn	the season that falls after summer and before winter	Every autumn, we visit the park to enjoy the crisp, cool air and colorful leaves.
seize	to grab or take quickly	The teacher seized the toy from her student.

Which word best completes each sentence?

The United States does not have a king or queen; we have an elected president rather than a _____. (monarch)

Fall is my favorite time of year because the weather is cool and the leaves are beautiful. Another word for this season is _____. (autumn)

The bully in my class annoys me because he likes to _____ my pencils and refuses to return them. (seize)

My grandfather earned medals when he was a _____ in the Army. (colonel)

The opposite of smooth is _____. (rough)

My best friend and I planned a _____ to convince my parents to take us to the movies. (scheme)

Our house is filled with furniture from long, long ago because my parents love to collect _____. (antiques)

A ruler who has total power and often uses it to harm the people is a _____. (despot)

Vocabulary Day 4

> Introduce Target Words (display power point with pictures of each target word on an iPad).

For each word:

* Point to the picture and say the target word.
* Ask the child to repeat the word.
* Give the student-friendly definition and use the word in a sentence (see below).
* Repeat the target word.

> After introducing each word, review each power point slide. Point to the picture and say the target word. Ask the child to use the word in a sentence.

> Finally, ask the child to find the target word that fits each sentence (see next page). Allow the child to scroll through the pictures on the iPad to find the target word that best completes each sentence.

Target Word	**Student-Friendly Definition**	**Example sentence**
Day 4		
orchid	a type of plant with showy flowers	My mom arranged the orchids in a vase.
bouquet	a bunch of flowers	My dad gave my mother a beautiful bouquet of roses on Mother's Day.
debut	one's first time to perform in public	We watched my sister's debut as a ballerina.

chorus	a group of singers	My brother sings in the middle school chorus.
guide	one who leads or directs another	A guide led the Boy Scouts through the woods to the campground.
brooch	a fancy, ornamental pin	Each Sunday, my grandmother wears a beautiful brooch pinned to her dress.
routine	a regular way of doing something	Each morning, I have the same routine: get up, get dressed, eat breakfast, leave for school.
phantom	something that seems to be there, but really isn't, like a ghost	This book is about phantoms said to haunt our town's cemetery.

Which word best completes each sentence?

My mom took me to a flower store and allowed me to choose any flower I wanted. I chose a purple _____. (orchid)

A famous musical about a ghost who haunts an opera is The _____ of the Opera. (Phantom)

I picked a _____ of flowers from my garden and gave them to my neighbor. (bouquet)

My family drove to Nashville to see my brother's _____ as a country singer. (debut)

When I am in the fourth grade, I will join the school _____. (chorus)

I had to practice for weeks to learn my dance _____ for the school musical. (routine)

A student at my school cannot see. She depends on her seeing-eye dog to _____ her to class. (guide)

My grandmother wears a jeweled _____ pinned to her scarf when she dresses up for important occasions. (brooch)

Vocabulary Day 5

> Introduce Target Words (display power point with pictures of each target word on an iPad).

For each word:

* Point to the picture and say the target word.
* Ask the child to repeat the word.
* Give the student-friendly definition and use the word in a sentence (see below).
* Repeat the target word.

> After introducing each word, review each power point slide. Point to the picture and say the target word. Ask the child to use the word in a sentence.

> Finally, ask the child to find the target word that fits each sentence (see next page). Allow the child to scroll through the pictures on the iPad to find the target word that best completes each sentence.

Target Word	**Student-Friendly Definition**	**Example sentence**
Day 5		
steak	a slice of beef	We ate juicy steaks, baked potatoes and salad for my birthday.
dough	a soft mass of moist flour thick enough to roll or knead	The chef rolled out the dough for the pizza.
victuals	\ˈvi-tᵊl\ (rhymes with “hittles”) food	The Native Americans ate fresh victuals that included deer meat, fruits and vegetables.

spinach	a plant with dark green leaves that can be eaten	I prefer spinach, rather than lettuce, in my salads.
pecan	a nut that can be eaten	My grandmother makes delicious pecan pies for Christmas.
special	set apart, designed for a specific purpose or occasion	Each year, we celebrate my grandfather's birthday with a special dinner at our house.
meringue	a dessert topping made of stiffly beaten egg whites and sugar	Lemon meringue pie is my favorite dessert.
bologna	a lunch meat	My brother likes ham sandwiches for lunch, but I prefer bologna.

Which word best completes each sentence?

Tonight we are going to grill out. My dad will grill a juicy _____ for each of us. (steak)

I helped my grandfather bake homemade bread. It was my job to knead the _____. (dough)

I love chocolate pie, but I like it best with _____ on top. (meringue)

My brother made all A's on his report card so my mother is going to fix a _____ dinner for him. (special)

We prepared a variety of sandwiches for everyone at the sleepover. Two kids had turkey, five chose ham and three asked for _____ (bologna)

My mom refuses to give us processed foods, so she only serves fresh, organic _____ (victuals).

My mom makes me eat _____ every week because she says green leafy veggies are good for me. (spinach)

My grandmother puts _____ in the chocolate icing she makes for cakes. The nutty flavor is delicious! (pecans)

APPENDIX K

Post-study target word data

	Read Correctly Automatically	Read Correctly	Spelled Correctly
marina	25	27	6
dinghy	19	19	0
recede	23	24	4
voyage	30	37	5
island	35	39	11
salmon	23	29	12
freighter	9	13	1
wharf	31	38	4
orchid	10	12	4
bouquet	13	17	1
debut	3	6	1
chorus	8	16	1
guide	38	40	12
brooch	29	32	4
routine	30	36	7
phantom	22	29	5
steak	31	36	20
dough	27	32	12

meringue	4	7	2
spinach	30	38	6
pecan	27	35	7
bologna	17	24	0
monarch	12	18	4
antiques	12	17	3
scheme	13	21	1
despot	19	24	10
rough	25	30	13
colonel	2	2	1
autumn	25	31	1
seize	17	25	3
trough	5	9	7
gauge	12	19	4
predator	23	29	2
cygnet	9	20	5
machine	26	26	7
fierce	25	29	1
gnaw	18	26	8
weigh	29	33	9
special	38	42	3
victuals	3	9	1