The Effect of Orthographic Mapping, Context, and Word Class on Sight Word Learning for Native and Nonnative English-Speakers

Katharine Pace Miles
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THE EFFECT OF ORTHOGRAPHIC MAPPING, CONTEXT, AND WORD CLASS ON SIGHT WORD LEARNING FOR NATIVE AND NONNATIVE ENGLISH-SPEAKERS

by

Katharine Pace Miles

A dissertation submitted to the Graduate Faculty in Educational Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2015
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This manuscript has been read and accepted by the Graduate Faculty in Educational Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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THE CITY UNIVERSITY OF NEW YORK
Abstract

THE EFFECT OF ORTHOGRAPHIC MAPPING, CONTEXT, AND WORD CLASS ON SIGHT WORD LEARNING FOR NATIVE AND NONNATIVE ENGLISH-SPEAKERS

by

Katharine Pace Miles

Adviser: Professor Linnea C. Ehri

This study investigated three questions: 1.) Does training in orthographic mapping better support flashcard reading over a control group, 2.) Does providing meaning clarifications during flashcard reading better support learning over not providing meanings, 3.) Does grammatical word class affect word learning, and 4.) Do these manipulations affect word learning differently in native and nonnative speakers? Additionally, this study investigated whether literacy and language skills predict the reading of words presented in isolation. Native \((n = 40)\) and nonnative \((n = 41)\) English-speaking kindergarten students’ were randomly assigned to either the orthographic mapping or control condition prior to flashcard word reading. Students in the orthographic mapping condition were trained in small groups on mapping grapheme-phoneme relations in words for three consecutive days. Students in the control group participated in an interactive read aloud for the equivalent amount of time. After the third day of training, individual students practiced learning to read content and function words on flashcards. In one condition words were taught in meaningful sentences. In the other condition words were taught in isolation. Results of ANOVAs demonstrated that both native and nonnative speakers were better able to read words when they were taught in isolation than in sentences, and native speakers were better able to spell words when taught in isolation than in sentences. However, both groups were better able to embed words in sentences when words were taught with meaning clarifying sentences than in isolation. Both native and nonnative speakers performed better with
content words than with function words. Full alphabetic readers performed better than partial alphabetic readers on orthographic mapping, reading, and spelling words regardless of language proficiency status. Also, results of hierarchical linear regressions demonstrated that language proficiency accounted for a significant amount of unique variance in reading function words in isolation, but this was not the case for reading content words in isolation.
Acknowledgements

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Finally, an overwhelming thanks to my husband, Garth Miles, for the faith you had in me to accomplish this goal. The innumerable sacrifices you made during this process did not go unnoticed. I am grateful every day to be with a person of such integrity, intellect, and humor. This journey was exponentially more enjoyable with you by my side.
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Orthographic Mapping, Context, and Word Class

Chapter 1

Introduction

The goal of early childhood literacy education is to support children in becoming fluent readers with strong comprehension skills. The backbone of successful reading lies in beginning readers’ ability to acquire a large sight word vocabulary in order to make the recognition of words effortless. Questions still remain as to what practices best support beginning readers in most efficiently acquiring sight word vocabularies. Teachers may use instructional strategies that are not supported by research simply because they are practices that mentors and/or colleagues have used for years. One such strategy involves having students read high frequency words on flashcards. The belief is that high frequency words need to be memorized, especially if the word is spelled irregularly, in order to be read automatically.

Questions also still remain regarding the level of foundational literacy skills that students need in order to benefit from sight word teaching practices such as flashcard reading. Students as young as kindergarten are given sets of words on flashcards or in lists to practice reading as quickly as possible. These young students may not have the necessary literacy skills to benefit from this instructional practice. For instance, these young readers may not have sufficient phoneme segmentation skills or letter knowledge, and ELLs may not have enough language proficiency skills to even attempt to guess at an English pronunciation or meaning of the word. Even if students eventually read the words on the flashcards, the orthographic representation of the words may not be securely stored in memory because the words were simply memorized as a whole visual, non-alphabetic unit.

Ehri (1998) explains that the most efficient way to read words is by matching the written form on the page to its spelling stored in memory. Prior to being able to read words automatically from memory, words may be read by decoding the word’s letter-sound sequence,
by analogizing the word to a known word in memory, or by predicting/guessing the word based on context clues. Through repeated exposure to the orthographic representation of the word, mature beginning readers are able to form full connections between the letters and sounds of the words. This connection between the spelling and pronunciation of the word becomes bonded to the meaning of the word as well. Eventually the word is stored in memory such that sight of the spelling of the word automatically activates its pronunciation and meaning in memory.

Ehri (1992) explains that attention to a word’s letter-sound relationships coupled with knowledge of the word’s meaning more securely stores the word in memory than memorization of words as whole visual units associated to meanings. However, the practice of reading words in isolation on flashcards or on lists focuses readers’ attention to the word as a whole unit. Little if any instruction is provided to analyze grapheme-phoneme relationships within the words. Yet, as Ehri points out, this is imperative to proper word storage. The skill of analyzing grapheme-phoneme relations is not exclusive to regularly spelled words. Ehri (1998) explains that irregular spelling patterns often recur in several words and so there is the potential to make this knowledge systematic. Also, all but one or a few letters in irregularly spelled words follow a consistent pattern of orthographic mapping allowing the reader to analyze the known relationships and flag the silent letters in memory if necessary.

Evidence provided by Boyer and Ehri (2011) and Ehri, Satlow, and Gaskins (2009) suggests that phoneme segmentation practice with orthographic mapping may be a viable way to secure words in memory. Boyer and Ehri trained preschool students to segment words into phonemes and to match sounds to the letters in the word. One group was trained to segment the phonemes using pictures of articulatory gestures along with letters (LPA group). Another group also segmented the words into phonemes, but they were only provided with letter tiles (LO
group). The results indicated that the LPA group performed significantly better than the LO group on measures of word reading after training time was used as a covariate.

Ehri, Satlow, and Gaskins (2009) trained students with a history of reading difficulties to segment the phonemes and analyze the letter-sound relationships in keywords that were later used to read other words by analogy. The comparison group learned to read the keywords without segmenting the phonemes or analyzing the letter-sound relationships in the word. The results showed that during the first two years of instruction, students who received the phoneme segmentation and letter-sound training read and spelled significantly better than students who did not receive this instruction.

These two studies motivated the procedures used in the present study to train students on how to segment phonemes and analyze letter-sound relationships in words. The students in the orthographic training condition were taught to look at the shape of their mouths as they segmented phonemes in words to draw attention to articulatory features, based on Boyer and Ehri’s (2011) findings. Also, the experimenter drew attention to the number of phonemes in the word as compared to the number of letters, as was done in Ehri, Satlow, and Gaskins (2009). The expectation was that students who received this training would perform significantly better than students in the control group on a flashcard word reading task because they would implicitly activate knowledge of the letter-sound relationships that they learned during training. By activating this knowledge they would be more efficient at storing the words in memory, and subsequently they would read more words correctly across the four testing trials.

Another issue that plagues the instructional practice of having students read words in isolation is that the words to be learned are often function words. Research has demonstrated that function words may be more difficult to learn than content words because they depend on the
measure of other words to be meaningful (Ehri, in press, 1975, 1976). Also, word learning experiences impact the knowledge that readers acquire about words’ identities (Ehri & Roberts, 1979; Ehri & Wilce, 1980; Johnston, 2000). Reading words in isolation has been shown to facilitate knowledge of the orthographic identity of a word, whereas reading words in context facilitates knowledge of the syntactic/semantic identity of a word. The word learning experiences that beginning readers and nonnative speakers receive may be of particular importance when attempting to learn function words. Moreover, Morris (2001) found that ELLs had weaker orthographic memory for function words in comparison to content words.

These findings along with Goldenberg’s suggestion that ELLs may need additional learning supports motivated the design of the flashcard word reading task. Two sets of function words were used. One set was presented with meaning clarifying sentences and the other set was presented without meaning clarifying sentences. The expectation was that the function words presented with meaning clarifying sentences would be more efficiently learned because readers would be able to create an amalgam between the spelling, pronunciation, syntactical use and semantic meaning of the word to securely store the word in memory (Ehri, 1992). Additionally, ELLs were expected to benefit even more from hearing the meaning clarifying sentences than native English-speakers due to the reduced amount of exposure that they have had with colloquial English.

In summary, the current study investigated the effect of both orthographic mapping and hearing isolated function words presented in meaningful contexts on native and nonnative English-speakers’ ability to retain sight words in memory. The current study also investigated the skills that beginning readers must have in order to benefit from the commonly used practice
of sight word reading (flashcards). These findings are considered important to ensure that best practices are used with young native and nonnative English readers.
Chapter 2

Literature Review

How Sight Words are Learned

Beginning readers use multiple strategies to read unknown words. Once readers have successfully read a word a few times the word becomes stored in memory and is available to support the reading of other words. When a word is stored in memory its pronunciation and meaning are available to be used automatically when the reader comes across this known word in text. The more words a reader has in memory, the less effort the reader has to expend to read print. It is imperative that all readers build up the number of words they have stored in memory during the early elementary years in preparation for when exponentially more effort is necessary to comprehend text in later elementary grades and beyond.

Various Ways Words are Read. Ehri (1998) explains that there are several ways to read words. If a reader comes across a word that is unknown they may employ decoding, analogy, or prediction skills to figure out the new word. In order to decode words, readers must use their grapheme-phoneme skills to breakdown the spellings of unknown words. Once the grapheme-phoneme relations are isolated, the reader will use blending skills to put the word back together in order to determine its pronunciation. With greater exposure to words, readers are able to recognize common syllabic and morphologic units, and they may use their knowledge of the pronunciation of these units to break words down into larger chunks that are then able to be blended together to pronounce the unknown word.

In English, many words have variable or irregular spellings, and this complicates the decoding process because the variation of the word based on the grapheme-phoneme relations may not produce an accurate pronunciation of the word. However, this may be rectified by having students test variations of the vowel and consonant sounds until they come to a
recognizable version of word based on their vocabulary knowledge. Tumner and Chapman (2012) have described this process that readers go through to decode irregular words by attempting multiple variations of the pronunciation as set for variability.

Unknown words may also be read by analogy and prediction (Ehri, 1998). To read words by analogy readers must already possess the relevant sight words in memory. This is necessary because this bank of sight words serves as the reference that the unknown word may be compared to and subsequently analogized. For example, if a reader already possesses the word *house* in memory they are then able to determine the pronunciation of the unknown word *mouse* by recognizing the similar spelling patterns between the two words.

To read words by prediction, the reader uses context clues in the surrounding text and pictures to predict the pronunciation of the unknown word. Readers may also use their background knowledge and the information that they have gathered up to that point in the book to predict the unknown word. Ehri (1998) explains that when words are misread, and the substituted word fits syntactically and semantically it is an indication that the reader attempted to use prediction to determine the unknown word.

The most efficient way to read words is by sight (Ehri, 1998). All words, both regularly and irregularly spelled words, can be read by sight by accessing information already stored in memory from previous experiences with the words (Ehri, 1992). Seeing the spelling of the word automatically activates memory for the pronunciation and meaning of the word. This allows readers to read each word as a whole unit automatically without exerting any effort to decode the word. This is the most efficient way to read words because it frees-up mental energy that may have been used to read words by decoding, analogy, or prediction, and it enables the reader to focus her energy on comprehending the text.
Ehri (1998) explains that in order to get words into memory readers must analyze connections between the graphemes in the spellings of words and the phonemes represented by these graphemes. Readers’ knowledge of letter-sound relations provides the mnemonic system that bonds the written form of the word to its spoken form. Ehri argues that both regularly and irregularly spelled words can be stored as sight words through this connection forming process. For irregularly spelled words, readers have the opportunity to recognize that the irregularity of the spelling actually recurs in other English words. By recognizing the reoccurrence of irregular spelling patterns, readers have the potential to make this knowledge systematic.

Ehri and Soffer (1999, p.1) define graphophonemic awareness as “the ability to match up letters or graphemes in the spellings of words to sounds or phonemes detected in their pronunciations.” Ehri (1998) explains that there are three graphophonemic capabilities that enable beginners to secure complete representations of sight words in memory. These capabilities include knowledge of letter shapes, knowledge of how graphemes typically represent phonemes in words, and phonemic segmentation skills. In this study beginning readers’ knowledge of letters was assessed and this variable was included to predict their ability to read a set of unknown words on flashcards. One group of students was also trained on how to segment phonemes and how to map graphophonetic relations in words. It was expected that students who received this training would outperform students in the control condition on their ability to read a set of unknown words on flashcards.

**Connectionist Theory.** Practitioners commonly assign general lists of high frequency words to students and require students to read the words multiple times in an attempt to store the words in memory. In this approach, the lists of words are memorized as whole units without any instruction on how to analyze the orthographic composition of the word. However, Ehri (1992)
explained that sight word reading, the most efficient form of reading, involves establishing systematic visual-phonological connections between spellings of words and their pronunciations. The connection between the spelling and pronunciation of a word are encoded through knowledge of grapheme-phoneme or letter-sound relations. When a reader first encounters a word he/she relies on letter-sound relationships to decode and pronounce the words. Through this phonological recoding process the reader establishes the visual-phonological pathway for a new word by connecting the spelling of the word to its pronunciation in memory. The establishment of these pathways in memory enables a reader to automatically retrieve the spoken and written version of the word, as well as its meaning.

Similar to Ehri’s (1992, 2005) connectionist theory, Share’s (2008) self-teaching hypothesis suggests that decoding supports learning of orthographic representations of words. The self-teaching hypothesis proposes that the process of taking the printed version of a word and translating it into its spoken form is the primary way in which the orthographic representations of words are learned. The decoding process directs readers’ attention to the individual grapheme-phoneme relations in specific words and thus supports storage of the order and identity of the letter strings. Relatedly, Ehri’s connectionist theory claims that exposure to orthography activates connections between grapheme-phoneme relations in words, which subsequently clarifies the order and identity of letter strings. As previously mentioned, Ehri (1998) explains that this connection forming process is the essence of sight word reading.

Jorm and Share (1983) explain that the value of analyzing grapheme-phoneme relations in order to phonologically recode words is particularly important for beginning readers. They explain that the process of recoding is essential for reading new words independently. Through repeated practice, phonologically recoded words are systematically stored in memory and are
available for efficient retrieval. Without the ability to phonologically recode new words, beginning readers would be at the mercy of another reader to pronounce every new word that they come across.

**Orthographic Mapping.** The role of phonemic awareness and graphophonemic knowledge in literacy development has been well-established in the literature. The National Reading Panel (2000) found that phonemic awareness instruction was significantly better than alternative forms of training in helping students acquire phonemic awareness skills and to transfer this skill to reading and spelling. The findings of the meta-analysis showed that teaching children phonemic awareness skills was highly effective across all literacy domains. Specifically, the National Reading Panel found that phonemic awareness instruction assisted children in learning to read real words and pseudo words, and it was effective in supporting reading comprehension performance. Phonemic awareness training was also effective in supporting spelling skills. Shankweiler, Lundquist, Dreyer, and Dickinson (1996) found that children’s phonemic awareness skills, specifically their phoneme segmentation abilities, were highly correlated with their ability to represent the phonemes in spelling words. This is important to note considering the high correlation between reading and spelling ability (Ehri, 1997).

Furthermore, Ehri and Roberts (2006) report that phonemic awareness instruction is more effective when letters are incorporated as it allows fleeting phonemes to attach to concrete representations. In the current study, students in the treatment condition were trained to isolate the phonemes in words and to map letter-sound correspondences within the spellings of words.

Based on Ehri’s (1992) theory of the visual-phonological route for encoding words, studies were conducted to explore the effect of training students to map grapheme-phoneme relations on their ability to read new words. Boyer and Ehri (2011) explained that understanding
how graphemes in written words systematically represent phonemes in spoken words is at the core of learning how to read and spell. The authors cited Nation and Hulme’s (1997, as cited in Boyer & Ehri) argument that the skill of segmenting words into phonemes is one of the strongest predictors of reading and spelling abilities. Nation and Hulme stated that phoneme segmentation skills are especially important in less transparent orthographies such as English.

Boyer and Ehri (2011) trained preschoolers to segment words into phonemes by using either letters and pictures of articulatory gestures (LPA group) or letters only (LO group). In the LPA group students were taught the correspondences of eight mouth picture tiles and their phonemes, and they were taught to segment VC and CV words with the mouth pictures. Then, students were taught the correspondences between the letters and their phonemes, and they were taught to segment VC and CV words with the letter tiles. The training progressed to the point where students were segmenting CVC and VC/CV words with both mouth pictures and letters. Students in the LO condition received the same training except there was no attention to mouth pictures or articulation of phonemes.

Both training methods helped preschoolers acquire phoneme segmentation and phonemic spelling skills better than the no-training control group (Boyer & Ehri, 2011). The LPA group performed better than the LO group on the reading posttests after training time was used as a covariate in the analysis. The authors reasoned that because the LPA training enhanced the recognition of phonemes in words by illustrating their articulatory features, graphemes may have become more securely attached to these phonemes during the connection-forming process and enhanced retention of the words in memory. This research stands in stark opposition to the theory that readers memorize the visual shapes of words and connect those shapes to the pronunciation and meaning of words (Ehri, 1992).
In the current study, students in the treatment condition received training in segmenting phonemes in words as was done in Boyer and Ehri (2011). However, instead of using pictures of articulatory gestures, students used individual mirrors to look at the shape of their mouths as they made each sound in the word. Also, students wrote the letters that represented each phoneme in the word in a set of horizontal boxes. This paralleled Boyer and Ehri’s training of having students move letters into boxes to represent each phoneme in the word.

Ehri, Satlow, and Gaskins (2009) also used orthographic mapping training to support word reading for first, second, and third graders enrolled in a private school for struggling readers. The authors compared the effect of an instructional approach based on decoding words through the use of analogy to 120 keywords (KEY program) to an approach based on grapho-phonemic analysis of keywords that were then used for analogy reading (KEY Plus program). In the Key program students were taught to read 120 words that contained the most common English spelling patterns. The students were instructed to use these words to read other words by analogizing. For example, students used the word *look* to read the word *book*. The keywords were posted in the classroom after they were taught so that they could be referenced by the students when reading new words. In the KEY Plus program the students were still taught to decode new words by using an analogy approach to the key words; however, when a key word was presented, students were taught to fully analyze the grapheme-phoneme relations in the word. In addition, students and teachers discussed spelling regularities in words and spelling activities were incorporated to further develop phonemic segmentation skills. The results showed that during the first two years of instruction, students who received the KEY Plus program read and spelled significantly better than students who received the KEY program. This pattern of better word reading and spelling was maintained during the third and fourth year of instruction,
although the difference was not significant. The procedures for teaching orthographic mapping used in the Key Plus program were adapted in the present study. This procedure was used to teach students in the treatment group to analyze words into their grapheme-phoneme relations.

**Content vs. Function Words: Importance of Syntactic and Semantic Identity.** As previously stated, Ehri’s (1992) connectionist theory explains that the spelling, pronunciation, and meaning of a word form an amalgam that is stored in memory and is activated when the reader sees the word in print. Orthographic mapping is an important way that spellings are connected to their pronunciations and stored in memory. Ehri (in press) explains that another important aspect of securing words in memory involves creating connections between words in memory. These connections to other words involve both syntactic and semantic relationships. Ehri explains that little attention has been given to the connections between spellings and syntactic and semantic functions of different words, even though this relationship may influence the ease at which words are learned and stored as sight words.

Moreover, the type of word being learned matters in terms of the syntactic and semantic information required to secure the word in memory. Function words (e.g., with, of, from, this) require exposure to the use of the word in context to connect the syntactic and semantic identities of the word to its spelling. This is different from content rich words (e.g., chair, cow, sneaker) whose pronunciations activates a clear meaning of the word. This difference in word type is important when considering instructional practices of reading words in isolation to store words in memory. Reading content rich words in isolation may be fine; however, reading syntactically dependent function words in isolation may be less effective.

To investigate this disparity between word types, Ehri (1975) investigated the word consciousness of prereaders and readers. The author administered five tasks to measure students’
metalinguistic capabilities. In the sentence segmentation task, students’ ability to segment sentences into their component words and syllables was examined. Ehri found that almost all of the prereaders missed identifying at least one word within sentences. The author stated that function words were the primary category of words missed by these prereaders, and often the prereaders considered these words as parts of other words in the sentence. However, Ehri explained that there were also instances where the prereaders stated the function word separately from the other words in the sentence but simply did not mark it as an independent word.

As a follow-up, Ehri (1976) investigated the effect of word type on prereaders’ and readers’ ability to effectively learn new words. The study demonstrated that context-free words were easier for students to learn than context dependent words. The author used a paired associate learning task in which words were paired with distinct squiggles. In each of the three word sets, five words consisting of a high-frequency, unambiguous noun, adjective, past tense verb, preposition, and function word were presented along with their corresponding symbol. Half of the participants heard the words presented with contextual sentences and the other half heard the words spoken twice. Ehri found that nouns were easier to learn than adjectives, verbs, prepositions, and function words, regardless of whether the word was presented with or without a sentence.

In the current study, function words were read in isolation on flashcards. One set of the words was supported with meaning clarifying sentences while the other set did not receive any clarification. The words that received the meaning clarifying sentences were expected to be learned faster over trials than the words that did not receive the clarifications because this syntactical information was bonded to the pronunciation and spelling of the words allowing them to be more securely stored in memory. As will be explained in the upcoming sections, nonnatives
were expected to benefit even more from hearing the clarifying sentences than native English-speakers because they have had less exposure to the function words.

Phase Theory

Ehri (2005) explains four phases of sight word reading that children move through during development: pre-alphabetic, partial alphabetic, full alphabetic, and consolidated alphabetic. In the pre-alphabetic phase beginning readers form connections between visual attributes of words and their pronunciations or meanings. These connections are stored in memory as a form of visual cue reading. Letter-sound connections are not involved in this phase. Instead, some visual feature of the word or the word’s surrounding environment (i.e., McDonald’s arches) serve as a cue for retrieval of the pronunciation and meaning. In the partial alphabetic phase, beginning readers form partial connections between some of the letter-sound units in words. Often the first and last letters are remembered because they are the most salient. This process of remembering the most salient letters in the word is referred to as phonetic cue reading. Beginners in this phase know some letter-sound correspondences and they possess the ability to segment the initial and final sounds of the word. Often the names of the letters facilitate memory for the sounds in the word.

Ehri (2005) explains that beginners in the full alphabetic phase are able to form complete connections between the letters and sounds in words. This ability comes from beginners’ phonemic segmentation skills, their knowledge of the major grapheme-phoneme relationships, and their ability to connect graphemes to phonemes within the spellings of individual words that they read. The ability to decode unfamiliar words activates connections between spellings and pronunciations of the words. When words are read connections are formed between the graphemes and phonemes in the word and these connections are retained in memory. With
practice, readers are able to access the word in memory by sight, and this replaces the need to decode the word.

Through multiple exposures to words, students in the full alphabetic stage begin to consolidate the grapheme-phoneme connections in words into whole units (Ehri, 2005). These units are then stored in memory and used to read words automatically. As readers move towards this consolidated alphabetic phase word reading becomes more efficient because readers are able to use these consolidated units to read other, larger words. These consolidated units include whole word and multiletter units, such as morphemes, syllables, and rimes. These multiletter units reduce the memory load for storing sight words because these units can be flexibly applied thus requiring only limited grapheme-phoneme decoding of words.

The present study focused on the skills that native speakers and nonnative English speakers in the partial alphabetic phase need in order to maximally benefit from reading words in isolation. These skills were predicted to parallel Ehri’s (1998) explanation of the three skills necessary to store words in memory: letter knowledge, phonemic segmentation skills, and grapheme-phoneme knowledge. As Ehri and Wilce (1978) demonstrated, training partial phase readers to segment phonemes and match phonemes to letters supported their ability to read words from memory better than the partial alphabetic readers who were trained on letter-sound relations. Students in the treatment condition were taught to spell several sets of mostly nonsense words. Students repeated the word after the experimenter stated it, and they placed a letter tile that they believed matched the sound that they heard in the spelling frame. As students placed each letter tile in the frame, they stated its sound. Students in the control condition were taught to match letters to isolated sounds. Students repeated the sound after the experimenter stated it, and they picked a letter tile that represented the sound. The result showed that partial alphabetic
readers in the spelling treatment condition learned to read a set of words more effectively than the control group. This suggests that the training may have supported the transition of students from the partial to the full alphabetic stage of word reading.

Ouellette and Senchal (2008) investigated whether training kindergarten students in invented spellings would facilitate word reading skills. Students in the invented spelling treatment stretched the pronunciations of words, wrote an invented spelling to match the sounds they heard in the word, and they were provided with feedback to enhance their spelling by one element and to remove any extra letters. Students in the phonemic awareness treatment condition analyzed the individual phonemes in words by matching initial and final sounds in the words to pictures and stamping boxes for each phoneme a word contained. The results indicated that the invented spelling group and the phonemic awareness group both demonstrated enhanced phonemic awareness knowledge over the control group. However, the invented spelling group demonstrated enhanced performance on the orthographic awareness and reading of target words task, as well as the learning to read words transfer task. The authors stated that the grapheme-phoneme training provided in the invented spelling condition facilitated students’ ability in learning to read words. Again, this training may provide an important skill necessary to transition partial alphabetic readers into the full alphabetic stage of word reading.

In the current study students in the treatment condition received training in both phoneme segmentation and grapheme-phoneme relations. It was expected that this training would better support students learning of words in the flashcard reading task than the control condition because, as the previous studies demonstrate, the training may support students in transitioning from the partial to the full alphabetic stage of word reading. It should be noted that students’ letter-sound knowledge and phonemic segmentation skills were analyzed prior to training.
Students who had adequate letter-sound knowledge (a score of 16 out of 22 on letter writing) were included in the analysis.

**Methods of Teaching Sight Words**

As Ehri (1998) explains, there are two definitions of sight words. One is a method of teaching that often involves reading isolated words on flash cards. The other was described above as a cognitive process that all beginning readers go through in which the mind stores the written and spoken forms of words that have been repeatedly seen and heard. When a reader comes across such a word in print, the pronunciation and meaning of the word are immediately retrieved from memory. This retrieval is based in the connections that the reader has previously formed between the spelling, pronunciation, and meaning of the word. Ehri clarifies that sight word reading is not limited to strangely spelled words or high frequency words. On the contrary, she argues that the goal of efficient reading is to make all words sight words. Only then is mental energy for decoding/word level processing freed up so that more attention can be given to comprehension of the text.

As a teaching method, sight word reading often manifests as word list or flash card reading. For example, young children, both ELLs and native English speakers, are given either individual lists of challenging words or standard lists of words with the goal of learning to read the words quickly and automatically. These word lists include many high frequency words with less regular spellings. The belief is that the best approach to storing these words in memory is to memorize the visual representations of the words as whole units. This approach overlooks the need for attention to the graphophonemic composition of the word. Furthermore, this teaching approach is used in the early elementary grades as a way to speed up the word recognition process. In fact, relatively large amounts of time are spent having children practice lists of words.
by repeatedly reading through the words (either in a column format or on index cards) either with or without being timed. This method is conducted without regard to beginning readers’ phonemic awareness, letter knowledge, orthographic mapping, or decoding/word reading skills. Of even greater concern is that this task is sometimes used even before knowledge of letters is mastered.

**Learning to Read Words in Isolation vs. Context.** Ehri and Roberts (1979) investigated skills and experiences that facilitate word learning for first graders. The authors explain that a word’s identities consist of its pronunciation, syntactic function, meaning, and spelling. Different word reading experiences may strengthen one or another of these identities. In the study, two word learning groups were compared. One group read target words in meaningful contexts while the other group read target words on flashcards and then heard meaningful sentences that contained the words. The target words were homonym pairs because the researchers wanted to focus on the process of attaching meanings to spellings of individual words without being able to rely on the pronunciation of the word as the identifier. The results demonstrated that students who read words in context learned the semantic identities of words better than students in the isolation group; however, students in the isolation group better learned the orthographic representation of the words. Ehri and Roberts explained that these findings demonstrate that word learning is contingent upon word experiences.

As a follow-up, Ehri and Wilce (1980) examined whether first graders acquisition of syntactic/semantic knowledge and orthographic knowledge of function words are influenced differentially by two types of word learning experiences. The authors explain that function words are of particular importance because they are among the first words to be taught to beginning readers on sight word vocabulary lists. One group of students read the target words in sentences (context group) while the other isolation group read the words in lists and then heard the defining
sentences. The results supported the researchers’ hypotheses; the context group learned more about the syntactic/sematic identity of the words and the isolation group learned more about the orthographic identity of the words. These findings demonstrate that word training experiences develop specific knowledge of a word’s identity.

Johnston (2000) investigated whether first graders’ word learning in predictable text was enhanced when they were given support in three instructional methods that varied in the degree of whole-to-part support that students received. All three treatments used the same predictable texts over the course of a four day plan. The repeated reading group read the same book ten times over the four days. The sentence context treatment chorally read the predictable text and then read the text on a chart without the illustrations. Afterwards, they built the story together using sentence strips. Students in the word bank treatment intervention were given unillustrated copies of the story on days 2 and 3 and they underlined known words while they read it silently. These words were then written on small cards and practiced. The results indicated that the students in the word bank treatment condition learned the most words as demonstrated by their performance on both an immediate and delayed recall test.

Johnston’s (2000) findings suggest the effectiveness of using word lists to support word reading in predictable text; however, they do not necessarily suggest that the use of general word list reading disconnected from a text (i.e., Dolch word list) is effective. Similarly, while Ehri’s studies show some benefit from reading words in isolation, her studies also demonstrate the value in reading words in context. Presently, word lists, such as the Dolch and Seeing Stars lists, are used as a common form of sight word reading training for beginning native English readers and for ELLs of all ages. These words are disconnected from a text and are not supported with meaningful sentences. In addition, the words on these lists are assumed to be irregularly spelled
words that students simply need to memorize. No attention is given to orthographic mapping of the word. Instead students are instructed to practice the words, and parents are often asked to time students in reading the words, so that these words become retrieved automatically.

The practice of having students read irregularly spelled words in isolation stands in contrast to the findings of Whang, Castles, Nickels, and Nation (2011). The authors investigated the effect of context on the orthographic learning of both regularly and irregularly spelled words. Second grade students were pre-exposed to the pronunciation of words and were shown pictures to support the meaning of the words. Then, children were presented with the target words either in isolation or in context in a repeated measures design. The context condition embedded the words into a story, and the isolation condition presented the target words in context free lists. Findings revealed that correct reading of both regularly and irregularly spelled words was supported by context reading over isolation reading. Moreover, contextual information better supported word reading of irregularly than regularly spelled words. For the irregularly spelled words, results indicated that context supported correct initial reading of the words and better orthographic learning than isolation reading. Presenting the irregular words in isolation resulted in incorrect pronunciations that commonly reflected an attempt to decode words into their phonetic components. Consistent with previously mentioned findings, orthographic knowledge was not enhanced when regular words were presented in context. The findings of this study are in direct opposition to the practice of having children read irregularly spelled words in isolation, and they seem to be particularly relevant for ELLs who would have far less exposure to the pronunciation of the irregularly spelled words in general.

**ELL: Learning to Read and Spell Words**
The population of English language learners (ELLs) in the U.S. continues to increase each year, and the disparity in academic achievement between ELLs and native English speakers is vast (Garcia & Kleifgen, 2010). ELLs who enter kindergarten with limited English are at an increased risk of developing reading difficulties by the end of the primary grades (Keiffer, 2010). This is elucidated by the differences in their reading growth trajectories from their native English-speaking counterparts. These disparate trajectories result in dramatic differences in academic achievement in fifth grade (Keiffer, 2008). Moreover, 27% of ELLs who enter kindergarten with limited English proficiency encounter reading difficulties by the end of third grade, as compared to only 9% of native English speakers (Keiffer, 2010). While the field acknowledges that ELLs are at increased risk for reading difficulties, the sources of the difficulties have yet to be fully understood (August & Shanahan, 2006). The purpose of the current study was to investigate the effectiveness of a common instructional practice used with both native and nonnative English speakers, that of teaching beginners to read words in isolation on flashcards.

Goldenberg (2013) explains that while there has been a dramatic increase in the amount of professional publications regarding ELLs since 2000, there is still little empirical research on instructional strategies that improve ELL development in language and other content areas. In reviewing the available research, Goldenberg (2008, 2013) identifies three important principals based on the research with ELLs: 1.) Generally effective practices are likely to be effective with ELLs, 2.) ELLs require additional instructional supports, and 3.) The home language can be used to promote academic development. While the third principal is outside the scope of the current study, the other two principals can be seen as a framework for the training and supports that were provided.
With regards to Goldenberg’s (2008, 2013) first principal, as previously reviewed, training students in a combined approach of phonemic segmentation and orthographic mapping has been shown to be effective with native English-speakers both for learning target words and for transferring the skill to learn new words (Boyer & Ehri, 2011; Ehri, Satlow, Gaskins, 2009; Ouellette & Sénéchal, 2008). However, research has yet to use this strategy to train ELLs. In the current study both native and nonnative English-speakers were included in the treatment condition which provided students with phonemic segmentation and orthographic mapping training. All students received a flashcard word reading sessions to investigate whether students in the treatment condition implicitly activated their trained skills and applied them to the new words being learned.

Supporting phonemic segmentation and orthographic mapping skills may be particularly important for nonnatives due to potential confusion between the letter-sound patterns in their native language and English. Fashola, Drum, Mayer, and Kang (1996) investigated the orthographic errors of Spanish-speaking children who were transitioning to literacy in English. The researchers examined spelling errors for eight English sounds: /k/, /h/, “sk” blend, /b/, “all” cluster, /e/, /u/ and /U/ phonemes. These particular sounds were chosen because they could be predicted by applying Spanish phonological and orthographic rules to English words. For example, /k/ in the word soccer was predicted to be spelled in three ways according to Spanish rules: soccer, soker, soquer. The results showed that Spanish-speaking students made more than four times as many predicted errors as native English-speaking students did, but the groups produced similar numbers of nonpredicted errors. The analysis indicated that the transitioning students applied phonological and orthographic rules from Spanish to English spellings. Interestingly, the English-speaking students showed a significant decline in mean number of
nonpredicted errors from younger to older grades, whereas Spanish-speaking students did not show a significant drop.

Stuart (1999) investigated the role of phoneme awareness training on ELLs’ orthographic knowledge. The author found that the training not only accelerated acquisition of phoneme awareness and phonics knowledge, but children were also able to apply these skills to improve their spelling of words. Both Everatt, Smythe, Adams, and Ocampo (2000) and Allaith and Joshi (2007) found a connection between phonemic awareness and orthographic skills in samples of Sylheti-English bilinguals and Arabic-English bilinguals. The authors demonstrated that second language learners having difficulties in spelling also had difficulties in phonological awareness. These difficulties that ELLs have with acquiring orthographic mapping skills may impede their ability to store sight words in memory. As Ehri (1998) explains, connections must be formed between the graphemes in spellings to phonemes in pronunciations in order for words to be stored in memory.

The difficulties that ELLs have with acquiring orthographic mapping skills in English may be explained by grain size theory (Ziegler & Goswami, 2005). Ziegler and Goswami (2005) explain that reading development may be impeded in low transparency/opaque languages, such as English, due to the lack consistency between graphemes and phonemes. In low transparency languages some orthographic units have multiple pronunciations and some phonological units have multiple spellings. This requires the learning of more orthographic units. This is unlike high transparent languages, such as Spanish, which have virtually a one-to-one correspondence with regards to letter-sound relations. For ELLs, this persistent lack of such one-to-one letter-sound correspondences in English may cause confusion.
Furthermore, the writing systems of languages affect children’s acquisition of literacy skills (Coulmas, 1989; as cited in Bialystok, Luk, and Kwan, 2005). Bialystok et al. claim that different cognitive skills are required for learning literacy based on the symbolic relations of a writing system. In alphabetic systems the symbolic relations lie in the correspondence between graphemes and phonemes. In syllabary systems the correspondences are based on relations between consonant-vowel groups and graphemes, while in character languages morphemes are used as the most basic linguistic unit, which represent both semantic and phonological properties. Bialystok et al. claim that these unique systems place different demands on bilinguals’ analysis of spoken words and their recording of language to print. In the present study, nonnatives were from a variety of native language systems. Teaching the grapheme-phoneme relations of the English language for nonnative speakers seems to be of increased importance due to the differences between correspondences in other written systems and English.

Even between two similar language systems there may be issues with the mapping of grapheme-phoneme relations depending on the level of transparency of the language. For example, both English and Spanish are alphabetic languages; however, when native Spanish speakers learn to read and write in English they must map letter-sound relations that do not exist in Spanish (Raynolds & Uhry, 2010.) This issue is most obvious when comparing vowel sounds in English and Spanish. Spanish has five graphemes that represent its five vowels, whereas English has 14 vowels (Raynolds, Uhry, & Brunner, 2012). Native Spanish-speakers may be confused by the lack of certain vowel sounds in Spanish. In fact, Honig, Diamond, Gutlohn, and CORE (2008) and Cardenas-Hagan (2011) explain that Spanish-speakers may assimilate English vowel sounds that are not available in Spanish to the closest Spanish phoneme or these sounds may be simply too difficult for the nonnative speaker to distinguish.
Taken together, accurate perception and production of phonemes and the ability to correctly map grapheme-phoneme relations to store words in memory may be more difficult for nonnatives. Explicit training may be necessary to draw attention to the lack of one-to-one correspondence in several English words. Also, phoneme segmentation training that includes drawing attention to the articulatory features of the mouth may support nonnative speakers’ ability to distinguish and produce sounds that are unavailable in their native language. In the current study, students were trained to distinguish the number of phonemes in words and they looked at their mouths in individual mirrors as they stated each phoneme. Then, they said each phoneme as they mapped the letters that make each sound into a set of horizontal boxes.

Goldenberg’s (2008, 2013) second principal is that ELLs require additional instructional supports. As was previously established, content and function words require different supports in order to be stored in memory. While content words may be learned in isolation because their spelling and pronunciation elicits enough content rich information to securely store the word in memory, the meaning of function words relies on their surrounding context. This context is necessary to elucidate the meaning and use of the word. This syntactical information is then stored along with the spelling and pronunciation of the word in memory. Exposure to the syntactical use of function words is necessary for all beginning readers. However, while native English-speakers have been exposed to colloquial English since birth, nonnative English speakers may be learning the spelling, pronunciation, syntactic and semantic meanings of words all at the same time. Providing syntactical examples of function words may be necessary to clarify the meaning and use of the word, just as providing a clarifying definition of a content rich word would be necessary for these students.
Morris’s (2001) findings support the claim that ELLs may need additional support with function words. The researcher analyzed the spelling errors of fifth and sixth grade ELL students with a range of proficiency levels in English. Students were asked to produce a short written response to a picture prompt. Focus was paid to whether the students misspelled content or form/function words. The author states that ELLs left out more form words than content words in their writing. Also, the researcher reports that ELLs spelled content words surprisingly well compared to form words. Even content words with consonant cluster, vowel combinations, diphthongs, etc. were spelled accurately. However, function words were less frequently spelled correctly and unstressed function words tended to be spelled incorrectly most often. Morris states that this was the case even though these words were considered high frequency. The author also clarifies that this finding does not parallel that of spelling errors of native English speakers.

Morris (2001) argues that intensive exposure to oral and written forms of a second language were not adequate for these ELLs to acquire orthographic knowledge of high frequency unstressed function words, even though they did acquire orthographic knowledge of stressed content words. Furthermore, the author states that the phonetic and informational salience of the word played a larger role in acquiring orthographic knowledge than did frequency of exposure to the word for ELLs. This research demonstrates that function words are more difficult for ELLs to acquire than content words, and they may need to receive additional supports to better secure these words in memory.

In the current study, both native and nonnative English-speaking students received two sessions of flashcard reading. Each set of words contained both content and function words. In one of the sessions the words were read in isolation without any meaning clarifications, as is typically done with lists or sets of flashcards in early elementary classrooms. In the other session,
the words were read in isolation and meaning clarifying sentences that demonstrate the syntactic
use of the function word were provided by the experimenter. The purpose of providing these two
sessions was to determine if words that receive the clarifying sentences were learned more
quickly than words learned in isolation. This was expected to be the case based on Ehri’s
connectionist theory (1992). It was also expected that nonnatives would receive a greater boost
in learning from hearing the clarifying sentences than native English-speakers due to their lack of
exposure to the use of these words.
Chapter 3

Rationale, Hypothesis, and Overview of Study

Rationale and Hypotheses

Based on the review of the literature, it is evident that beginning readers need to have a foundational understanding of letter-sound relationships before the benefits of reliable sight word learning can be realized (Ehri, 1992, 1998). Evidence provided by Boyer and Ehri (2011) and Ehri, Satlow, and Gaskins (2009) suggests that phoneme segmentation practice with orthographic mapping is a viable way to better secure words in memory. Research has also shown that function words may be more difficult to learn than content words (Ehri, in press, 1975, 1976), and word learning experiences impact the knowledge that readers acquire about words’ identities (Ehri & Roberts, 1979; Ehri & Wilce, 1980; Johnston, 2000). With regard to the practice of having students memorize irregularly spelled words in isolation as whole units, Wang, Castles, Nickels, and Nation (2011) found that irregularly spelled words were better learned when placed in context than in isolation. Furthermore, Goldenberg (2008, 2013) suggests that ELLs need additional instructional supports, and Morris (2001) found that ELLs had weaker orthographic memory for function words in comparison to content words. Therefore the following hypotheses and questions were investigated:

Research Hypotheses

1. Children who receive training in orthographic mapping (OM) will learn to read words taught on flashcards more easily than children in the control group who do not receive this training.
2a. Children will learn to read both content and function words more easily when the words are taught in isolation without sentences than when the words are accompanied by meaning-clarifying sentences.
2b. Children will be better able to embed content and function words in grammatically correct and contextually rich sentences when the words are taught with meaning-clarifying sentences than when the words are taught in isolation.

3. Children in both the OM treatment and control groups will learn to read content words more easily than the function words in the flashcard task.

4. The presence of sentences will benefit children's learning of function words more than the learning of content words when compared to the absence of sentences.

Research Questions

The following questions investigated the literacy skills that young students’ in the partial alphabetic phase need to possess in order to benefit from the instructional practice of flashcard word reading. As was mentioned above, reading words in isolation on flashcards or lists is a common instructional practice used with young children before foundational literacy skills such as phonemic awareness, letter knowledge, and oral language proficiency are in place.

1. To what extent will nonnatives’ word learning differ from that of native English speaking children as a function of orthographic mapping training, word type, and meaning clarifying sentences?

2. Which of the following skills explain unique variance in children’s word learning when the words are taught in isolation: alphabetic and spelling knowledge, word reading, and vocabulary/language?

Overview of Study

The study used a repeated measures, counterbalanced design with random assignment to experimental and flashcard conditions. Students were randomly assigned to the treatment and control training conditions prior to the flashcard reading task. Within each cell of the flashcard
task shown below, half were native and half were nonnative English speakers (see Table 1). For each language group, half received the OM treatment and half did not.
Table 1

Word Set-Meaning Assignments.

<table>
<thead>
<tr>
<th>Order of Learning</th>
<th>Set A with Meanings</th>
<th>Set A without Meanings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Set B without Meanings</td>
<td>Set B with Meanings</td>
</tr>
<tr>
<td><strong>Meanings 1(^{st}), No Meanings 2(^{nd})</strong></td>
<td>10 Native English-Speakers (5 treatment, 5 control)</td>
<td>10 Native English-Speakers (5 treatment, 5 control)</td>
</tr>
<tr>
<td></td>
<td>10 Nonnative Speakers (5 treatment, 5 control)</td>
<td>10 Nonnative Speakers (5 treatment, 5 control)</td>
</tr>
<tr>
<td><strong>No meanings 1(^{st}), Meanings 2(^{nd})</strong></td>
<td>10 Native English-Speakers (5 treatment, 5 control)</td>
<td>10 Native English-Speakers (5 treatment, 5 control)</td>
</tr>
<tr>
<td></td>
<td>10 Nonnative Speakers (5 treatment, 5 control)</td>
<td>10 Nonnative Speakers (5 treatment, 5 control)</td>
</tr>
</tbody>
</table>

The orthographic mapping treatment condition entailed training students to map the grapheme-phoneme relations in words that resembled the target words used in the flashcard reading task by having similar onset and rime features. The control condition entailed participation in an interactive read aloud with a follow-up writing activity. In addition to treatment, two other independent variables were manipulated in the flashcard reading condition, presence vs. absence of meaning clarifying sentences and type of word (content vs. function word). The main dependent variable was performance in reading words over six test trials in the flashcard task. Two other dependent variables were memory for the spelling of flashcard target words and ability to embed the target words in grammatically coherent sentences.

Both native and nonnative English-speaking kindergarten students were included in the study. The nonnative students came from a variety of native languages. Students were recruited from public elementary schools in a large metropolitan area in the Northeast. All students knew between 16 and 22 letter names and sounds, and they were not able to read more than two of the
target words used in the flashcard reading task. Their phonemic awareness, spelling, word reading, and vocabulary skills demonstrated considerable variability. Students who did not meet the letter knowledge or word reading criteria listed above were included in the control condition, but they were not given the flashcard reading task. The decision to include both underperforming and over-performing students in the control sessions came from principals’ requests that all students in the class be included in some capacity. Performance of these students was not analyzed.

On the first day of the study, students’ were pretested individually for 30 minutes on three categories of literacy skills. Students’ level of alphabetic spelling knowledge was assessed by measuring their phonemic awareness, letter writing/sound knowledge, and spelling ability. Students’ ability to segment and blend phonemes was assessed using a subsection of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, Rashotte, 1999). Students’ knowledge of 22 letter shapes and sounds (v, x, q, z were not included) was assessed through a task in which students heard the name of a letter and they were asked to write the shape of the letter. After, students were shown all 22 letters and they were asked to say the sound of the letter. A set of five regularly spelled nonwords was used to assess students’ spelling skills (words: hud, gat, kif, des, jom).

Students’ level of word reading skills was assessed through three word reading tasks. Students were asked to read lists of words on the Word Identification subtest of the Woodcock Reading Mastery Test-III (WRMT-III; Woodcock, 2011). Also, the 12 target words from the flashcard reading task were tested to ensure that students qualified for the study (gave, held, told, kept, since, might, farm, soap, heat, crab, clock, fence). In addition, a set of five nonwords was
used to assess students’ ability to apply their letter-sound knowledge to decode words (dut, sep, mul, kaf, nib).

Students’ vocabulary knowledge and English language proficiency were assessed using three measures. The Peabody Picture Vocabulary Test-4 (PPVT; Dunn & Dunn, 2007), Form A or Form B were administered to assess students receptive vocabulary. Also, a rating scale assessing students’ ability to read, write, understand, and speak in English was administered to teachers to create a composite score of students’ English language proficiency.

On the second day of the study students were randomly assigned to either the treatment or control condition, and they received training in their assigned group for 30 minutes on three sequential days. There were 3-4 students in each training group. Students in the treatment group received training in orthographic mapping of letter-sound relations. The purpose of this condition was to teach letter-sound mappings within words to see if the skills acquired in this condition transferred and facilitated flashcard word reading. The expectation was that students would implicitly form at least partial connections between letters and sounds in order to remember how to read the words even when complete connections could not be formed due to the irregular spellings of the words.

In the orthographic mapping training sessions, students heard a word and then segmented the phonemes in the word. While they counted the number of phonemes they looked in a mirror to see the changes that their mouths made with the production of each phoneme. Students then spoke each phoneme as they wrote the corresponding letter in a row of horizontal boxes. The words used in this training condition contained the same onsets and rimes as the target words used in the flashcard word reading task.
Students in the control condition participated in an interactive read aloud with a follow-up informal writing activity. There were 3-4 students in each control condition group. Students heard a high quality piece of children’s literature read aloud. The lesson format included teaching 3-4 unknown vocabulary words from the story, making predictions based on the cover illustrations, setting a purpose for reading, answering three high level comprehension questions through a turn and talk format, and hearing a teacher think-aloud during a complex part in the story. After the reading, students completed an informal writing activity about what happened at the beginning, middle, and end of the story. While this condition provided exposure to a highly engaging read aloud, it controlled for student exposure to explicit training in segmenting phonemes and mapping letter-sound relations.

On the fifth day of the study all students were tested individually for 30-35 minutes on the posttest measures. First, students were assessed on their orthographic mapping skills. The same protocol that was used in the orthographic mapping training condition was used in this posttest. The words were different from those used in the training condition. The purpose of this task was to determine if students had learned what they were taught in the treatment condition. However, students from both treatment and control conditions completed the task.

Following the orthographic mapping posttest, students were administered two rounds of flashcard word reading on the same day with approximately 30 minutes between each round. Each round of flashcard word reading consisted of three tasks: learning to read the words on flashcards, spelling the words, and using the words in sentences. Twelve high frequency function and content words (six of each word class) at the first grade level and higher were assigned in an effort to make two equivalent sets. One set of words was presented with meaning clarifying sentences and the other set was presented without clarifying sentences in a repeated measures,
counterbalanced design. For each set of words, there was one study trial and three testing trials with feedback. In the no sentence condition, students saw and heard each word spoken by the experimenter, they read the word, and then the experimenter repeated the word. During subsequent test trials, the student read each word and the experimenter repeated the word. During the study trial in the sentence condition, students saw each word and heard the experimenter say the word, the students repeated the word, and then the experimenter read the word embedded in a meaning clarifying sentence. During subsequent test trials, the students read the word, and the experimenter then read the word written in a different clarifying sentence.

After each flashcard reading session, students’ memory for the spellings of each of the target words was assessed. The experimenter stated each word, and students repeated the word and then wrote the spelling of the word. Students’ ability to embed each target word properly in a sentence was also assessed. A rubric was generated to score each of the students’ sentences.
Chapter 4

Method

Participants

Participants were 81 children, 40 native English speakers and 41 nonnative English speakers. Of the native speakers, 8 were female and 11 male, and the students ranged in age from 5.5 to 6.6 years ($M = 6.0$ years). Of the nonnative speakers, 11 were female and 10 male, and the students ranged in age from 5.6 to 6.6 years ($M = 6.1$ years). Participants were drawn from six kindergarten classrooms in four public schools serving predominately middle and low socio-economic students in the Bronx, Brooklyn, and Manhattan (East and West Harlem). In three out of the four schools one hundred percent of the students in the school qualified for free or reduced lunch. In the fourth school fifty two percent qualified.

Participants from each school were randomly assigned to the treatment and control conditions in blocks of eight. That is, blocks of eight students were formed. Then their names were drawn randomly from the block and assigned to the eight conditions shown in Table 2 until all eight cells were filled. The eight blocking possibilities were comprised of a combination of the two conditions (treatment vs. control) and the four flashcard tasks possibilities (two word sets by two sentence orders) (see Table 2). If only part of a block was completed with the participants at one school, it was then filled with participants from the next school. The breakdown of the number of native and nonnative students per school who received either the treatment or control condition is presented in Table 3.
Table 2

*Blocking System used for Random Assignment.*

<table>
<thead>
<tr>
<th>Condition by Flashcard Task</th>
<th>Student Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition: OM</strong>&lt;br&gt; Flashcard Task: Set A with sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set B without sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Condition: OM</strong>&lt;br&gt; Flashcard Task: Set A without sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set B with sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Condition: OM</strong>&lt;br&gt; Flashcard Task: Set B with sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set A without sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Condition: OM</strong>&lt;br&gt; Flashcard Task: Set B without sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set A with sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Condition: Control</strong>&lt;br&gt; Flashcard Task: Set A with sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set B without sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Condition: Control</strong>&lt;br&gt; Flashcard Task: Set A without sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set B with sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Condition: Control</strong>&lt;br&gt; Flashcard Task: Set B with sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set A without sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Condition: Control</strong>&lt;br&gt; Flashcard Task: Set B without sentences 1&lt;sup&gt;st&lt;/sup&gt;, Set A with sentences 2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>
Table 3

*Characteristics and Abilities of Native and Nonnative English Speaking Participants.*

<table>
<thead>
<tr>
<th></th>
<th>OM</th>
<th></th>
<th>Control</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$ or $N$</td>
<td>$(SD)$ Range</td>
<td>$M$ or $N$</td>
<td>$(SD)$ Range</td>
</tr>
<tr>
<td><strong>Native</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>6;0</td>
<td>(0.34) 5;5-6;6</td>
<td>6;1</td>
<td>(0.29) 5;6-6;6</td>
</tr>
<tr>
<td>Gender</td>
<td>8F; 11M</td>
<td></td>
<td>11F; 10M</td>
<td></td>
</tr>
<tr>
<td>Language (L1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>19</td>
<td></td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A (100% free/red.)</td>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>B (52% free/red.)</td>
<td>6</td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>C (100% free/red.)</td>
<td>4</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>D (100% free/red.)</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Nonnative</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>6;1</td>
<td>(.31) 5;6-6;5</td>
<td>6;1</td>
<td>(0.42) 5;6-7;2</td>
</tr>
<tr>
<td>Gender</td>
<td>13F; 7M</td>
<td></td>
<td>10F; 11M</td>
<td></td>
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<tr>
<td>Language (L1)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>English</td>
<td>-</td>
<td></td>
<td>-</td>
<td></td>
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<tr>
<td>Spanish</td>
<td>13</td>
<td></td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
Table 3 (continued)

*Characteristics and Abilities of Native and Nonnative English Speaking Participants.*

<table>
<thead>
<tr>
<th></th>
<th>OM M (SD) Range</th>
<th>Control M (SD) Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Russian</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>4 (100% free/red.)</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>7 (52% free/red.)</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>8 (100% free/red.)</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>1 (100% free/red.)</td>
<td>3</td>
</tr>
</tbody>
</table>

*Note.* Free/red. = percent of students at the school that qualified for free or reduced lunch.

IRB approval was obtained from the CUNY Graduate Center prior to any contact with the students. The researcher spoke with principals to obtain permission to work with students enrolled in kindergarten classrooms. After teacher permission was obtained, consent letters were sent home to parents explaining the study and requesting permission to have their child participate. The 110 children whose parents signed permission forms were pretested individually to determine qualification for participation in the study. After the beginning of each pretest
session, researchers explained to the children what they would be asked to do, and they were asked if they were willing to participate in the study. Children who agreed to participate were then administered the pretest measures. All children were given the option to withdraw at any time. Children’s behavior was monitored during the course of the study, and if a child displayed signs of discomfort the researcher investigated the possible causes. When this occurred, the researcher obtained the child’s consent to continue the procedures. No child was dismissed from the study.

There were two criteria for participating in the study: 1.) ability to write a minimum of 16 out of 22 letters, and 2.) ability to read no more than two out of the 12 target words. Also, children with severe emotional and/or behavioral problems were not included in the study. The identification of these students and the request to not have them participate came from the teachers and/or principal. Of the 110 children who were pretested, eight failed to qualify for inclusion because they could not correctly write 16 out of 22 letters, and 21 because they read three or more of the target words correctly.

Teachers decided if children should be considered native or nonnative English speakers based on their knowledge of the child’s school enrollment records. Students who had learned not only English but also another language since birth or very young (before preschool) and whom the teachers considered to be as proficient as a native English speaker were labeled as native speakers for the purpose of this study. Native and nonnative students were randomly assigned to either the orthographic mapping (OM) or control group using the blocking system previously mentioned. Characteristics of the native and nonnative children in the two conditions are presented in Tables 3 above.
The literacy curriculum provided within the regular kindergarten classroom revolved around meeting the Common Core Standards for kindergarten. Each of the classes had adopted a curriculum that was aligned with standards. Instruction involved read alouds with a focus on questioning, small group leveled reading, and word work sessions that included letter knowledge. Instruction also involved the use of decodable readers that were assigned based on reading ability. Teachers in three of the four schools stated that the majority of time for reading instruction focused on reading comprehension activities due to the new state mandates. One of the four schools provided differentiated small group instruction focused on letter-knowledge and decoding skills for students whose word reading skills placed them in the bottom third of the class. Another one of the schools provided this type of instruction in the mornings before school started for students whose reading performance was below grade level. All of the classrooms had a word wall with sight words posted. Students participated in the study towards the end of the school year in either May or June.

Four research assistants were hired to work on this study. One research assistant had to resign from the position due to a family emergency during the second week of testing. The assistants were graduate and undergraduate (seniors) in psychology or speech-pathology who had previous experience using educational or psychological measures with children in a one-on-one setting. Research assistants completed a three hour training session conducted by the primary researcher. The primary researcher discussed each pre and post assessment with the research assistants. She modeled how the assessments should be administered and gave examples of potential student responses. Research assistants were given practice packets to complete with a friend, sibling, or child at home. They attended a follow-up meeting with the primary researcher to clarify and rectify any issues with the materials and/or protocols. Each research assistant
conducted pre and post testing with both native and nonnative speakers who were randomly and evenly distributed to their caseloads on each day of testing. The pre and post testing for students in each of the conditions were randomly assigned to the research assistants and the primary researcher each day. The primary researcher conducted all the OM sessions, and she trained the classroom teachers to conduct all of the story training sessions with students. Two of the research assistants served as the interrater scorers for the necessary measures. All research assistants were kept blind to the hypotheses of the study for the entire duration of testing and scoring.

**Materials and Procedures**

On the first day of testing, there was one pretest session lasting approximately 30 minutes. All pretesting was conducted individually. This was followed by three training sessions each lasting 30 minutes administered on days two, three, and four. Students were randomly assigned to either the orthographic mapping or story book training conditions. All training sessions were conducted with small groups of three to four students. On day five, students completed two rounds of flashcard word learning, one round with meaning clarifying sentences and one round without. Students’ orthographic mapping skills, sentence production, and memory of spellings of the target words were also assessed. Each flashcard session with the corresponding posttests for that set of words was conducted individually in two separate 15 minute sessions. Students were given a break of 25-30 minutes between the first session and the second session of flashcard word reading.

**Literacy and Language Pretest Measures.** Three categories of pretests were used to assess students’ language and literacy levels.

*Alphabetic spelling knowledge.* Students’ level of alphabetic spelling knowledge was assessed by measuring their phonemic awareness, letter writing/sound knowledge, and spelling
ability. Students’ ability to segment and blend phonemes was assessed using the Sound Matching subsection of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999). This subsection consists of two tasks: a first sound matching task and a last sound matching task. In the First Sound task, a target picture was shown along with three additional pictures. The experimenter asked which word starts with the same sound as the target word, and she stated the name of the three target words. For example, the experimenter said, “Which word starts with the same sound as foot? Bat, hook, or fish?” The experimenter pointed to each picture as she stated the name of the object. Feedback was provided on the three practice trials and the first three test trials. Responses were scored as correct or incorrect. Testing stopped when the child received four incorrect out of seven items, with the stipulation that at least seven items were given. The maximum number of trials was ten.

In the Last Sound task of the CTOPP (Wagner, Torgesen, & Rashotte, 1999), a target picture was shown along with three additional pictures. The experimenter asked which word ends with the same sound that the target word ends with, and she stated the name of the three target words. For example, the experimenter said, “Which word ends with the same sound as gum? Goat, nut, farm?” The experimenter pointed to each of the pictures as she stated the names of the objects. Feedback was provided on the three practice trials and the first three test trials. Responses were scored as correct or incorrect. The testing stopped when the child received four incorrect out of seven items, with the stipulation that at least seven items were given. The maximum number of trials was ten. The test-retest reliability coefficients of the CTOPP range from .70 to .92 as reported in the manual, and the Spearman-Brown split-half reliability of the measure for this study was .75.
Students’ knowledge of 22 letter shapes and sounds (v, x, q, z were not included) was assessed using a letter writing and a letter sound task (see Appendices B-E). In the letter writing task students were given the name of a letter and they wrote the letter on the line. Lower case and capital letters were acceptable. In the letter sound task students were shown a capital letter and they were asked to state the sound that the letter makes. The experimenter recorded students’ responses to the letter sound task on a scoring sheet. Responses for both the letter writing and the letter sound task were scored as correct or incorrect. Students who knew fewer than 16 out of 22 letter shapes were not included in the study.

A set of five regularly spelled nonwords was used to assess students’ spelling skills (hud, gat, kif, des, jom; see Appendix F and G). The experimenter said the word, and students repeated the word. Then, students wrote the word on the line. Responses were scored at the letter level. Credit was given for each phonetically correct letter written in the word. Incorrect phonetic representations were not scored, and any correct phonetic representations written after the letter representing the final sound in the word was not given credit. If a phonetic component of the target word appeared within a random string of letters that a student produced, credit was not awarded. The interrater reliability of scoring the spellings of the words at the letter level was .92. The Cronbach’s alpha reliability coefficient for this measure was .66.

*Word Reading.* The Word Identification subtest of the Woodcock Reading Mastery Test-III (WRMT-III; Woodcock, 2011) was used to assess students’ sight word vocabulary. Students were instructed to read each word presented in isolation. The words became progressively more difficult. The experimenter scored the students reading accuracy as correct or incorrect. Reading was terminated once a student read six or more words incorrect consecutively within a set. The split half reliabilities of the WRMT-III range from .86 to .99 as reported in the manual.
Student’s ability to read the target words to be used subsequently in the flashcard word reading sessions was pretested (see Appendix H and I). Students were presented with a sheet of paper with the 12 target words listed in rows of four. The experimenter asked the students to read the words by placing a finger underneath each word as they read. Students were instructed to read going across the rows. Students’ responses were scored as correct or incorrect. Students who were able to read 3 or more of the 12 words were eliminated from the study.

A set of five nonwords was used to assess students’ ability to apply their letter-sound knowledge to decode words (dut, sep, mul, kaf, nib; see Appendix K and L). The experimenter explained that the words were not real words, and so when you read the words they may sound funny. The students were instructed to read the list of words going down the column. They were told to put a finger beneath the word that they were reading. Responses were scored as correct or incorrect. Experimenters wrote down what the student said if the word was read incorrectly. Floor effects precluded determining the reliability of this measure.

Vocabulary/Language. The Peabody Picture Vocabulary Test-4 (Dunn & Dunn, 2007), Form A or Form B was administered to assess students’ receptive vocabulary. Students were shown a page with four pictures. The experimenter asked the students to point to the picture of the target word. For example, students saw a page with a fence, table, shoe, and ball, and the experimenter asked the child to point to the ball. Feedback was given on two practice trials. Students progressed until they responded incorrectly to eight items within a section. Responses were scored as correct or incorrect. The split-half reliability coefficients of this measure on Forms A and B as reported in the manual are .94 and .95, respectively.

A rating scale assessing each students’ ability to read, write, understand, and speak in English was completed by their teacher to create a composite score of students’ English language
proficiency (adapted from the Language and Social Background Questionnaire, Bialystok, 2013; see Appendix M). Teachers were asked to rate each of four skills (reading, writing, understanding, and speaking) on a continuum of 0 to 100, with 0 indicating no proficiency and 100 indicating native-like proficiency. The continuum of 0 to 100 had the 25th, 50th, and 75th quartiles demarcated. Teachers were instructed to rate the child’s proficiency in each of the aforementioned skills relative to a native speaker’s performance by placing an X on each of the four lines. Teachers were also asked to write down the child’s native language if they were a nonnative English speaker.

**Orthographic Mapping Group.** All training was done in small groups over three sessions lasting approximately 30 minutes. Students were randomly assigned to either the orthographic mapping or the control condition. Students in the orthographic mapping condition were taught how to analyze letter-sound mappings in words. Students detected and wrote the phonemes that were heard in words and that were present in the correct spelling of the words. Words selected for this training contained the same onset or rime letter-sound correspondences as those in the words to be taught in the flashcard reading condition (see Table 4). The training words were randomly assigned to each of the sessions. Six training words were taught in session one, and nine training words were each taught in sessions two and three.
Table 4

*Target Word for Flashcard Reading and Training Words for Orthographic Mapping.*

<table>
<thead>
<tr>
<th>Flashcard Target Words</th>
<th>Orthographic Mapping Training Words (onset/ rime)</th>
<th>Boxed Letters</th>
<th>Crossed Out Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.) gave</td>
<td>onset: gait</td>
<td>g-a-t</td>
<td>i</td>
</tr>
<tr>
<td></td>
<td>rime: save</td>
<td>s-a-v</td>
<td>e</td>
</tr>
<tr>
<td>2.) held</td>
<td>onset: help</td>
<td>h-e-l-p</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rime: weld</td>
<td>w-e-l-d</td>
<td></td>
</tr>
<tr>
<td>3.) told</td>
<td>onset: toad</td>
<td>t-o-d</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>rime: fold</td>
<td>f-o-l-d</td>
<td></td>
</tr>
<tr>
<td>4.) kept</td>
<td>onset: kelp</td>
<td>k-e-l-p</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rime: lept</td>
<td>l-e-p-t</td>
<td></td>
</tr>
<tr>
<td>5.) since</td>
<td>onset: sit</td>
<td>s-i-t</td>
<td>e</td>
</tr>
<tr>
<td></td>
<td>rime: wince</td>
<td>w-i-n-c</td>
<td></td>
</tr>
<tr>
<td>6.) might</td>
<td>onset: my</td>
<td>m-y</td>
<td>gh</td>
</tr>
<tr>
<td></td>
<td>rime: fight</td>
<td>f-i-t</td>
<td></td>
</tr>
<tr>
<td>7.) farm</td>
<td>onset: far</td>
<td>f-a-r</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rime: arm</td>
<td>a-r-m</td>
<td></td>
</tr>
<tr>
<td>8.) soap</td>
<td>onset: soak</td>
<td>s-o-k</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>rime/same vowel: coap (cope)</td>
<td>c-o-p</td>
<td>a</td>
</tr>
<tr>
<td>9.) heat</td>
<td>onset: heap</td>
<td>h-e-p</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>rime: eat</td>
<td>e-t</td>
<td>a</td>
</tr>
<tr>
<td>10.) crab</td>
<td>onset: craft</td>
<td>c-r-a-f-t</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rime: lab</td>
<td>l-a-b</td>
<td></td>
</tr>
<tr>
<td>11.) clock</td>
<td>onset: clop</td>
<td>c-l-o-p</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rime: lock</td>
<td>l-o-c-k</td>
<td></td>
</tr>
<tr>
<td>12.) fence</td>
<td>onset: felt</td>
<td>f-e-l-t</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rime: hence</td>
<td>h-e-n-c</td>
<td>e</td>
</tr>
</tbody>
</table>
The protocol for the training was adapted from the Key-Plus Program (Ehri, Satlow, & Gaskins, 2009; Gaskins, Ehri, Cress, O’Hara, & Donnelly, 1997). Students were taught to fully analyze the grapheme-phoneme relations in the training words through guided practice (see Appendix N for script). The training sessions took place on three consecutive days within the same week. During each session, round one consisted of the experimenter stating the word and then stretching out the sounds in the word while holding a magnifying glass up to her mouth to enlarge it. Students were directed to focus on the shape of the experimenter’s mouth as she stretched the sounds. Students then stretched the sounds with the experimenter and held up a finger for each sound they heard. While students stretched the sounds, they looked in a small mirror to notice the changes in the shape of their mouths as they made each sound.

Next, the spelling of the word was shown and the experimenter and students counted the number of letters in the word together. Discrepancies between the number of sounds and the number of letters in the word were identified, and students were told that sometimes two letters make one sound or one letter doesn’t make any sound. Table 4 indicates which letters were crossed out or combined. If there was an equivalent number of sounds and letters in the word the experimenter stated that each letter represents a sound in the word. In either case, the teacher demonstrated which letters corresponded to each sound by writing the letters into Elkonin boxes (i.e., a diagram of horizontal boxes) as she said each sound, and she crossed out any letter in the spelling of the word that did not make a sound. Finally, students said each sound as they wrote the letters into the appropriate boxes on their worksheet and crossed out any letters that didn’t make a sound. They checked their work with the teacher’s when they finished. These steps were applied to the set of six or nine words depending on the session, one word at a time.
The experimenter provided feedback to students if they were not able to correct their mistakes by looking at the teacher’s example. This feedback included the experimenter pointing to each box on the student’s paper while she said each sound in the word. After realizing the mistake, the student would cross out the incorrect letter in the box and write the letter that corresponded to the sound that the experimenter said. The student would also be directed to correct any mistakes in crossing out the letters in the spelling of the word based on the correction s/he made in writing the letters into the boxes.

In the second round of each session, which immediately followed the first round, the teacher stated the word and together with the students stretched and held up corresponding fingers for each sound. Then, students were instructed to try to map the letters into the correct boxes on their own by saying each sound as they wrote the corresponding letter(s) in a box. Students were instructed to cross out any letters in the spelling of the word that did not make a sound. After they completed the task the teacher modeled how to map the sounds to the letters in the boxes, and she also crossed out any letters that did not make a sound in the spelling of the word. Students were instructed to check their work with the experimenters. Again, the experimenter provided feedback to students if they were not able to correct their mistakes by looking at the teacher’s example. The feedback was the same as stated above.

**Control Group.** The control group was engaged in storybook reading. The experimenter trained the teacher to read a highly engaging storybook to the students and as a group they discussed story grammar elements through the use of an interactive read aloud lesson plan. The lesson format included teaching 3-4 unknown vocabulary words from the story. The words were listed on chart paper and the definitions of the words were discussed prior to reading. The teacher directed students’ attention to the cover of the book and she asked students to make
predictions about what the story might be about based on the cover illustrations. Before opening the book the teacher set the purpose for reading by asking students to pay attention to what happened in the beginning, middle, and end of the story. During the reading the teacher asked three high level comprehension questions through a turn and talk format. The high level questions were predetermined and were written in sticky notes and placed on the page that the question should be asked. The teacher also demonstrated a think-aloud during a complex part in the story. She stopped and clarified her thinking by making a statement such as, “Hmm… I wonder why… I think that…” After the reading, students completed an informal writing activity about what happened at the beginning, middle, and end of the story. While this condition provided exposure to a highly engaging read aloud, it controlled for student exposure to explicit training in segmenting phonemes and mapping letter-sound relations. The control group was engaged in the storybook reading and follow-up activity for the equivalent amount of time as the orthographic mapping group.

**Flashcard Learning.** Following the orthographic mapping and story book training and the orthographic mapping posttest (see Posttest section below) all students were presented with the flashcard word reading activity. All testing was conducted individually. Twelve target words (gave, held, told, kept, since, might, farm, soap, heat, crab, clock, fence) commonly found on graded lists on high frequency words used in flashcard and list reading with students were used. Words were assigned to two sets (six words per set, see Table 5). Three words in each list were context dependent words (past tense words and function words) and three words were context independent words (nouns/content words). All the words within each set began with different letters. Although the words were not completely regular in their spellings, most of the letters were regular. All of the context independent nouns were second grade level except for heat
which is a third grade level word as listed in Harris & Jacobson (1980). All of the context
dependent words were at either a first (three words) or a second (three words) grade-equivalent
level, so grade equivalent levels favored better performance on the context-dependent words.
Within each condition, one set of words was taught with meaning clarifying sentences and the
other set was taught without meaning clarifying sentences in a repeated measures design. The
procedure and sequence of events are explained in Table 6.
Table 5

*Target Words for Flashcard Word Reading.*

<table>
<thead>
<tr>
<th></th>
<th>List A</th>
<th>List B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function Words</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past verb</td>
<td>gave (1st)</td>
<td>held (2nd)</td>
</tr>
<tr>
<td>Past verb</td>
<td>told (1st)</td>
<td>kept (2nd)</td>
</tr>
<tr>
<td>Other</td>
<td>since (2nd)</td>
<td>might (1st)</td>
</tr>
<tr>
<td><strong>Content Words</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noun</td>
<td>farm (2nd)</td>
<td>soap (2nd)</td>
</tr>
<tr>
<td>Noun</td>
<td>heat (3rd)</td>
<td>crab (2nd)</td>
</tr>
<tr>
<td>Noun</td>
<td>clock (2nd)</td>
<td>fence (2nd)</td>
</tr>
</tbody>
</table>

*Note. Other: might = auxiliary verb; since = conjunction*

The order of treatment (meanings vs. no meanings) and the word set (Set A vs. Set B) assigned to each treatment were counterbalanced. At the start of each round students were told that they should learn the words as best they could because they would be asked to read them later on. All students were given one study trial and three test trials with corrective feedback to read the words (see Table 6 and Appendix O and P for scripts). Different sentences were provided on each meaning clarification trial so that students heard each word in multiple syntactic formats (see Appendix S for sentences).
Table 6

*Example of Protocol for Flashcard Reading Study Trials and Test Trials.*

<table>
<thead>
<tr>
<th>First Study Trial</th>
<th>Flashcard Reading with Meaning Clarification</th>
<th>Flashcard Reading without Meaning Clarification</th>
</tr>
</thead>
</table>
| 1st Study Trial   | - Experimenter (E) shows spelling of target on first card, points to word and says word.  
|                   | - Student (S) says the word.  
|                   | - E shows a second card displaying a sentence and points to each word while reading the sentence.  
|                   | - E instructs S to point to the target word in the sentence  
|                   | - S points to target word  
|                   | - E says the word  
|                   | (S hears word-4x, says word 1x) | - E shows spelling of target word on first card, points to word and says word.  
|                   | - S says word.  
|                   | - E shows a second card displaying target word, points to word and says word.  
|                   | - E instructs S to point to the target word  
|                   | - S points to word  
|                   | - E says the word  
|                   | (S hears word- 4x, says word- 1x) |
| Multiple Test Trials with Feedback | - E shows spelling.  
| (same procedure followed for all test trials) | - S reads word.  
|                   | - E says the word  
|                   | - E shows second card and points to each word while reading the sentence.  
|                   | - E instructs S to point to the target word  
|                   | - S points to target word.  
|                   | - E points and says the word  
|                   | (S hears word- 4x, reads word- 1x)  
|                   | - E shows spelling.  
|                   | - S reads word.  
|                   | - E says the word  
|                   | - E shows second card, points to word and says word.  
|                   | - E instructs S to point to the target word  
|                   | - S points to word  
|                   | - E says the word  
|                   | (S hears word- 4x, reads word- 1x) |

In both the meaning and no meaning conditions, the students saw the isolated spelling on the first card and heard the pronunciation of the word. They pronounced it themselves an equal number of times across conditions. On the second card in the meaning condition, the target word was not underlined or highlighted. The word was simply embedded in the sentence. As the experimenter read the sentence she pointed to each of the words in the sentence. When the student was asked to point to the target word, s/he needed to locate it within the sentence. After
the student located or attempted to locate the word, the experimenter provided feedback by pointing to the word and stating it again.

**Posttest Measures**

*Orthographic Mapping.* This task was administered individually prior to the flashcard word reading task. It assessed students’ ability to segment each phoneme in a word and to write the corresponding letters that represent each phoneme in the word into a separate box (see Appendix T for script and Appendix U for worksheet). The same script used in the first example of the first session of the OM treatment condition was used for the practice/learning round of the task for all students regardless of whether they were in the OM or control condition. The experimenter demonstrated how to stretch the sounds in a word. Students were directed to pay attention to the shape of the experimenter’s mouth. Then, students were provided with a small mirror to look at their mouth while they stretched the sounds in the word and counted the number of sounds they heard. Next, they counted the number of letters in the word together. Discrepancies between the number of sounds and the number of letters in the word were identified, and students were told that sometimes two letters make one sound or one letter doesn’t make any sound. If there was an equivalent number of sounds and letters in the word the experimenter stated that each letter represents a sound in the word. In either case, the experimenter demonstrated which letters corresponded to each sound by writing the letters in Elkonin boxes (i.e., a diagram of horizontal boxes) as she said each sound, and she crossed out any letter in the spelling of the word that did not make a sound. Finally, students said each sound as they wrote the letters in the appropriate boxes on their worksheet and crossed out any letters that didn’t make a sound. They checked their work with the experimenter’s when they finished.
Students then proceeded to complete the six items on the posttest without feedback from
the experimenter (words: cave, melt, light, boat, stop, dance). The words used in this task were
different from those used in the training, but their spelling structures were similar (CVCC,
CCVC, bossy e, silent e, silent letters). For each item, the experimenter stated the word, and
asked the students how many sounds they heard. The experimenter recorded the student’s
response on the script sheet (see Appendix T). The experimenter then prompted the student to
write the letters that make each sound in their own boxes below the spelling (see Appendix U).
Most students said each sound aloud as they wrote the letters in the box, although this was not
always the case. The experimenter did not record whether or not the student spoke the sounds
aloud.

Each item was scored as correct or incorrect. Correct responses included accurate
representations of the letters that make each sound in individual boxes. Items were scored as
incorrect if the sequence of the letters was out of order or if letters that did not make a sound in
the word were included in the boxes. Credit was not taken off if the letters that did not make a
sound were not properly crossed out. The Cronbach’s alpha reliability coefficient was .50.

Word knowledge. After each of the two flashcard word learning tasks was completed a
spelling task was administered to measure students’ memory for the orthographic composition of
each target word (see Appendix V and X for scripts). The experimenter said the word. Students
were asked to repeat the word, and then the experimenter instructed the student to write the
spelling of the word on a line. Spellings were scored at the letter level because so few entire
words were written correctly. Credit was given for each letter written in the word. Incorrect
phonetic representations were not scored, and any correct letters written after the final sound in
the word was written was not given credit. If a correct letter appeared in a random string of
letters produced by the student, credit was not given. The maximum score was 26. The interrater reliability for scoring spelling at the letter level was .92.

A sentence production task was used to measure students’ ability to demonstrate how each target word functions syntactically and semantically (see Appendix Z and AA for scripts). The experimenter said each word and asked students to use the word in a sentence. Students embedded each word in a meaningful sentence that they said aloud. The scoring system used in Ehri and Wilce (1980) was adapted for this task. Three categories were used to judge the quality of the sentences produced. The categories were complete, questionable, and unacceptable. A rubric was used for scoring student responses based on these three categories. Complete sentences were awarded two points, questionable sentences one point, and unacceptable sentences zero points. To be considered a complete sentence the target word must have been used correctly and the sentence must have specified a context by including at least one content word. Sentences judged as questionable did not completely specify the syntactic or semantic role of the target word. These sentences were abbreviated sentences that did not include a context word, incomplete phrases, or odd sentences that strained the use of the word or included uncommon combinations of words. The maximum scores for this task was 12. The interrater reliability of this task was .98.
Chapter 5

Results

Characteristics of Participants

Several pretest measures were used to qualify students for the study and to determine students’ level of language and literacy skills. The pretests included a language proficiency rating scale for speaking, understanding, reading, and writing English (rating scale of 0 to 100), the PPVT-4 (Dunn & Dunn, 2007) (raw, standard, and z-scores), the CTOPP Sound Matching subtest (Wagner, Torgesen, Rachotte, 1999), letter shape knowledge (total letters written correctly), letter sound knowledge (total letter sounds correctly produced), spelling nonwords (total phonetic representations written), high frequency word reading (total words read correctly), target word reading (total words read correctly), and nonword reading (total nonwords read correctly). The group means and percent zero scores for these measures are reported in Table 7 for native English speakers and Table 8 for nonnative speakers.
### Table 7

**Abilities of Native English Speaking Participants.**

<table>
<thead>
<tr>
<th></th>
<th>OM</th>
<th>Control</th>
<th>$t \ (p)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$(N = 19)$</td>
<td>$(N = 21)$</td>
<td></td>
</tr>
<tr>
<td>M (SD) Range</td>
<td>M (SD) Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English Lang. Proficiency Rating (100 max)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speaking</td>
<td>90.00 (13.64) 50-100</td>
<td>90.71 (15.99) 50-100</td>
<td>-0.15 (.88)</td>
</tr>
<tr>
<td>Understanding</td>
<td>90.53 (13.93) 50-100</td>
<td>95.48 (8.50) 70-100</td>
<td>-1.34 (.19)</td>
</tr>
<tr>
<td>Reading</td>
<td>80.00 (24.32) 25-100</td>
<td>89.52 (14.99) 50-100</td>
<td>-1.51 (.14)</td>
</tr>
<tr>
<td>Writing</td>
<td>79.47 (24.15) 25-100</td>
<td>87.62 (17.51) 50-100</td>
<td>-1.23 (.23)</td>
</tr>
<tr>
<td>PPVT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>87.37 (15.13) 51-122</td>
<td>95.81 (20.75) 57-136</td>
<td>-1.46 (.15)</td>
</tr>
<tr>
<td>Standard</td>
<td>91.42 (8.68) 72-113</td>
<td>96.67 (13.02) 74-123</td>
<td>-1.48 (.15)</td>
</tr>
<tr>
<td>CTOPP (20 max)</td>
<td>11.58 (5.25) 3-20</td>
<td>13.14 (4.16) 3-20</td>
<td>-1.05 (.30)</td>
</tr>
<tr>
<td>Letter Writing (22 max)</td>
<td>21.37 (1.01) 19-22</td>
<td>21.43 (1.40) 17-22</td>
<td>-0.15 (.88)</td>
</tr>
<tr>
<td>Letter Sound (22 max)</td>
<td>20.79 (1.13) 19-22</td>
<td>20.10 (2.36) 14-22</td>
<td>1.20 (.24)</td>
</tr>
<tr>
<td>Spelling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letters Correct (15 max)</td>
<td>10.42 (3.89) 0-15</td>
<td>10.48 (3.49) 2-15</td>
<td>-0.05 (.96)</td>
</tr>
</tbody>
</table>
Table 7 (continued)

*Characteristics and Abilities of Native English Speaking Participants.*

<table>
<thead>
<tr>
<th></th>
<th>OM</th>
<th>Control</th>
<th>$t$ ($p$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>($N = 19$)</td>
<td>($N = 21$)</td>
<td></td>
</tr>
<tr>
<td><strong>M (SD) Range</strong></td>
<td>$M$</td>
<td>$(SD)$</td>
<td>Range</td>
</tr>
<tr>
<td><strong>Word Reading</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Words (WRMT-R)</td>
<td>8.74</td>
<td>(8.74)</td>
<td>0-27</td>
</tr>
<tr>
<td>% Zero</td>
<td>10.5%</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Target Words</td>
<td>0.37</td>
<td>(0.76)</td>
<td>0-2</td>
</tr>
<tr>
<td>% Zero</td>
<td>78.9%</td>
<td></td>
<td>71.4%</td>
</tr>
<tr>
<td>Nonwords (5 max)</td>
<td>1.84</td>
<td>(1.57)</td>
<td>0-5</td>
</tr>
<tr>
<td>% Zero</td>
<td>26.3%</td>
<td></td>
<td>42.9%</td>
</tr>
</tbody>
</table>

*Note.* *p < .05; **p < .01.*

OM = orthographic mapping condition.

PPVT = Peabody Picture Vocabulary Test- IV.

CTOPP = Comprehensive Test of Phonological Processing.

WRMT-III = Woodcock Reading Mastery Test- III.
Table 8

*Abilities of Nonnative English Speaking Participants.*

<table>
<thead>
<tr>
<th></th>
<th>OM</th>
<th>Control</th>
<th>$t$ ($p$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$(N = 20)$</td>
<td>$(N = 21)$</td>
<td></td>
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<tr>
<td>English Lang. Proficiency Rating (100 max)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Speaking</td>
<td>65.00 (20.13)</td>
<td>56.90 (17.71)</td>
<td>1.37 (.18)</td>
</tr>
<tr>
<td>Understanding</td>
<td>70.25 (13.72)</td>
<td>71.90 (18.81)</td>
<td>-0.32 (.75)</td>
</tr>
<tr>
<td>Reading</td>
<td>63.00 (16.17)</td>
<td>63.10 (15.21)</td>
<td>-0.02 (.99)</td>
</tr>
<tr>
<td>Writing</td>
<td>62.50 (16.18)</td>
<td>61.90 (14.70)</td>
<td>0.12 (.90)</td>
</tr>
<tr>
<td>PPVT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>73.80 (15.75)</td>
<td>70.05 (11.85)</td>
<td>0.87 (.39)</td>
</tr>
<tr>
<td>Standard</td>
<td>83.55 (8.68)</td>
<td>81.48 (6.62)</td>
<td>0.86 (.39)</td>
</tr>
<tr>
<td>CTOPP (20 max)</td>
<td>9.90 (4.61)</td>
<td>10.52 (4.00)</td>
<td>-0.46 (.65)</td>
</tr>
<tr>
<td>Letter Writing (22 max)</td>
<td>21.00 (1.59)</td>
<td>20.81 (1.72)</td>
<td>0.37 (.72)</td>
</tr>
<tr>
<td>Letter Sound (22 max)</td>
<td>19.95 (2.89)</td>
<td>18.62 (5.00)</td>
<td>1.04 (.31)</td>
</tr>
<tr>
<td>Spelling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letters Correct (15 max)</td>
<td>8.80 (3.89)</td>
<td>8.48 (3.42)</td>
<td>0.28 (.78)</td>
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</tbody>
</table>
Table 8 (continued)

*Characteristics and Abilities of Nonnative English Speaking Participants.*

<table>
<thead>
<tr>
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<th>OM</th>
<th>Control</th>
<th>t (p)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(N = 20)</td>
<td>(N = 21)</td>
<td></td>
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<tr>
<td>M</td>
<td>(SD)</td>
<td>Range</td>
<td>M</td>
</tr>
<tr>
<td>Word Reading</td>
<td></td>
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<tr>
<td>Words (WRMT-R)</td>
<td>14.40</td>
<td>(11.59)</td>
<td>14.81</td>
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<tr>
<td>% Zero</td>
<td>5%</td>
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<td>0%</td>
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<tr>
<td>Target Words</td>
<td>0.55</td>
<td>(0.83)</td>
<td>0.38</td>
</tr>
<tr>
<td>% Zero</td>
<td>65%</td>
<td></td>
<td>66.7%</td>
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<tr>
<td>Nonwords (5 max)</td>
<td>1.55</td>
<td>(1.70)</td>
<td>0.95</td>
</tr>
<tr>
<td>% Zero</td>
<td>40%</td>
<td></td>
<td>57.1%</td>
</tr>
</tbody>
</table>

*Note.* *p* < .05; **p** < .01.
OM = orthographic mapping condition.
PPVT = Peabody Picture Vocabulary Test-IV.
CTOPP = Comprehensive Test of Phonological Processing.
WRMT-R = Woodcock Reading Mastery Test-Revised.

As expected for native English speakers, the mean teacher rating scores of their language proficiency in speaking, understanding, reading, and writing English were high on the scale of 0 to 100 ranging from 79 to 95 (see Table 7). The mean standard scores on the PPVT-4 (Dunn & Dunn, 2007) for both the OM and Control groups were below average. Scores on the CTOPP (Wagner, Torgesen, & Rashotte, 1999) subtest measure of phonemic awareness were slightly above fifty percent of the items correct. Ceiling effects are evident on student performance of
letter writing and letter sounds, indicating that students who qualified for the study knew nearly all of the letter shapes and sounds tested. Students’ performance on the nonword spelling task shows that on average students were able to write phonetically acceptable letters for over half of the phonemes in the nonwords. The result of independent samples t-tests revealed that there were no significant differences between the OM and control groups for the native English speakers on the language proficiency rating scales, PPVT-4 receptive vocabulary measure, CTOPP measure of phonemic awareness, nonword spelling, letter writing, and letter sounds tasks.

Word reading performance was measured with the Word Identification subtest of the Woodcock Reading Mastery Test- III (Woodcock, 2011), a target word list, and a nonword list. The majority of native English speaking students in both groups were able to read several words on the Woodcock word list. As expected, the majority of students could not read any of the words on the target word list, as these words ranged in difficulty from 1st to 3rd grade. Students were included in the study if they were able to read no more than two of the target words. A floor effect is also apparent on the nonword reading task. Twenty six percent of the OM students and 43 percent of the control students were not able to read any of the nonwords. Results of independent samples t-tests revealed no significant differences between the OM and control groups for the native English speakers on the three word reading tasks.

For the nonnative English speakers, the mean teacher rating scores of their language proficiency in speaking, understanding, reading, and writing were moderate ranging from 57 to 72 on the scale of 0 to 100, which is expected for this population (see Table 8). The mean scores on the PPVT-4 (Dunn & Dunn, 2007) for both the treatment and control groups of nonnative English speakers were greater than one standard deviation below the mean. Scores on the CTOPP (Wagner, Torgesen, & Rashotte, 1999) Sound Matching subtest measure of phonemic
awareness demonstrated that on average students responded correctly on fifty percent of the items. Ceiling effects are evident on student performance of letter writing and letter sounds, indicating that students who qualified for the study knew the majority of letter shapes. However, the range of knowledge demonstrated on the letter sound task was much larger for nonnative than native English speakers. Average performance is evident on the nonword spelling task for both the OM and control groups, suggesting that students were able to spell phonetically roughly half of the phonemes in the nonwords. The results of independent samples t-tests demonstrated that there were no significant differences between the OM and control groups for the nonnative English speakers on the language proficiency scores, PPVT-4 receptive vocabulary measure, CTOPP subtest measure of phonemic awareness, nonword spelling, letter writing, and letter sounds.

Word reading performance for nonnative English speakers was also measured with the Word Identification subtest of the WRMT-III (Woodcock, 2011), a target word list, and a nonword list. The majority of students in both the OM and control groups were able to read several words on the Woodcock list. The majority of nonnative English speaking students could not read any of the words on the target word list, as these words ranged in difficulty from 1st to 3rd grade. Students were included in the study if they were able to read no more than two of the words on the list. A floor effect is apparent on the nonword reading task for both the OM and control groups. Forty percent of the OM students and 57 percent of the control students were not able to read any of the nonwords. Results of independent samples t-tests revealed no differences between the OM and control groups for the nonnative English speakers on the three word reading tasks.
Comparison of mean performance of the native and nonnative English speakers in Tables 7 and 8 reveals that nonnatives received substantially lower ratings on the language proficiency ratings, as well as lower scores on the vocabulary test. Mean scores ranged from 63-72 for nonnatives and 80-95 for natives on the proficiency ratings, and 81-84 for nonnatives and 91-97 for natives on the standard score of the vocabulary measures (PPVT). Scores were generally lower on the other literacy measures for nonnatives except for the WRMT-R word identification test where nonnatives read several more words on average ($M = 14.6$ words) than natives ($M = 9.8$ words).

**Performance During Training**

Students who participated in the OM condition received 30-35 minutes of training. Training was conducted in small groups of 3-4 students, and it was not possible to keep track of individual student performance during the training. All three training sessions followed the treatment script (see Appendix N). Students who did not properly fill in their boxes during the independent practice time were provided with feedback from the teacher. This feedback often required a reminder about a letter that was omitted from the sequence, or a letter that was used from the spelling of the word but was not necessary in the orthographic mapping of the letters into the sound boxes. For example, if the word was *fight* and the student wrote *f-i-g-t* in the boxes, the experimenter would remind the participant that there are only three sounds in the word *fight* and so only three boxes should have letters. The experimenter would wait for the child to correct the mistake. If the child was not able to identify and correct the error, the experimenter would draw the child’s attention to the boxes that she filled in and both of them would say the sounds in the boxes together to form the word. The child was then directed to fix his/her boxes to match the experimenter’s. In the allotted time students completed all of the words in the training
packets. Six training words were taught in session one, and nine training words were each taught in sessions two and three. Students in the control group were engaged in the book reading session for the equivalent amount of time.

Anecdotal observations recorded by the experimenter after the training sessions indicated that students tired and became distracted after 15-20 minutes of the OM training. The experimenter had to provide more feedback about sitting properly and not playing with the materials towards the end of the sessions. Also due to training in small groups, students sometimes looked at their neighbor’s work when they were having difficulty writing the letters that represented the sounds in the boxes.

Prior to the word reading posttest, students were asked to complete the orthographic mapping task in which they isolated sounds in six words and then wrote the letters that represented each sound in the word into individual, horizontally linked boxes. In this task, the experimenter read the word in each item and asked students how many sounds they heard in the word. The experimenter recorded the student’s response, and then the experimenter asked students to write the letters that make each sound into their own box below the spelling. Students, regardless of receiving the OM training or not, proceeded with seeming confidence through this task. Credit was given if all of the sounds in the word were correctly represented in the boxes. Results of an independent samples t-test, \( t (38) = 5.52, p < .001 \), revealed that native English speaking students who were trained in orthographic mapping performed significantly better than students in the control group: \( M = 5.63, SD = .76 \) (OM group) vs. \( M = 3.38, SD = 1.69 \) (control group), maximum score = 6. Similarly results of the t-test applied to performance of nonnative speakers revealed a significant effect of OM training, \( t (39) = 6.64, p < .001 \). Nonnative students who received OM training outperformed control students: \( M = 5.30, SD = \)
.87 (OM) vs. $M = 3.10$, $SD = 1.22$ (control group). These findings show that the OM training was effective, that students did learn how to analyze words into their constituent phonemes and write letters for the sounds.

**Posttest Performance**

Several tasks were administered to assess effects of training in orthographic mapping (OM). The tasks assessing outcomes included target word reading over three trials, memory for spellings of the target words, and ability to embed the target words in meaningful sentence contexts. ANOVAs were applied to outcome measures. The independent variables were: treatment (OM vs. control), sentence context (presence vs. absence), and word class (content vs. function words). Trials was included as an additional independent variable in the analysis of word reading. The latter three variables were repeated measures. Separate ANOVAs were conducted on performance of the two language groups. Results of the ANOVAs are reported in Table 9 for native speakers and Table 10 for nonnative speakers. Mean performance of the groups is reported in Table 11 along with effect sizes ($d$). Effect sizes reflect differences in mean performance between the OM and control groups, between sentence present and sentence absent word learning conditions, and between content and function words. These effect sizes are shown on each of the three outcome measures. In addition, effect sizes are shown comparing performance of the two language groups on the various measures.
Table 9

Analyses of Variance as a Function of Treatment, Sentence Context, and Word Class for Native Speakers.

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>df</th>
<th>MS</th>
<th>F (p)</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Word Reading</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Treatment (T)</td>
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<td>.121</td>
<td>.03 (.868)</td>
<td>.00</td>
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<tr>
<td>Error</td>
<td>38</td>
<td>4.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sentence Context (S)</td>
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<td>5.65</td>
<td>4.18* (.048)</td>
<td>.10</td>
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<tr>
<td>S x T</td>
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<td>.01</td>
<td>.01 (.919)</td>
<td>.00</td>
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<tr>
<td>Error</td>
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<td>1.35</td>
<td></td>
<td></td>
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<tr>
<td>Word Class (W)</td>
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<td>54.35*** (.000)</td>
<td>.59</td>
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<td>2.56 (.118)</td>
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<tr>
<td>Error</td>
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<td>.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trials (Tr)</td>
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<td>66.29*** (.000)</td>
<td>.64</td>
</tr>
<tr>
<td>Tr x T</td>
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<td>.04</td>
<td>.09 (.918)</td>
<td></td>
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<tr>
<td>Error</td>
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<tr>
<td>Error</td>
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<td></td>
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<tr>
<td>W x Tr</td>
<td>1.87</td>
<td>2.43</td>
<td>7.54** (.001)</td>
<td>.17</td>
</tr>
</tbody>
</table>
Table 9 (continued)

**Analyses of Variance as a Function of Treatment, Sentence Context, and Word Class for Native Speakers.**

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>df</th>
<th>MS</th>
<th>F (p)</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>W x Tr x T</td>
<td>2</td>
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<td>.09 (.918)</td>
<td>.00</td>
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<td>76</td>
<td>.30</td>
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<tr>
<td>Spelling</td>
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<td>.00</td>
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<td>.06 (.806)</td>
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<td>.12 (.729)</td>
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<td>Error</td>
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<td></td>
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<td>.90 (.349)</td>
<td>.02</td>
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<td>Sentence Production</td>
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<td></td>
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<tr>
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<td>.68 (.416)</td>
<td>.02</td>
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<tr>
<td>Error</td>
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<td>11.31</td>
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<tr>
<td>Sentence Context (S)</td>
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<td>46.07</td>
<td>28.11*** (.000)</td>
<td>.43</td>
</tr>
</tbody>
</table>
Table 9 (continued)

Analyzes of Variance as a Function of Treatment, Sentence Context, and Word Class for Native Speakers.

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<th></th>
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<td>.04</td>
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<tr>
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<tr>
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<tr>
<td>Error</td>
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<td>1.89</td>
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</table>

* p < .05. ** p < .01. *** p < .000.
Table 10

*Analyses of Variance as a Function of Treatment, Sentence Context, and Word Class for Nonnative Speakers.*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>df</th>
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<tr>
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<td>.07</td>
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<tr>
<td>Error</td>
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<td>5.01</td>
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<tr>
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<td>.08</td>
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<tr>
<td>Error</td>
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<td>.65</td>
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<td>.75</td>
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<td>.84 (.366)</td>
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<td>Error</td>
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<tr>
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<td>1.53 (.224)</td>
<td>.04</td>
</tr>
</tbody>
</table>
Table 10 (continued)

*Analyses of Variance as a Function of Treatment, Sentence Context, and Word Class for Nonnative Speakers.*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>df</th>
<th>MS</th>
<th>(F(p))</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>W x Tr x T</td>
<td>2</td>
<td>.04</td>
<td>.10 (.905)</td>
<td>.00</td>
</tr>
<tr>
<td>Error</td>
<td>78</td>
<td>.42</td>
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<tr>
<td><strong>Spelling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment (T)</td>
<td>1</td>
<td>15.19</td>
<td>.61 (.441)</td>
<td>.02</td>
</tr>
<tr>
<td>Error</td>
<td>39</td>
<td>25.02</td>
<td></td>
<td></td>
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<tr>
<td>Sentence Context (S)</td>
<td>1</td>
<td>6.62</td>
<td>2.73 (.107)</td>
<td>.07</td>
</tr>
<tr>
<td>S x T</td>
<td>1</td>
<td>.03</td>
<td>.01 (.913)</td>
<td>.00</td>
</tr>
<tr>
<td>Error</td>
<td>39</td>
<td>2.43</td>
<td></td>
<td></td>
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<tr>
<td>Word Class (W)</td>
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<td>7.46</td>
<td>5.85* (.020)</td>
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<td>.00 (.992)</td>
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<td>S x W</td>
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<td>.77 (.385)</td>
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<tr>
<td>S x W x T</td>
<td>1</td>
<td>4.54</td>
<td>4.22* (.047)</td>
<td>.10</td>
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<tr>
<td>Error</td>
<td>39</td>
<td>1.08</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sentence Production**

| Treatment (T)       | 1   | 35.24 | 5.22* (.028) | .12                 |
| Error               | 39  | 6.75  |            |                     |
| Sentence Context (S)| 1   | 32.67 | 11.50** (.002) | .23                 |
Table 10 (continued)

Analyses of Variance as a Function of Treatment, Sentence Context, and Word Class for Nonnative Speakers.

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>df</th>
<th>MS</th>
<th>F (p)</th>
<th>Partial Eta Squared</th>
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<tbody>
<tr>
<td>S x T</td>
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<td>.47</td>
<td>.17 (.686)</td>
<td>.00</td>
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<td>Error</td>
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<tr>
<td>Word Class (W)</td>
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<td>117.92</td>
<td>52.37*** (.000)</td>
<td>.57</td>
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<tr>
<td>S x W</td>
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<td>.07</td>
<td>.04 (.835)</td>
<td>.00</td>
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<tr>
<td>Error</td>
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<td>1.53</td>
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</tbody>
</table>

* *p < .05. ** *p < .01. *** p < .000.
Table 11


<table>
<thead>
<tr>
<th></th>
<th>Native</th>
<th>Nonnative</th>
<th>d&lt;sub&gt;n vs n&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>M</td>
<td>SD</td>
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<td><strong>Word Reading (3 words max)</strong></td>
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<td></td>
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<td>Treatment</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Orth. Map</td>
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<td>.88</td>
<td>-.03</td>
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<td>Control</td>
<td>1.53</td>
<td>.94</td>
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<td>Sentence Context</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>With Sentences</td>
<td>1.41</td>
<td>0.90</td>
<td>-.23*</td>
</tr>
<tr>
<td>Without Sentences</td>
<td>1.62</td>
<td>0.92</td>
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</tr>
<tr>
<td>Word Class</td>
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<td></td>
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</tr>
<tr>
<td>Content</td>
<td>1.84</td>
<td>0.87</td>
<td>.71*</td>
</tr>
<tr>
<td>Function</td>
<td>1.19</td>
<td>0.96</td>
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<tr>
<td><strong>Spelling (13 letters max)</strong></td>
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<tr>
<td>Treatment</td>
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<td>.08</td>
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<td>With Sentences</td>
<td>7.59</td>
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<tr>
<td>Without Sentences</td>
<td>8.14</td>
<td>2.26</td>
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Table 11 (continued)


<table>
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<tr>
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<th>Native</th>
<th>Nonnative</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sub&gt;NvsNon&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>8.09 (2.35)</td>
<td>7.95 (2.74)</td>
<td>0.19*</td>
<td>0.16*</td>
<td>0.05</td>
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<tr>
<td>Function</td>
<td>7.64 (2.48)</td>
<td>7.52 (2.69)</td>
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<td></td>
<td>0.05</td>
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</table>

**Sentence Production (6 points max)**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Native</th>
<th>Nonnative</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sub&gt;NvsNon&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orth. Map</td>
<td>3.28 (1.90)</td>
<td>3.23 (1.86)</td>
<td>-0.21</td>
<td>0.51*</td>
<td>0.03</td>
</tr>
<tr>
<td>Control</td>
<td>3.71 (2.21)</td>
<td>2.30 (1.78)</td>
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<td></td>
<td>0.70</td>
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</table>

<table>
<thead>
<tr>
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<th>Native</th>
<th>Nonnative</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sub&gt;NvsNon&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Sentences</td>
<td>4.03 (1.89)</td>
<td>3.21 (1.88)</td>
<td>0.51*</td>
<td>0.48*</td>
<td>0.44</td>
</tr>
<tr>
<td>Without Sentences</td>
<td>2.96 (2.28)</td>
<td>2.32 (1.85)</td>
<td></td>
<td></td>
<td>0.31</td>
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</table>

<table>
<thead>
<tr>
<th>Word Class</th>
<th>Native</th>
<th>Nonnative</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sup&gt;a&lt;/sup&gt;</th>
<th>d&lt;sub&gt;NvsNon&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>4.28 (2.09)</td>
<td>3.61 (1.90)</td>
<td>0.75*</td>
<td>0.91*</td>
<td>0.34</td>
</tr>
<tr>
<td>Function</td>
<td>2.71 (2.09)</td>
<td>1.91 (1.83)</td>
<td></td>
<td></td>
<td>0.41</td>
</tr>
</tbody>
</table>

*Note. M = mean. SD = standard deviation. *p < .05, see exact p values in Tables 9 and 10. Table shows mean performance of native and nonnative speakers on measures of word reading, spelling, and sentence production when words were learned with a meaningful sentence or without and when the word was a content versus a function word. d<sub>NvsNon</sub> = effect sizes comparing native to nonnative students on each measure; d<sup>a</sup> = effect sizes comparing means with vs. without sentence contexts or means for content vs. function word class for each outcome measure in each student group.*
Native Speakers: Word Reading. Students in both the treatment and control conditions were taught to read two sets of six words on flashcards. First, participants were given one study trial to learn the words, and then in three consecutive test trials with corrective feedback participants were prompted to read each word presented on a flashcard. Their performance reading each word was scored as correct or incorrect. The ANOVA was conducted on the mean number of words read correctly averaged across trials. Results showed no effect of treatment condition \((p > .05)\) indicating that students in the treatment and control conditions performed equally well on the word learning task (see Table 9). This does not support the hypothesis that OM training would facilitate stronger word reading performance than the control condition.

Native speakers’ performance reading words on flashcards was influenced by the sentence context variable. Each student learned one set of target words by reading each word in isolation first and then embedded in a contextually rich sentence. The other set of words was read twice in isolation without any sentences. The ANOVA revealed a main effect of sentence context (see Table 9). Mean performance in Table 11 shows that words were more easily read when the words were taught without sentences than when they were presented with sentences. This finding supports the hypothesis that learning words in isolation would better support word reading than learning words embedded in sentences.

Another significant main effect was detected in native speakers’ word reading performance on the grammatical word class variable. Half of the words read were context-independent words (nouns) and half context-dependent words (function). Students’ scores on the nouns and function words were averaged over the three trials. The ANOVA revealed a main effect of word class (See Table 9). Mean performance in Table 11 shows that nouns were more
easily read than function words. This supports the hypothesis that content words would be easier to read than function words.

A main effect of trials was detected showing that native speakers’ performance differed across the three word reading trials (see Table 9). Inspection of the means revealed that performance improved as learning progressed: Trial 1 $M = 1.06$; Trial 2 $M = 1.59$; Trial 3 $M = 1.90$ (maximum = 3 words correct).

A significant interaction was detected between sentence context, word class, and treatment on the word learning task (see Table 9). Figure 1 shows performance of the native speaking control and orthographic mapping groups on reading content and function words presented with and without sentences. The figure reveals the same pattern of performance when the OM and control groups read content and function words in isolation, but a different pattern of performance distinguishing the two groups in reading content and function words embedded in sentences. Whereas word reading means were similar for content and function words learned in sentences by the control group, they were quite disparate in the OM group with content words read much better than function words. Students’ performance reading function words with sentences was subtracted from their performance reading content words with sentences, and OM and control groups were compared on this mean difference with an independent samples $t$-test. Results revealed a significant difference between the control and orthographic mapping conditions: $t (38) = 3.03, p < .01, M$ difference = 0.76 (control) vs. 2.74 (OM). This finding suggests that the orthographic mapping condition may have boosted students’ performance reading content words taught with sentences but suppressed performance reading function words that were buried within sentences. Why this happened is not clear.
An interaction between word class and trials was also evident in the analysis of word reading (see Table 9). Figure 2 shows performance reading content and function words over the three trials. The figure demonstrates that content words were initially easier to read and became increasingly easier as learning proceeded. Again, this supports the hypothesis that content words would be easier to learn to read than function words.
Native Speakers: Spelling. After completion of each word reading task, participants were asked to spell the target words. ANOVA of the mean number spelled correctly showed no effect of the treatment condition (see Table 9) indicating that native speakers in the treatment and control conditions performed equally as well on the spelling task. This was despite the OM group receiving training in how to analyze sounds in words and write letters for the sounds. A significant main effect in native speakers’ spelling performance was evident on the sentence context variable (see Table 9). As shown in Table 11, spellings of words were better remembered when the words were taught without sentences than when they were taught with sentences. A difference in native speakers’ spelling performance was also evident on the word class variable (see Table 9). Comparison of the means indicates that spellings of content words were better remembered than spellings of function words (see Table 11). No other effects were significant.

FIGURE 2 Mean number of words read correctly by native speakers over trials as a function of the words being either content or function words (maximum = 3 correct).
Native Speakers: Sentence Production. Following the spelling task participants were asked to use each of the target words in a sentence. ANOVA of the means showed no effect of the treatment condition, indicating that native speakers in the treatment and control conditions performed equally as well on the sentence production task. A significant difference in native speakers’ ability to use the words in sentences was evident on the sentence context variable (see Table 9). Comparison of the means indicates that children were better able to embed words in sentences when they had been exposed to sentences during word learning than when they had not. This finding supports the hypothesis that learning words in context would better support students’ ability to generate grammatically correct and contextually rich sentences than learning to read words in isolation without clues to their meaning. A difference in native speakers’ performance was also apparent on the word class variable (see Table 9). Comparison of the means indicates that content words were more effectively embedded in grammatically correct and contextually rich sentences than function words (see Table 11).

A significant interaction between the variables of word class and treatment was detected in the sentence production task (see Table 9). Figure 3 depicts the interaction. The figure shows that the treatment and control groups performed equally well embedding content words in sentences; however, the orthographic mapping group performed significantly worse using function words in sentences. Why this occurred is not clear.
Nonnative Speakers: Word Reading. The same protocols were used for the word reading task, and all other tasks, as explained above for the native speakers. ANOVA of the mean number of words read correctly showed no significant effect of the treatment condition (see Table 10) indicating that students in the OM and control conditions performed equally well on the number of words correctly read during the word learning task. This does not support the hypothesis that OM training would better support word reading than the control training.

A significant difference in nonnative speakers’ word reading performance was detected on the sentence context variable (see Table 10). Comparison of means indicates that words were better remembered when they were taught without meaning clarifying sentences than when they were presented with sentences (see Table 11). This finding supports the hypothesis that learning words in isolation would better support word reading than learning words embedded in sentences.
A significant difference in nonnative speakers’ word reading performance was detected on the word class variable (see Table 10). Comparison of means indicates that content words were remembered better than function words (see Table 11). This finding supports the hypothesis that learning to read content words would be easier than learning to read function words. Also, the ANOVA indicated that that nonnative speakers’ performance differed across the three word reading trials. Comparison of means demonstrates that performance improved over the three trials: Trial 1 $M = 1.01$; Trial 2 $M = 1.57$; Trial 3 $M = 1.85$ (maximum score = 3). None of the tests of interaction effects was significant.

Nonnative Speakers: Spelling. Memory for the spellings of the target words was assessed after each word reading session. The ANOVA revealed no effect of treatment condition indicating that nonnative speakers in the OM and control conditions performed equally well on the spelling task. A significant difference in native speakers’ spelling performance was evident on the word class variable (see Table 10). Comparison of means indicates that spellings of content words were easier to remember that spellings of function words (see Table 11).

The ANOVA of spelling performance also revealed a significant interaction between sentence context, word class, and treatment. Figure 4 shows the performance of the treatment and control conditions on spelling content and function words learned with and without sentences. The figure indicates that nonnative speakers in the orthographic mapping condition performed most noticeably better than the control group on spelling content words learned with sentences, and on spelling function words learned without sentences. Also it is apparent that the main effect of word class favoring the spelling of content over function words held in all but one case. Among children receiving OM training, the difference in spelling content and function
words when they had been learned without sentences was minimal (see Figure 4). OM training may have boosted recall of function words by making students more sensitive to orthography.
Nonnative Speakers: Sentence Production. Following the word learning task nonnative speakers were asked to use each of the target words in a sentence. The ANOVA showed an effect of treatment condition (see Table 10). Comparison of means in Table 11 shows that nonnative speakers in the treatment group performed significantly better than nonnative speakers in the control condition. Why this occurred is not clear since OM training did not teach students to produce sentence contexts for words.

The ANOVA also detected a significant difference in nonnative speakers’ ability to use the words in sentences on the sentence context variable (see Table 10). Comparison of means indicates that words taught with meaning clarifying sentences were embedded in sentences more effectively than words learned without meaning clarifying sentences (see Table 11). This finding supports the hypothesis that students would be better able to embed words in grammatically
correct and contextually rich sentences when the words were learned within a sentence rather than in isolation.

A significant difference in native speakers’ performance was also detected on the word class variable (see Table 10). Comparison of means indicates that content words were more effectively used in grammatically correct and contextually rich sentences than function words (see Table 11). None of the interactions was statistically significant.

*Supplementary Analysis of Word Learning.* Supplementary analyses of word learning were conducted to evaluate the effects of the two control variables resulting from the counterbalanced design: word set (i.e., Set A and Set B) and task order (i.e., words with sentences learned first vs. words with sentences learned second). ANOVAs were conducted that included three between-subject independent variables: Treatment (OM vs. Control), Word Set (A vs. B), and Task Order (words accompanied by sentences first and words without sentences second vs. the opposite order). Separate analyses were conducted on two dependent measures computed for each student: (1) the difference between performance on words accompanied by sentences and words without sentences; (2) the difference between performance with content words and with function words. These analyses were applied to performance in the three posttests, reading words summed across three trials, spelling words at the end of the learning trials, and generating meaningful sentences containing the target words. These analyses were conducted separately for native and nonnative speakers.

The question addressed in the analyses was whether the control variables that involved counterbalancing to eliminate effects of the particular word set and task order altered any of the main findings reported previously. Results of the ANOVAs are reported in Table 12 where it is
evident that only a few tests of main effects or interactions involving the word set and task order variables were significant at $p < .05$ and none was significant at $p < .01$.

In the analyses of native English speaking children, only one effect emerged as significant, a main effect of treatment in the sentence generation task (see Table 12). Inspection of mean differences between performance with content and function words revealed that the difference favoring sentences generated for content words over function words was much greater among children who had received orthographic mapping training than among children in the control group. This difference was detected in the previous ANOVA (see Table 9 and Figure 3). Why this occurred is unclear and may be a chance finding as OM training focused on letter-sound mappings rather than anything semantic. Importantly, neither word set nor task order differentially influenced native speakers’ performance on any of the word learning posttests.
Table 12. Results of analyses of variance (F-statistics) of word learning on three tasks, reading words summed over three learning trials, spelling the words learned, and generating sentences containing the words. Results are reported separately for native English speakers and nonnative speakers. The independent variables were Treatment (Orthographic Mapping vs. Control), Word Set (A vs. B), and Task Order (Sentence Contexts first vs. second). The dependent measures were the difference between performance on words learned with sentence contexts and words learned without sentence contexts, and the difference between learning content and function words.

<table>
<thead>
<tr>
<th>Dep. Variable</th>
<th>Read Words</th>
<th>Spell Words</th>
<th>Generate Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native Speakers of English (N = 40)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Diff. With vs. W-out Sentences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment (T)</td>
<td>0.09 ns</td>
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<td>1.80 ns</td>
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<td>Word Set (S)</td>
<td>1.78 ns</td>
<td>0.08 ns</td>
<td>1.83 ns</td>
</tr>
<tr>
<td>Task Order (O)</td>
<td>0.38 ns</td>
<td>0.74 ns</td>
<td>2.56 ns</td>
</tr>
<tr>
<td>T x S</td>
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<td>0.74 ns</td>
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<tr>
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<td>0.07 ns</td>
<td>0.08 ns</td>
<td>0.29 ns</td>
</tr>
<tr>
<td>S x O</td>
<td>.00ns</td>
<td>0.08 ns</td>
<td>0.76 ns</td>
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<tr>
<td>T x S x O</td>
<td>1.38 ns</td>
<td>0.74 ns</td>
<td>0.20 ns</td>
</tr>
<tr>
<td>Diff. Content vs. Funct. Words</td>
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<tr>
<td>Treatment (T)</td>
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<td>5.51*</td>
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<tr>
<td>Word Set (S)</td>
<td>0.02ns</td>
<td>0.65ns</td>
<td>0.91ns</td>
</tr>
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</table>
Table 12 (continued)

<table>
<thead>
<tr>
<th>Dep. Variable</th>
<th>Indep. Variables</th>
<th>Read Words</th>
<th>Spell Words</th>
<th>Generate Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Order (O)</td>
<td>0.02ns</td>
<td>0.81ns</td>
<td>1.10ns</td>
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<td>0.79ns</td>
<td>1.19ns</td>
<td>0.10ns</td>
<td></td>
</tr>
<tr>
<td>T x O</td>
<td>0.02ns</td>
<td>2.76ns</td>
<td>0.85ns</td>
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</tr>
<tr>
<td>S x O</td>
<td>3.16ns</td>
<td>1.89ns</td>
<td>1.04ns</td>
<td></td>
</tr>
<tr>
<td>T x S x O</td>
<td>0.06ns</td>
<td>1.64ns</td>
<td>3.45ns</td>
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</tbody>
</table>

Nonnative Speakers of English

Diff. With vs. W-out Sentences

<table>
<thead>
<tr>
<th></th>
<th>Treatment (T)</th>
<th>Word Set (S)</th>
<th>Task Order (O)</th>
<th>T x S</th>
<th>T x O</th>
<th>S x O</th>
<th>T x S x O</th>
</tr>
</thead>
</table>
| Diff. Content vs. Funct. Words
| Treatment (T)     | 1.04ns        | 0.00ns       | 0.05ns        |
| Word Set (S)      | 0.79ns        | 1.29ns       | 1.24ns        |
| Task Order (O)    | 1.42ns        | 0.19ns       | 0.11ns        |
In the analyses of nonnative speakers, three of the six ANOVAs revealed significant interactions involving the control variables (see Table 12). In two of these analyses, differences in performance were greater in one condition than in another condition, but all of the differences were consistent with the main findings showing either superior word reading of content than function words, or superior sentence generation for words that had been learned with sentences than without sentences. In one analysis, involving the task of reading words with and without sentences, a significant interaction was detected between word set and task order. In three of the four cells, the difference in performance favored word reading without sentences over with sentences in support of the main finding reported previously. In the fourth cell, the difference was slight but opposite of the main finding. A $t$-test however, showed that this difference was not statistically significant, $t(9) = 0.80, p > .05$. In sum, results of these supplementary analyses show that the main findings were not altered or undermined by the control variables of task order or word set. Out of 72 comparisons there were only four significant findings and all of the $p$
values of these findings were greater than .01, suggesting that these may have occurred by chance.

*Analysis of Performance on Individual Words.* Students’ performance on individual words in reading, spelling, and embedding the words in sentences was analyzed. For word reading, the pattern of findings indicates that students performed better when words were read without sentences rather than with sentences. This pattern was evident for five out of six content words as well as five out of six function words for native speakers, and four out of six content words and three out of six function words for nonnative speakers (see Tables 13 and 14).
Table 13

*Performance by Word for Native English Speakers.*

<table>
<thead>
<tr>
<th></th>
<th>With Sentences</th>
<th>Without Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reading (%)</td>
<td>Spelling</td>
</tr>
<tr>
<td></td>
<td>Reading (%)</td>
<td>Spelling</td>
</tr>
<tr>
<td><strong>Content Words</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Set A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm</td>
<td>61.93</td>
<td>2.29 (0.72)</td>
</tr>
<tr>
<td>Clock</td>
<td>63.50</td>
<td>2.86 (0.79)</td>
</tr>
<tr>
<td>Heat</td>
<td>34.90</td>
<td>2.67 (0.58)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>55.08</td>
<td>2.64 (0.95)</td>
</tr>
<tr>
<td><strong>Set B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fence</td>
<td>40.33</td>
<td>2.32 (1.25)</td>
</tr>
<tr>
<td>Soap</td>
<td>73.70</td>
<td>2.84 (1.26)</td>
</tr>
<tr>
<td>Crab</td>
<td>56.13</td>
<td>2.84 (1.07)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>55.08</td>
<td>2.64 (0.95)</td>
</tr>
<tr>
<td><strong>Function Words</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Set A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gave</td>
<td>32.86</td>
<td>2.19 (1.12)</td>
</tr>
<tr>
<td>Since</td>
<td>33.33</td>
<td>2.86 (0.91)</td>
</tr>
<tr>
<td>Told</td>
<td>46.01</td>
<td>2.38 (1.11)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>35.66</td>
<td>2.42 (1.03)</td>
</tr>
<tr>
<td><strong>Set B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kept</td>
<td>38.60</td>
<td>2.21 (1.08)</td>
</tr>
<tr>
<td>Might</td>
<td>29.83</td>
<td>2.32 (0.95)</td>
</tr>
<tr>
<td>Held</td>
<td>33.33</td>
<td>2.58 (1.02)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>35.66</td>
<td>2.42 (1.03)</td>
</tr>
</tbody>
</table>
Note. Reading = % of students (N = 40) who correctly read the word averaged over the three trials. Spelling = mean score on performance spelling each target word. Spellings were scored at the letter level. Sentence = mean score on performance orally generating a sentence that uses the target word. A rubric was used to assign a score of 0-2 for each response.
Table 14

*Performance by Word for Nonnative English Speakers.*

<table>
<thead>
<tr>
<th></th>
<th>With Sentences</th>
<th></th>
<th>Without Sentences</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reading (% read over trials)</td>
<td>Spelling</td>
<td>Sentences</td>
<td>Reading (% read over trials)</td>
</tr>
<tr>
<td><strong>Content Words</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm</td>
<td>66.70</td>
<td>2.57 (1.08)</td>
<td>1.33 (0.86)</td>
<td>95.00</td>
</tr>
<tr>
<td>Clock</td>
<td>74.60</td>
<td>3.05 (1.16)</td>
<td>1.43 (0.81)</td>
<td>85.00</td>
</tr>
<tr>
<td>Heat</td>
<td>23.80</td>
<td>2.10 (1.04)</td>
<td>0.71 (0.96)</td>
<td>36.67</td>
</tr>
<tr>
<td><strong>Set B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fence</td>
<td>56.67</td>
<td>2.40 (1.27)</td>
<td>1.35 (0.88)</td>
<td>58.73</td>
</tr>
<tr>
<td>Soap</td>
<td>83.33</td>
<td>3.00 (0.80)</td>
<td>1.60 (0.68)</td>
<td>71.43</td>
</tr>
<tr>
<td>Crab</td>
<td>50.00</td>
<td>2.50 (1.10)</td>
<td>1.65 (0.67)</td>
<td>44.43</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>59.18</td>
<td>2.60 (1.08)</td>
<td>1.35 (0.81)</td>
<td>65.21</td>
</tr>
<tr>
<td><strong>Function Words</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gave</td>
<td>30.17</td>
<td>2.48 (1.21)</td>
<td>0.81 (0.93)</td>
<td>53.33</td>
</tr>
<tr>
<td>Since</td>
<td>15.87</td>
<td>2.29 (1.15)</td>
<td>0.19 (0.40)</td>
<td>26.67</td>
</tr>
<tr>
<td>Told</td>
<td>36.50</td>
<td>2.57 (1.12)</td>
<td>0.90 (0.94)</td>
<td>63.33</td>
</tr>
<tr>
<td><strong>Set B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kept</td>
<td>38.33</td>
<td>1.85 (0.93)</td>
<td>1.00 (0.97)</td>
<td>25.40</td>
</tr>
<tr>
<td>Might</td>
<td>40.00</td>
<td>2.70 (1.13)</td>
<td>0.85 (0.99)</td>
<td>23.83</td>
</tr>
<tr>
<td>Held</td>
<td>40.00</td>
<td>2.60 (1.27)</td>
<td>1.00 (0.97)</td>
<td>39.70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>33.48</td>
<td>2.42 (1.14)</td>
<td>0.79 (0.87)</td>
<td>38.71</td>
</tr>
</tbody>
</table>
Note. Reading = % of students (N = 41) who correctly read the word averaged over the three trials. Spelling = mean score on performance spelling each target word. Spellings were scored at the letter level. Sentence = mean score on performance orally generating a sentence that uses the target word. A rubric was used to assign a score of 0-2 for each response.

For spelling, comparisons across individual words reveal that students performed better spelling letters in words that were taught without sentences rather than with sentences. This pattern is evident for four out of six content words and five out of six function words (one pair was equal) for both native and nonnative speakers (see Tables 13 and 14).

Conversely, for performance on generating sentences with the words, the pattern of findings indicates that students performed better when words were learned with sentences rather than without sentences. This pattern held for four out of six content words and for all six of the function words for native speakers, and five out of six content words and four out of six function words for nonnative speakers (see Tables 13 and 14). It is important to note that these comparisons involve different subject groups in contrast to the results reported previously that involved within-subject comparisons and thus they are less reliable and subject to greater error variance. Nevertheless, in general the same findings held across the majority of individual words.

Comparison of Performance of Natives and Nonnatives. Similarities and differences in native and nonnative speakers’ performance patterns on the four posttests are evident. To summarize, both native and nonnative speakers who had received orthographic mapping training performed significantly better on the orthographic mapping task than their respective control groups, indicating that both OM groups learned what they were taught. Learning to read words on flashcards was easier for native and nonnative speakers when words were learned in isolation (without sentences) than with sentences, and both groups significantly improved their performance over the three trials. Content words were easier to learn to read and spell from
memory than function words for both native and nonnative speakers. While learning to read the words in isolation made it easier for native speakers to spell the words, it did not make a difference for nonnative speakers. For both native and nonnative speakers, learning words with sentences better supported their ability to embed the words in grammatically correct and contextually rich sentences (sentence production task) than learning the words without sentences. Also, both native and nonnative speakers’ were better able to use content words than function words in the sentence production task. Interestingly, nonnative speakers in the orthographic mapping condition performed significantly better on the sentence production task than controls, but this pattern was not evident for native speakers. Unexpected interactions defying explanation emerged on the word reading and sentence production tasks for native speakers and on the spelling task for nonnative speakers.

In the current study, ANOVAs were conducted separately on the native and nonnative speaker groups. However, it was of interest to see whether and where the groups might differ. To compare mean performance of the two language groups on each outcome measure, effect sizes (Cohen’s $d$) were calculated. These are reported in the right-hand column in Table 11. Inspection of these values reveals that effects were small or minimal ($d$s ranging from .02 to .25) across treatment, sentence context and word class variables in the word reading and spelling tasks. This indicates that native and nonnative speakers differed very little in their word reading and spelling performance. In contrast, effect sizes were more substantial across variables in the sentence production task, with $d$s ranging from .31 to .70 except in one comparison (see Table 11). In general, natives were more successful than nonnatives in embedding the target words in grammatical and meaningful sentences. This is perhaps not surprising and reflects a difference in their mastery of syntactic and semantic features of English. This interpretation is bolstered by a
comparison of the two groups’ mean performance on the PPVT vocabulary test. An independent samples $t$-test revealed a significant difference favoring native over nonnative speakers: $t(79) = -5.44, p < .001, M = 94.2, SD = 11.35$ for natives vs. $M = 82.5, SD = 7.67$ for nonnatives.

The one exception occurred in the comparison of natives and nonnatives who received OM training. The difference in generating sentences was minimal, with $d = .03$. How OM training contributed is unclear because the focus was not on semantics.

**Predictors of Children’s Word Learning.** Hierarchical linear regressions were conducted with all 81 participants to investigate which predictor variables explained unique variance in learning to read words in isolation on flashcards (see Table 16). The outcome variables being predicted were reading of content words and reading of function words. Performance on words presented without context was analyzed because this is typically how flashcard reading is conducted in classrooms. The question of interest was which language and reading abilities might underlie and enable beginning readers to remember how to read content and function words when no information is provided about the meanings of the words. It was expected that their vocabulary knowledge might be an important source, particularly in learning to read function words.

Prior to the analyses Pearson product-moment correlations were calculated between several of the language and literacy pretests and the dependent variables. Results are shown in Table 15. Distributions of scores revealed a bimodal distribution of students’ scores averaged across the four Teacher Rating Scales of English Proficiency. Therefore, this variable was not used in the regression analyses. Because teacher ratings were strongly correlated with PPVT scores, PPVT served as the language proficiency predictor variable. A significant and moderately strong correlation was detected between nonword reading and nonword spelling. Because a
substantial percentage of students did not read any of the nonwords correctly in the nonword reading task, this task was not used as a predictor. Rather the nonword spelling task was interpreted as assessing students’ grapheme-phoneme knowledge and served as a predictor. Because a minimum score was required on the letter writing task to participate in the study, this variable and the letter sound variable were not used in the analyses due to ceiling effects.
### Table 15

Correlations between Language Variables, Pretest, and Posttest Measures.

<table>
<thead>
<tr>
<th></th>
<th>Teacher Rating Score</th>
<th>PPVT</th>
<th>CTOPP</th>
<th>Nonword Spelling</th>
<th>Word Reading</th>
<th>Nonword Reading</th>
<th>Flashcard Content Words Without Context</th>
<th>Flashcard Function Words Without Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher Rating Score</td>
<td>.501**</td>
<td>.355**</td>
<td>.334**</td>
<td>-.029</td>
<td>.169</td>
<td>.169</td>
<td>.156</td>
<td></td>
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<tr>
<td>PPVT</td>
<td>.274*</td>
<td>.388**</td>
<td>-.103</td>
<td>.181</td>
<td>.087</td>
<td></td>
<td>.214</td>
<td></td>
</tr>
<tr>
<td>CTOPP</td>
<td>.267*</td>
<td>.299**</td>
<td>.213</td>
<td>.364**</td>
<td>.336**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonword Spelling</td>
<td>.224*</td>
<td>.541**</td>
<td>.210</td>
<td>.415**</td>
<td>.397**</td>
<td></td>
<td>.576**</td>
<td></td>
</tr>
<tr>
<td>Word Reading</td>
<td></td>
<td>.196</td>
<td>.380**</td>
<td>.471**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonword Reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.415**</td>
<td>.397**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flashcard Content Words Without Context</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flashcard Function Words Without Context</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>76.03</td>
<td>88.26</td>
<td>11.30</td>
<td>9.53</td>
<td>12.25</td>
<td>1.44</td>
<td>5.90</td>
<td>3.63</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>18.42</td>
<td>11.26</td>
<td>4.60</td>
<td>3.72</td>
<td>10.12</td>
<td>1.55</td>
<td>2.09</td>
<td>2.59</td>
</tr>
</tbody>
</table>

*Note.* Teacher Rating Score = average score of the speaking, understanding, reading, and writing variables from the teacher rating scale from 0-100 of English language skills. PPVT = Peabody Picture Vocabulary Test IV. CTOPP = Comprehensive Test of Phonemic Processing. Nonword Spelling = ability to spell 5 experimenter generated nonwords. Word Reading = Woodcock Reading.
Mastery Test. Nonword Reading = ability to read 5 experimenter generated nonwords. Flashcard Content Words Without Context = Scores across trials on reading content words when presented without context.

* *p < .05; ** *p < .01.
Table 16

Hierarchical Regression Analyses Displaying Order of Entry of Predictor Variables on Flashcard Reading of Content and Function Words When Words Were Taught Without Sentences (N = 81).

<table>
<thead>
<tr>
<th>Model</th>
<th>( R^2 )</th>
<th>( R^2 ) Change</th>
<th>( F ) Change</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading Content Words</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Literacy(^a)</td>
<td>.218</td>
<td>.218</td>
<td>7.162</td>
<td>.000</td>
</tr>
<tr>
<td>2 PPVT</td>
<td>.218</td>
<td>.000</td>
<td>.030</td>
<td>n.s.</td>
</tr>
<tr>
<td>1 PPVT</td>
<td>.008</td>
<td>.008</td>
<td>.598</td>
<td>n.s.</td>
</tr>
<tr>
<td>2 Literacy(^a)</td>
<td>.218</td>
<td>.211</td>
<td>6.838</td>
<td>.000</td>
</tr>
<tr>
<td><strong>Reading Content Words</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 PPVT</td>
<td>.008</td>
<td>.008</td>
<td>.598</td>
<td>n.s.</td>
</tr>
<tr>
<td>2 CTOPP</td>
<td>.132</td>
<td>.125</td>
<td>11.224</td>
<td>.001</td>
</tr>
<tr>
<td>3 Spelling</td>
<td>.149</td>
<td>.017</td>
<td>1.515</td>
<td>n.s.</td>
</tr>
<tr>
<td>4 Sight Word Reading</td>
<td>.218</td>
<td>.069</td>
<td>6.745</td>
<td>.011</td>
</tr>
<tr>
<td>2 CTOPP</td>
<td>.132</td>
<td>.125</td>
<td>11.224</td>
<td>.001</td>
</tr>
<tr>
<td>3 Sight Word Reading</td>
<td>.215</td>
<td>.082</td>
<td>8.075</td>
<td>.006</td>
</tr>
<tr>
<td>4 Spelling</td>
<td>.218</td>
<td>.004</td>
<td>.364</td>
<td>n.s.</td>
</tr>
<tr>
<td>2 Sight Word Reading</td>
<td>.160</td>
<td>.153</td>
<td>14.164</td>
<td>.000</td>
</tr>
<tr>
<td>3 Spelling</td>
<td>.167</td>
<td>.007</td>
<td>.627</td>
<td>n.s.</td>
</tr>
<tr>
<td>4 CTOPP</td>
<td>.218</td>
<td>.052</td>
<td>5.022</td>
<td>.028</td>
</tr>
</tbody>
</table>
Table 16 (continued)

**Hierarchical Regression Analyses Displaying Order of Entry of Predictor Variables on Flashcard Reading of Content and Function Words When Words Were Taught Without Sentences (N = 81).**

<table>
<thead>
<tr>
<th>Model</th>
<th>R²</th>
<th>R² Change</th>
<th>F Change</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading Function Words</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Literacy&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.269</td>
<td>.269</td>
<td>9.421</td>
<td>.000</td>
</tr>
<tr>
<td>2 PPVT</td>
<td>.308</td>
<td>.039</td>
<td>4.280</td>
<td>.042</td>
</tr>
<tr>
<td>1 PPVT</td>
<td>.046</td>
<td>.046</td>
<td>3.797</td>
<td>.055</td>
</tr>
<tr>
<td>2 Literacy&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.308</td>
<td>.262</td>
<td>9.571</td>
<td>.000</td>
</tr>
<tr>
<td><strong>Reading Function Words</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 PPVT</td>
<td>.046</td>
<td>.046</td>
<td>3.797</td>
<td>.055</td>
</tr>
<tr>
<td>2 CTOPP</td>
<td>.129</td>
<td>.083</td>
<td>7.466</td>
<td>.008</td>
</tr>
<tr>
<td>3 Spelling</td>
<td>.138</td>
<td>.008</td>
<td>.756</td>
<td>n.s.</td>
</tr>
<tr>
<td>4 Sight Word Reading</td>
<td>.308</td>
<td>.170</td>
<td>18.638</td>
<td>.000</td>
</tr>
<tr>
<td>2 CTOPP</td>
<td>.129</td>
<td>.083</td>
<td>7.466</td>
<td>.008</td>
</tr>
<tr>
<td>3 Sight Word Reading</td>
<td>.307</td>
<td>.178</td>
<td>19.807</td>
<td>.000</td>
</tr>
<tr>
<td>4 Spelling</td>
<td>.308</td>
<td>.000</td>
<td>.014</td>
<td>n.s.</td>
</tr>
<tr>
<td>2 Sight Word Reading</td>
<td>.291</td>
<td>.245</td>
<td>27.009</td>
<td>.000</td>
</tr>
<tr>
<td>3 Spelling</td>
<td>.291</td>
<td>.000</td>
<td>.000</td>
<td>n.s.</td>
</tr>
<tr>
<td>4 CTOPP</td>
<td>.308</td>
<td>.016</td>
<td>1.781</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

*Note. n.s. = not statistically significant at p < .05.*  
<sup>a</sup> the literacy predictor combined three measures, CTOPP (Comprehensive Test of Phonological Processing), spelling of nonwords scored at the letter level, and Woodcock Reading Test.
The first set of hierarchical linear regressions was conducted on the outcome measure of content word reading taught without sentences. Scored was the total number of words read correctly across the three trials of flashcard reading. In the first model, three literacy variables were entered together as the first step. This was done to control for performance on these measures in order to determine if language proficiency, as measured by the PPVT, explained a significant amount of unique variance beyond that accounted for by the literacy measures. The order of these steps was reversed in the second set of analyses: PPVT entered first and literacy measures entered second. Results are shown in Table 16.

For performance reading content words in isolation, literacy skills, when entered first, explained a significant amount of variance (22%), and language proficiency did not explain a significant amount of additional variance beyond that explained by the literacy measures. When language proficiency was entered first, it did not account for a significant amount of variance on its own, and literacy skills explained a unique amount of variance beyond that explained by language proficiency. In other words, language proficiency as measured by vocabulary scores did not predict performance of reading content words in isolation, but literacy skills collectively accounted for a significant amount of unique variance. This may not be surprising as the content words were all highly familiar nouns.

The same hierarchical linear regression analysis was conducted on the reading of function words presented without sentence contexts (see Table 16). In the first model, literacy was a significant predictor of reading function words, and language proficiency explained a significant amount of unique variance (4%) beyond that explained by literacy skills. When the predictor variables were entered in reverse order, language proficiency was borderline in accounting for a significant amount of variance, and literacy skills explained a significant amount of unique
variance (26%) beyond that of the vocabulary variable. Unlike performance on reading content words, for performance on reading function words, language proficiency and literacy skills both explained significant unique variance, reflecting differences among children in recognizing the semantic identities of function words heard in isolation.

To investigate which literacy skills explained unique variance after language proficiency was entered, two sets of hierarchical linear regressions were conducted on dependent variables involving the reading of content words in isolation and function words in isolation. For these analyses, language proficiency (PPVT) was entered first and each literacy measure was entered either as the second, third, or fourth predictor variable. The question of interest was whether each of these predictors when entered last explained unique variance in reading each word class.

For performance reading content words in isolation, sight word reading (7%) and phonemic awareness (CTOPP) (5%) each explained a significant amount of unique variance after all the other literacy measures had been entered in the model (see Table 16). In contrast, spelling of nonwords did not account for a significant amount of unique variance when entered last. For performance reading function words in isolation, sight word reading was the only literacy variable that accounted for significant unique variance (17%) after the other two literacy measures were entered.

*Partial versus Full Alphabetic Readers.* Participants were categorized as being in either Ehri’s (2005) partial or full alphabetic phase of reading depending on their performance on the nonword reading pretest. Students who did not read any of the nonwords correctly or refused to attempt to decode the words were considered partial alphabetic readers ($N = 34$), and students who read a minimum of one nonword correctly were considered to be transitioning into the full alphabetic phase of word reading ($N = 47$; see Table 17). ANOVAs with alphabetic phase,
language status (native vs. nonnative), and treatment (OM vs. control) as between subjects
variables and sentence context (words learned with vs. without sentences) and word type
(content vs. function words) as within subjects variables were conducted with word reading,
spelling, and sentences production as the dependent variables. Another ANOVA was conducted
using the three between subject variables with performance on the orthographic mapping posttest
as the dependent variable.
Results revealed a significant difference between partial and full alphabetic readers’ success on the orthographic mapping posttest (see Table 17). Comparison of means revealed that full alphabetic readers performed better on the orthographic mapping measure. ANOVA of means revealed a significant difference between partial and full alphabetic readers’ performance on the word reading task (see Table 17). Comparison of the means indicated that full alphabetic readers performed better reading the target words than partial alphabetic readers. ANOVA of means revealed a significant difference between partial and full alphabetic readers’ performance on the spelling task (see Table 17). Comparison of the means indicated that full alphabetic readers performed better spelling the target words than partial alphabetic readers. No significant differences between partial and full alphabetic readers were found on the sentence generation
task. The ANOVAs included several other independent variables: treatment, native/non-native English, word class, and sentence context. Across all ANOVAs, only one interaction involving phase was found to be statistically significant, that between sentence context, word type, alphabetic phase, and treatment on the measure of sentence production, $F(1,73) = 4.15$, $p = .045$. The pattern of mean differences across these variables was uninterpretable. Why this interaction occurred is not clear.

To further compare performance of the two alphabetic groups on the relevant outcome measures, effect sizes (Cohen’s $d$) were calculated. These are reported in the right-hand column in Table 17. Inspection of these values reveals that effects were large ($d$s ranging from .71 to 1.35) across the orthographic mapping, word reading, and spelling tasks. This indicates that partial and full alphabetic readers differed substantially in their orthographic mapping, word reading, and spelling performance. Full alphabetic readers were more successful than partial alphabetic readers on these tasks. In contrast, alphabetic phase (partial vs. full) exerted only a moderate effect ($d = .32$) on the students’ performance on the sentence production task.
Chapter 6

Discussion

Summary of Results

The purpose of this research was threefold: 1.) to investigate whether training beginning readers in orthographic mapping transfers and supports word reading, 2.) to investigate the impact of learning to read, spell, and properly use words when the words are either embedded in a sentence or taught in isolation on flashcards, 3.) to investigate the effect of word class (content vs. function) on word learning. All of these hypotheses were tested separately with native and nonnative speakers in order to determine if different patterns emerged in the two populations. Additionally, this study investigated whether literacy and language skills predicted reading of words presented in isolation on flashcards, which is a common practice used in schools.

Regarding the OM training condition, students received instruction in isolating individual sounds in words and moving the letters that make each sound into individual Elkonin boxes. Special attention was given to the movements that the mouth makes when saying each sound. The experimenter used a magnifying glass to enlarge her mouth while she said each sound, and the students were given small mirrors to look at their mouths while they said each sound. The control group received interactive read aloud sessions for the equivalent amount of time as the treatment condition.

An orthographic mapping (OM) posttest was administered to all students to assess their ability to map letter sound correspondences in words. Also, a flashcard reading task was conducted in which students studied each word during the first trial, and then in three subsequent trials they attempted to read the word. Two sets of words were learned: in one set the words were embedded in sentences and in the other set the words were taught in isolation. Each set contained
an equivalent number of content and function words. After each flashcard word reading task was completed, students were asked to spell each of the words and to use the words in a grammatically correct and contextually rich sentence.

Results on the OM posttest showed that trained students outperformed controls, confirming that they learned what they were taught. While results did not provide evidence showing the effectiveness of the OM treatment over the control group on word reading and spelling posttests, three noteworthy interactions emerged involving the treatment condition. First, on the word reading task, an interaction between sentence context, word class, and treatment was found for native speakers. Contrasting patterns were evident in reading content words and function words taught with sentences for the two treatment groups. Word reading means were similar for content and function words in the control group, but they were quite disparate in the OM group with content words read much better than function words. One interpretation is that OM training boosted performance reading content words taught with sentences and suppressed performance reading function words taught in sentences compared with no training. Why this happened is not clear since OM training did not focus on word meanings or sentences.

Another significant interaction between sentence context, word class, and treatment was found on the spelling task for nonnative speakers. A close examination of the means showed that OM training better supported spelling of content words learned with sentences and function words learned without sentences compared to the control group. Scores of students who received OM training were similar in spelling content and function words when learned without sentences. This suggests that OM training may have boosted recall of function words by making students more sensitive to orthography. However, another interaction between word class and treatment showed that OM trained students and control students performed equally well
embedding content words in sentences; however, OM students performed significantly worse embedding function words in sentences. It will be up to future research to further explore the effect of OM training on kindergarten native and nonnative speakers’ word reading to explicate these findings.

Analyses of performance in the flashcard word reading task showed that both native and nonnative students performed significantly better reading words when the words were presented in isolation than when they were embedded in sentences. Both groups also performed significantly better reading content words than function words. In addition, performance over learning trials revealed that content words were initially easier to learn than function words and they became increasingly easier as learning proceeded.

Results of the spelling task demonstrated that native speaking students spelled words significantly better when words were taught in isolation than when they were embedded in sentences. However, this was not the case for nonnative speakers. There was no significant difference in their spelling performance as a function of sentence context. Also, both native and nonnative speakers performed significantly better spelling content words than function words.

Results of the sentence production task revealed that for both native and nonnative speakers learning words embedded in sentences significantly improved their ability to use the words in grammatically correct and contextually rich sentences. Also, both native and nonnative speakers performed significantly better embedding content words than function words in sentences. Additionally, nonnative speakers who received the OM treatment condition performed significantly better on the sentence production task than nonnative students who received the control condition. This finding will be discussed in more detail below.
Taken together, these findings suggest that learning to read, spell, and use words in sentences was impacted by the context in which the words were taught and the type of word being learned. Both native and nonnative speakers were better able to remember how to read the words over three test trials when words were taught in isolation compared to context and when they were content words rather than function words. This was also the case for remembering the spellings of words for native speakers and for remembering the spellings of content words for both native and nonnative speakers. However, learning words embedded in a sentence better supported native and nonnative speakers’ ability to use the words properly in a sentence than reading them in isolation.

One question addressed in the present study was the extent to which nonnatives’ word leaning might differ from that of native English speaking children as a function of orthographic mapping training, word type, and meaning clarifying sentences. Effect sizes revealed that natives and nonnatives differed very little in their word reading and spelling performance. In contrast, effect sizes were more substantial across variables in the sentence production task, with \( ds \) ranging from .31 to .70 except in one comparison. As expected, natives were more successful than nonnatives in embedding the target words in grammatical and meaningful sentences. Interestingly, there was a significant difference between nonnative OM and control groups on the sentence production posttest. Results demonstrated that nonnatives in the OM group significantly outperformed the control group even though the intervention did not focus on semantics.

When students were divided into partial and full alphabetic readers and their performance was analyzed, a significant difference was found between the two groups on the orthographic mapping, word reading, and spelling tasks. Comparisons of the means indicated that full alphabetic readers performed better than partial alphabetic readers on all three tasks. Effect sizes
were large to very large in favor of the full alphabetic readers indicating that they performed substantially better than the partial alphabetic readers. Unlike the significant difference found between students in the partial and full alphabetic groups, students within each language status group (native vs. nonnative) performed similarly.

While partial and full alphabetic readers differed significantly on orthographic tasks of mapping letters to sounds, word reading, and spelling, they did not differ on the oral sentence production task. This is not surprising when considering Ehri’s (2005) theory which distinguishes phases in terms of orthographic mapping processes to support word reading and spelling but says little about syntactic and semantic language competencies. A partial phase reader might be skilled at generating sentences orally but might struggle to read and spell words.

Results of the hierarchical regression analyses revealed differences in predictor variables depending on whether students were learning content or function words taught in isolation on flashcards. In the analysis of content words, literacy skills, specifically sight word reading and phonemic awareness, accounted for a significant amount of unique variance. However, for function words, language proficiency and literacy skills both accounted for a significant amount of unique variance. When literacy skills were entered individually, sight word reading was the only literacy skill that accounted for a significant amount of unique variance after the other variables were entered into the model.

These findings suggest that attention should be paid to a young reader’s English language proficiency when assigning the task of reading function words in isolation. These findings raise the question whether PPVT would predict function word reading also when the words were taught in sentences. An additional analysis was conducted to investigate this question. The results of hierarchical linear regressions of content and function words taught in context using
the same series of predictor variables as in Table 16 revealed virtually identical findings. In the analysis of content words, literacy skills entered collectively and sight word reading more specifically accounted for a significant amount of unique variance. However, for function words, language proficiency and literacy skills again both accounted for a significant amount of unique variance. Also, when literacy skills were entered individually, sight word reading was the only literacy skill that accounted for a significant amount of unique variance after all other variables were entered into the model. This suggests that attention to young reader’s English language proficiency should be considered when learning to read function words both in context and in isolation. Apparently, learning to read function words demands greater proficiency in English than learning to read content words. For nonnative speakers, mastering these words may require additional support from instructors.

Orthographic Mapping Skills

It was hypothesized that children who received training in OM would learn to read words taught on flashcards more easily than children in the control group. Findings of the present study demonstrated that the OM group outperformed the control group on the OM posttest; however, learning did not transfer to the word learning task. In other words, training in orthographic mapping in the present study did not result in significantly better word reading or spelling performance for native or nonnative speakers as compared to no OM training. Also, OM training did not facilitate partial alphabetic readers in performing more like full alphabetic readers in their word reading and spelling skills.

The orthographic mapping training in the present study included elements from studies conducted by Boyer and Ehri (2011) and Ehri, Satlow, and Gaskins (2009). The absence of effect of the OM training may be due to the fact that not enough attention was given to articulatory
features, as was done in Boyer and Ehri (2011). In the present study, a magnifying glass and mirrors were used to draw students’ attention to the movements of their mouths. Boyer and Ehri used tiles with pictures of articulatory features and trained students to match the movements of their mouths to those of the tiles. This is an added level of analysis that was missing from the present study. Moreover, Boyer and Ehri provided substantially more training sessions by taking students to criterion in the training condition and students were trained individually. This is in stark contrast to the training provided in the present study in which small groups of students were trained together in only three sessions.

The absence of the effect of the OM training may also be due to the fact that the concept of comparing the number of sounds to the number of letters in words may have been too developmentally advanced for kindergarteners. Ehri, Satlow, and Gaskins (2009) used this compare and contrast technique between the number of sounds and letters in a word with first, second, and third graders. Older students have more advanced numeracy skills and larger working memories to hold two pieces of conflicting information. For all of these reasons learning in the OM condition may not have transferred to the word learning task.

**Teaching Words in Context vs. Isolation**

It was hypothesized that children would learn to read both content and function words more easily when the words were taught in isolation without sentences than when the words were accompanied by meaning clarifying sentences. Also, it was hypothesized that children would be better able to embed content and function words in grammatically correct and contextually rich sentences when the words were taught with meaning-clarifying sentences than when the words were taught in isolation. Results supported both of these hypotheses. Students read and spelled words better when they were learned in isolation than in context, but students
were better able to embed words in sentences when the words were taught in context than in isolation.

Findings of the current study replicate and extend the findings of Ehri and Roberts (1979) who investigated skills and experiences that facilitate word learning for first graders. In their study one group read target words in meaningful contexts while the other group read target words on flash cards and then heard meaningful sentences that contained the words. The researchers found that students who read words in context learned the semantic identities of words better than students in the isolation group; however, students in the isolation group better learned the orthographic representation of the words. In addition, Ehri and Wilce (1980) investigated the difference between the learning of function words in isolation and in sentence contexts. Again, students who read words embedded in contexts learned more about the syntactic/semantic identity of the words compared to students reading words in isolation who learned more about the orthographic identity of the words.

The findings of the current study replicate these findings and extend them to nonnative speakers. Both native and nonnative speakers better learned to read words when they were presented in isolation on flashcards. Also, native speakers better learned to spell the words when they were presented in isolation. However, both native and nonnative speakers better learned to use the words in grammatically correct and contextually rich sentences when the words were learned embedded in a sentence.

These findings support Ehri’s (1992) almagamation theory. Ehri explains that attention to a word’s letter-sound relationships coupled with knowledge of the word’s meaning more securely stores the word in memory. In this study, when words were presented only in isolation attention could be spent analyzing the grapheme-phoneme relationships in the word, but when
words were presented once in isolation and then embedded in context students may have spent less time mapping spellings on to pronunciations. Likewise, hearing the word embedded in a meaningful context facilitated better knowledge of the syntactic/semantic identity of the word than only being taught the word in isolation because students were able to hear the word used in multiple ways.

These findings also support the claims of Ehri and Roberts (1979) and Ehri and Wilce (1980) that word learning experiences affect the type of word knowledge acquired by the reader. Learning to read words in isolation allows attention to be paid to the orthographic identity of a word. Readers can analyze the letter-sound relationships in the word as they say the word aloud while looking at the printed version of the word on the card, and this more complete image of the word can be stored in memory. This learning experience supports the bonding of the pronunciation and spelling of the word in memory and facilitates word reading retrieval. However, this form of word learning experience provides less support to gaining knowledge of the syntactic/semantic identity of the word. As demonstrated in this study, students were better able to embed words in grammatically correct and semantically rich sentences when they were taught the words in a meaning context. This form of word learning experience bonded the pronunciation of the word to its meaning. In other words, when students heard the word read aloud by the experimenter they were better able to use it properly in a sentence. However, words learned in context were not as well retrieved in the word reading and spelling tasks as compared to when words were taught in isolation. Again, Ehri’s theory argues that knowledge of the pronunciation, spelling, and meaning of a word are necessary for proper word storage. In this study students demonstrated that learning experiences support one or the other of the necessary
components to storing words in memory. The implications of these findings for practitioners are discussed below.

**Content vs. Function Words**

It was hypothesized that children in both the OM and control groups would learn to read content words more easily than function words in the flashcard task. Not only did the findings support this hypothesis, they also demonstrated that content words were easier to spell and embed in sentences. The findings support those of Ehri’s (1975) investigation of readers’ and prereaders’ metalinguistic awareness. Ehri found that prereaders had the most difficulty distinguishing function words in a sentence segmentation task. Many combined the function words with other words in the sentence, or they stated the word separately but did not recognize its syntactic function. As a follow-up, Ehri (1976) investigated the effect of word class on prereaders’ and readers’ ability to learn new words. They found that context-free words (content words) were easier for students to recognize, spell, and use than context dependent words (function words).

It was also hypothesized that the presence of sentences would benefit children's learning of function words more than the learning of content words when compared to the absence of sentences. To investigate this hypothesis differences in sentence context versus isolation for content versus function words were compared. This was hypothesized because sentence contexts were thought to make function words easier to learn because function words are context dependent. In other words, it was thought that memory for content words would remain stable across sentence conditions, but memory of function words would be better in the sentence condition than in the isolation condition. No significant interactions were found thus failing to support this hypothesis. Contrary to this hypothesis, results demonstrated that both content and
function words were learned better when taught in isolation. This suggests that memory for orthography (grapheme-phoneme relations) is more important for reading and spelling both types of words.

Findings demonstrated that content words were easier to read, spell, and embed in sentences than function words regardless of whether they were taught in isolation or with sentence contexts. Even though activation of the syntactic and semantic identity of function words depends on the presence of other words in meaningful sentences, teaching these words in contexts was not sufficient to reduce or eliminate the difference favoring nouns. No interactions between word class and context in support of this pattern were detected in the present study. One possible explanation is that nouns are higher in imagery activation than function words, and other studies have shown that imagery strengthens word memory (Sadoski & Paivio, 2013). Concrete nouns activate a semantic representation that fully captures the meaning of the word in memory whereas function words do not.

The present study replicates and extends the findings of Ehri (1975, 1976) by investigating the difference in natives’ and nonnatives’ ability to read, spell, and properly use content and function words in sentences. Again, the reading, spelling, and semantic/syntactic use of content words were more effectively learned than that of function words for both language groups. This occurred even though lower grade equivalent reading levels favored better performance on the context-dependent function words. This finding is important when considering that word lists for beginning readers contain a large number of function words (i.e., a, the, and, but, or, this). In fact, on the Dolch Word List 14 out of the 40 words on the pre-primer list and 24 out of the 52 words on the primer list, as well as 25 out of the 58 words on the
The core preprimer list from Harris and Jacobson (1980) fall in the category of context dependent/function words as used in this study.

Furthermore, the present study investigated which skills (spelling knowledge, word reading, and vocabulary/language proficiency) explained unique variance in children’s word learning when the words were taught in isolation. The findings revealed that nonnative speakers performed worse in reading, spelling and using function words as compared to learning content words, and results of hierarchical linear regression models indicated that language proficiency accounted for unique variance in reading function words taught in isolation as well as taught in context. This falls in line with Morris’s (2001) findings that ELLs need additional support in learning function words. Morris found that ELLs left out more form/function words than content words in their writing, and they spelled content words better than form/function words, even though the form/function words were considered high frequency words.

These findings are also important when considering the fact that nonnative speakers are often initially provided with lists of high frequency word lists to memorize. These high frequency word lists contain many function words. This process may be futile at best if the nonnative speaker does not have sufficient knowledge of the English language. That being said, nonnative speaking beginning readers may be better served by learning to read content words first because language proficiency did not account for a significant amount of unique variance after literacy variables were entered and they performed better on reading, spelling and using content words.

**Strengths and Limitations**

The present study examined the benefit of providing kindergarteners with orthographic mapping training, and it also examined the difference in young children’s reading, spelling, and
sentence generation skills when they learned content or function words taught either in context or isolation. One interesting finding was that learning words in isolation better supported word reading and spelling skills, but learning words embedded in sentences better supported students’ ability to use the words properly in sentences. Also, function words were more difficult to read, spell, and embed in sentences than content words.

The present study was an experiment with a counterbalanced design in which participants were randomly assigned to treatment and control conditions. This allows for outcome differences to be attributed to the treatment, sentence context, and word class variables that were manipulated. Forty one nonnative and 40 native speakers participated in the study resulting in approximately 20 children in each treatment group and a total of 81 participants altogether. This provided sufficient power for hypothesis testing. Moreover, including native and nonnative speakers from low SES communities in a metropolitan area improved the external validity of the study. The US school system is facing an ever increasing influx of nonnative speaking children and, as Goldenberg (2008, 2013) points out, the need to experimentally examine effective strategies to support their early literacy skills is in high demand.

Threats to internal validity were addressed. Analysis of the pretest scores of participants demonstrated that the treatment and control groups were equivalent in their early literacy and vocabulary skills. With regard to time on task, the treatment and control groups were engaged in activities for an equivalent amount of time during each training session. With regard to experimenter bias, a team of four research assistants were kept blind to the hypotheses of the study. They supported the principal investigator in administering pre and posttest measures.

Several limitations of the study should be acknowledged. First, the fact that the orthographic mapping training was conducted for only three successive days instead of training
students individually to criterion may have weakened the impact of training effects. This may be why there were no main effects of the treatment condition for native and nonnative speakers.

Second, students were tested in small groups of 3-4 students. Training students individually to criterion may have resulted in more robust findings for the treatment condition. Additionally, the 30-35 minute sessions for the orthographic mapping training seemed to be too taxing for some of the kindergarten students. While all the students completed the sessions and all students seem to be excited to work with the experimenter each day, the experimenter observed that motivation seemed to dwindle as the sessions extended past 15 minutes. Future research should consider conducting the orthographic mapping training over the course of multiple weeks and have each session last for a shorter amount of time (15 minutes). In doing so, additional effects of the orthographic mapping training may be observed.

Another limitation of the study is the categorization of students as native and nonnative speakers. In the present study, teachers indicated whether the students were native speakers who had learned English at birth or a very early age, or nonnative speakers. Teachers’ decisions were based on school records and their knowledge of the language proficiency of each child, as well as anecdotal knowledge of the language proficiency of the child’s primary caregiver. The teacher rating scale of language proficiency was used to gather and analyze this information. However, distributions of the language (listening, speaking) and literacy (reading, writing) scales revealed bimodal distributions. Due to this, scores on the PPVT were used as a measure of native and nonnative language status in the hierarchical linear regression models. While the PPVT did demonstrate significant differences between the two groups, future studies should include multiple measures of language proficiency, including questionnaires for primary caregivers and a more nuanced language proficiency rating scale, in order to classify students according to
language status. This would allow for a more comprehensive categorization of nonnative speakers who are truly still acquiring English language skills.

In the current study ELLs came from various language backgrounds. Future studies should examine performance of students from specific native languages in greater depth. It may be that students from a particular native language have either an easier or more difficult time acquiring sight words due to similarities or differences in the structure of their native language to English. Also, future studies should examine students’ ability to read and write in their native language. This is important in order to determine the possible influence of familiarity with a writing system in the first language boosting performance in orthographic tasks in English.

Additionally, the fact that differences were evident between partial and full alphabetic readers but not native and nonnative speakers in learning to read, spell, and embed words suggests that native-nonnative may not be a relevant distinction when studying these skills in beginning readers. Rather, students’ standing in terms of their literacy skills is more important. This was indicated not only in the analyses of variance, but also in the comparison of effect sizes for partial and full phase readers. Effect sizes were much greater between phase groups than between native and nonnative groups.

It should also be acknowledged that only six function words were used in this study, and analysis of performance for individual words were not uniformly consistent, as evident in Tables 13 and 14. It will be up to future studies to further explore the specific types of function words that are the most difficult for beginning readers to learn.

**Implications for Practice and Future Directions**

The findings from the present study carry important educational implications. While training students in small groups was mentioned as a limitation of this study, it is important to conduct studies that mimic what actually occurs in classroom settings. Teachers are far more
likely to work with small groups of students than to find the time to work with students individually. As previously mentioned, in order to make the treatment condition more effective, future research should reduce the length of time of each session to make it more developmentally appropriate and increase the number of sessions that students receive over time. Future research should also combine the training protocol from the present study with the protocol of Boyer and Ehri (2011) in order to include a third training group that uses articulatory pictures. The combination of these two techniques may prove fruitful for natives and nonnatives in the partial alphabetic phase.

Future research should also investigate the substantial improvement of nonnatives’ sentence production skills when they participated in the OM treatment condition. The treatment did not focus on language production skills, but the small-group intervention with nonnative English speakers may have provided additional, unintended support in English language skills that benefited students in the sentence generation task. It may have been that working in small intensive groups supported overall language ability for nonnative speakers. Future research should further investigate this finding.

Educators should consider the finding that the presentation of words to kindergarten students matters with regards to the particular aspect of the word’s identity that the students are likely to acquire. Teachers need to consider that learning words includes their orthographic and syntactic/semantic identities. Students’ skills and learning goals should be taken into consideration in preparing word learning lessons. If a child is able to read a word when it is presented in isolation, but is unable to use the word in a sentence, teachers should consider providing explicit examples of the word in context. Likewise, if the child is able to use the word in a sentence but is unable to read or spell it, teachers should present the word in isolation for the
student to study. Moreover, teachers should pay considerable attention to the word acquisition skills of nonnative speakers who have had less exposure to colloquial English and to English in print.

Educators should also critically examine preprimer and primer word lists before assigning word learning tasks. As mentioned previously, these lists are full of function words, and students are often given lists of these words to memorize in the primary grades. Findings of the present study indicate that function words are more difficult than content words for young native and nonnative speakers to read, spell, and use in grammatically correct sentences. This is counterintuitive when considering that function words on these preprimer and primer word lists are often considered to be basic, short words that adults assume are easier for children to read than longer, seemingly more complex content words. However, this study demonstrated that function words were more difficult to learn than content words. It may be that the purpose of having students memorize these lists of words that include several function words needs to be reconsidered altogether.

In addition, acquiring function words may be particularly difficult for nonnative speakers. Findings from this study indicate that language proficiency is a factor in students’ ability to read function words in isolation. This falls in line with Morris’s (2001) finding that fifth and sixth grade nonnative speakers had more difficulty spelling and using function words appropriately in their writing. Function words may require additional analysis of the orthography and exposure to the use of the word in context, and this additional analysis may be even more important for nonnative than native English speakers.

Taken together, general education, dual language, and ESL teachers should pay special attention to the learning of these function words. A students’ level of language proficiency
should be taken into consideration before assigning flashcard reading of such words. Also, it may be beneficial to consider experiences specific to the learning of content and function words from lists of high frequency words that are commonly used in schools. Success in reading, spelling, and using content words should be established and used as a spring board for learning function words. Again, fostering success in literacy and language skills may be particularly important for nonnative speakers who have had less exposure to the English language and may feel acutely insecure about their developing skills. Anyone who has ever learned a new skill can attest that success breeds success. Nowhere in education do we need to foster such a feeling of success and encouragement than in early literacy development both for native and nonnative speakers.
## Appendix A

### Target Words and Training Words

<table>
<thead>
<tr>
<th>Flashcard Target Words</th>
<th>Orthographic Mapping Training Words (onset/ rime)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.) gave</td>
<td>onset: gait</td>
</tr>
<tr>
<td></td>
<td>rime: save</td>
</tr>
<tr>
<td>2.) held</td>
<td>onset: help</td>
</tr>
<tr>
<td></td>
<td>rime: weld</td>
</tr>
<tr>
<td>3.) told</td>
<td>onset: toad</td>
</tr>
<tr>
<td></td>
<td>rime: fold</td>
</tr>
<tr>
<td>4.) kept</td>
<td>onset: kelp</td>
</tr>
<tr>
<td></td>
<td>rime: lept</td>
</tr>
<tr>
<td>5.) since</td>
<td>onset: sit</td>
</tr>
<tr>
<td></td>
<td>rime: wince</td>
</tr>
<tr>
<td>6.) might</td>
<td>onset: my</td>
</tr>
<tr>
<td></td>
<td>rime: fight</td>
</tr>
<tr>
<td>7.) farm</td>
<td>onset: far</td>
</tr>
<tr>
<td></td>
<td>rime: arm</td>
</tr>
<tr>
<td>8.) soap</td>
<td>onset: soak</td>
</tr>
<tr>
<td></td>
<td>rime/same vowel: coap (cope)</td>
</tr>
<tr>
<td>9.) heat</td>
<td>onset: heap</td>
</tr>
<tr>
<td></td>
<td>rime: eat</td>
</tr>
<tr>
<td>10.) crab</td>
<td>onset: craft</td>
</tr>
<tr>
<td></td>
<td>rime: lab</td>
</tr>
<tr>
<td>11.) clock</td>
<td>onset: clop</td>
</tr>
<tr>
<td></td>
<td>rime: lock</td>
</tr>
<tr>
<td>12.) fence</td>
<td>onset: felt</td>
</tr>
<tr>
<td></td>
<td>rime: hence</td>
</tr>
</tbody>
</table>
Appendix B

Alphabetic Spelling Knowledge: Letter Writing Script

Name: _______________  ID#: __________________  Date: _______________

- “I am going to say the name of a letter. I want you to write the letter that I say on the line next to the number. If you do not know how to write the letter just say I don’t know.”

- Score as the child reads. Circle any letters that he/she writes incorrectly on the data sheet below.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.) D</td>
<td>2.) J</td>
<td>3.) C</td>
<td>4.) N</td>
<td>5.) H</td>
</tr>
<tr>
<td>6.) K</td>
<td>7.) I</td>
<td>8.) T</td>
<td>9.) R</td>
<td>10.) O</td>
</tr>
<tr>
<td>11.) G</td>
<td>12.) B</td>
<td>13.) U</td>
<td>14.) E</td>
<td>15.) P</td>
</tr>
<tr>
<td>16.) S</td>
<td>17.) W</td>
<td>18.) L</td>
<td>19.) F</td>
<td>20.) Y</td>
</tr>
<tr>
<td>21.) A</td>
<td>22.) M</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C

Alphabetic Spelling Knowledge: Letter Writing Worksheet

Name: ____________________ ID#:____________________ Date:_________________

1.) _______  2.) _______  3.) _______  4.) _______  5.) _______

6.) _______  7.) _______  8.) _______  9.) _______  10.) _______

11.) _______  12.) _______  13.) _______  14.) _______  15.) _______

16.) _______  17.) _______  18.) _______  19.) _______  20.) _______

21.) _______  22.) _______
Appendix D

Alphabetic Spelling Knowledge: Letter Sound Script

Name: ___________________   ID#: ___________________   Date: ___________________

- “Now I am going to point to a letter. I want you to say the sound that the letter makes. If you do not know the sound of a letter just say I don’t know.”

- Point to each letter on the student’s worksheet. Score as the child reads. Circle any letters that he/she states incorrectly on the data sheet below.

- If the child gives the letter name say, “That’s the name of the letter. Can you tell me its sound?”

- For failed letter-sounds or if the child doesn’t know the sound say, “Do you know the name of the letter?” Make a note on the score sheet that the child stated the name instead of the sound.

<table>
<thead>
<tr>
<th>1.) D</th>
<th>2.) J</th>
<th>3.) C</th>
<th>4.) N</th>
<th>5.) H</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.) K</td>
<td>7.) I</td>
<td>8.) T</td>
<td>9.) R</td>
<td>10.) O</td>
</tr>
<tr>
<td>11.) G</td>
<td>12.) B</td>
<td>13.) U</td>
<td>14.) E</td>
<td>15.) P</td>
</tr>
<tr>
<td>16.) S</td>
<td>17.) W</td>
<td>18.) L</td>
<td>19.) F</td>
<td>20.) Y</td>
</tr>
<tr>
<td>21.) A</td>
<td>22.) M</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E

Alphabetic Spelling Knowledge: Letter Sound Worksheet

Name: _________________   ID#:____________________    Date:_________________

<table>
<thead>
<tr>
<th>D</th>
<th>J</th>
<th>C</th>
<th>N</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>I</td>
<td>T</td>
<td>R</td>
<td>O</td>
</tr>
<tr>
<td>G</td>
<td>B</td>
<td>U</td>
<td>E</td>
<td>P</td>
</tr>
<tr>
<td>S</td>
<td>W</td>
<td>L</td>
<td>F</td>
<td>Y</td>
</tr>
<tr>
<td>A</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix F

Alphabetic Spelling Knowledge: Spelling Script

Name: ___________________ ID#: ___________________ Date:_________________

“Now we are going to spell some made-up words that don’t have any meanings. I will say the word, and I want you to repeat the word after me. Then you will write the spelling of the word on the line. Let’s begin.”

- The first word is hud. You say it. (Child repeats). Now write hud.
- The second word is gat. You say it. (Child repeats). Now write gat.
- The third word is kif. You say it. (Child repeats). Now write kif.
- The fourth word is des. You say it. (Child repeats). Now write des.
- The fifth word is jom . You say it. (Child repeats). Now write jom.

I changed the nonwords so that they included letters in the target words.
Appendix G

Alphabetic Spelling Knowledge: Spelling Worksheet

Name: ___________________   ID#:__________________   Date:__________________

1.) ____________________________________________________________

2.) ____________________________________________________________

3.) ____________________________________________________________

4.) ____________________________________________________________

5.) ____________________________________________________________
Appendix H

Word Reading: Target Word Reading Script

Name: ___________________   ID#: ___________________   Date: ___________________

- “Now I’m going to ask you to read a list of words. Please read the words going across the rows. Put your finger below the word that you are reading. You can say I don’t know if you can’t figure out what the word is.”

- Score as the child reads. Circle any words that he, she reads incorrectly on the list below.

<table>
<thead>
<tr>
<th>GAVE</th>
<th>HELD</th>
<th>TOLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>said,</td>
<td>said,</td>
<td>said,</td>
</tr>
<tr>
<td>______</td>
<td>______</td>
<td>______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KEPT</th>
<th>SINCE</th>
<th>MIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>said,</td>
<td>said,</td>
<td>said,</td>
</tr>
<tr>
<td>______</td>
<td>______</td>
<td>______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FARM</th>
<th>SOAP</th>
<th>HEAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>said,</td>
<td>said,</td>
<td>said,</td>
</tr>
<tr>
<td>______</td>
<td>______</td>
<td>______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CRAB</th>
<th>CLOCK</th>
<th>FENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>said,</td>
<td>said,</td>
<td>said,</td>
</tr>
<tr>
<td>______</td>
<td>______</td>
<td>______</td>
</tr>
</tbody>
</table>
### Appendix I

**Word Reading: Target Word Reading**

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<thead>
<tr>
<th>GAVE</th>
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<th>TOLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEPT</td>
<td>SINCE</td>
<td>MIGHT</td>
</tr>
<tr>
<td>FARM</td>
<td>SOAP</td>
<td>HEAT</td>
</tr>
<tr>
<td>CRAB</td>
<td>CLOCK</td>
<td>FENCE</td>
</tr>
</tbody>
</table>
## Appendix J

### Word Reading: Woodcock Word Reading List Worksheet

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.)</td>
<td>is</td>
</tr>
<tr>
<td>2.)</td>
<td>you</td>
</tr>
<tr>
<td>3.)</td>
<td>and</td>
</tr>
<tr>
<td>4.)</td>
<td>up</td>
</tr>
<tr>
<td>5.)</td>
<td>cat</td>
</tr>
<tr>
<td>6.)</td>
<td>stop</td>
</tr>
<tr>
<td>7.)</td>
<td>come</td>
</tr>
<tr>
<td>8.)</td>
<td>jump</td>
</tr>
<tr>
<td>9.)</td>
<td>help</td>
</tr>
<tr>
<td>10.)</td>
<td>book</td>
</tr>
<tr>
<td>11.)</td>
<td>play</td>
</tr>
<tr>
<td>12.)</td>
<td>sun</td>
</tr>
<tr>
<td>13.)</td>
<td>blue</td>
</tr>
<tr>
<td>14.)</td>
<td>two</td>
</tr>
<tr>
<td>15.)</td>
<td>no</td>
</tr>
<tr>
<td>16.)</td>
<td>boy</td>
</tr>
<tr>
<td>17.)</td>
<td>little</td>
</tr>
<tr>
<td>18.)</td>
<td>bed</td>
</tr>
<tr>
<td>19.)</td>
<td>milk</td>
</tr>
<tr>
<td>20.)</td>
<td>car</td>
</tr>
<tr>
<td>21.)</td>
<td>swim</td>
</tr>
<tr>
<td>22.)</td>
<td>fast</td>
</tr>
<tr>
<td>23.)</td>
<td>down</td>
</tr>
<tr>
<td>24.)</td>
<td>rug</td>
</tr>
<tr>
<td>25.)</td>
<td>with</td>
</tr>
<tr>
<td>26.)</td>
<td>find</td>
</tr>
<tr>
<td>27.)</td>
<td>said</td>
</tr>
<tr>
<td>28.)</td>
<td>night</td>
</tr>
</tbody>
</table>
Appendix K

Word Reading: Decoding Words Script

Name: ___________________ ID#: ___________________ Date: ___________________

- “Now I’m going to ask you to read a list of made-up words. They are not real words. They
don’t have any meanings. Please read the words going down the column. Put your finger below
the word that you are reading. These are made-up words so you should try to decode them as
best you can. They may sound funny to you but that is because they are made-up. You can say I
don’t know if you can’t figure out what the word is.”

- Score as the child reads. Circle any words that he/she reads incorrectly on the list below.

**DUT** if read incorrectly, ___________________

**SEP** if read incorrectly, ___________________

**MUL** if read incorrectly, ___________________

**KAF** if read incorrectly, ___________________

**NIB** if read incorrectly, ___________________
Appendix L

Word Reading: Decoding Words Worksheet

DUT

SEP

MUL

KAF

NIB
Language and Social Background Questionnaire

Name of Student: ____________________  ID#: ____________________
Name of Teacher: ____________________  Date: ____________________
Student Birthday: ____________________  Circle: Male or Female

1.) Relative to a native speaker’s performance, rate the child’s proficiency level on a scale of 0 – 100 for the following activities conducted in English.

**English**

<table>
<thead>
<tr>
<th>Activity</th>
<th>No Proficiency</th>
<th>Native-like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Understanding (Comprehension)</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Reading</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Writing</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

2.) Is the child a native or nonnative speaker of English?  Native___________  Nonnative_____
3.) If nonnative, what language(s) does the child speak?
________________________________________________________________________________
Appendix N

Orthographic Mapping Training Script

Session One

Round One- Practice Word

“I am going to teach you to separate the sounds in words and then write letters for the sounds you say and hear in the words.”

“First we are going to stretch the sounds in words. Watch me as I stretch the sounds in the word man, like this ./m/ /a/ /n/ As I say each sound I will hold up a finger for that sound, /m/ /a/ /n/ (hold up finger for each as you say it). Watch how my mouth moves as I say each sound: mmmmaaaaannnn: first my lips are closed to say mmmmm, then my mouth opens to say aaaaa, then my tongue lifts and touches the roof of my mouth to say nnnnn. (Open mouth as you say the sounds so children can see movement.)

Pass out mirrors

“We can see these movements of our mouth in a mirror. Here is a mirror. You say and stretch out the word man and watch your mouth move.” (Children do it. Provide reinforcement, feedback till all can do it.)

“Now put your mirrors down, and let’s begin. Watch my mouth as I make the sounds in the first word.”

- Experimenter states the word.

“rave”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/r/, /ā/, /v/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in rave.”

- Experimenter displays the spelling of the word.
- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two, three, four.”

“This is interesting. We counted that there are three sounds in the word, but there are four letters. That means that either two letters make one sound or one letter doesn’t make any sound. Watch as I say each sound and write the letters that make each sound into a box.”

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Each box represents one sound. Since there are only three sounds in “rave”, we can only fill in three boxes. Notice how the ‘e’ is not put in a box because it doesn’t make a sound on its own. Sometimes letters are left out and sometimes more than one letter can go in each box if there are two or more letters that make a sound. Now you say the sounds in rave as you write the letters that make each sound into a box on your sheet.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

Round 1- Learning Trial

1.) Experimenter states the word.

“save”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/s/, /æ/, /v/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in save.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.
“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, but there are four letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the e and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in save as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

2.) Experimenter states the word.

“jab”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/j/, /a/, /b/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in jab.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, and there are three letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.
- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in jab as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

3.) Experimenter states the word.

“gate”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/g/, /ā/, /t/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in gate.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, but there are four letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the e and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in gate as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”
- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

4.) Experimenter states the word.

“hence”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/h/, /e/, /n/, /s/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in hence.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are four sounds in the word, but there are five letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the e and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in hence as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

5.) Experimenter states the word.
“heap”
- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/h/, /ē/, /p/”

“See how my mouth moves from one sound to the next (repeat word)”
- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in heap.”
- Experimenter displays the spelling of the word.
- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, but there are four letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the a and explain that it doesn’t make a sound.
- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in heap as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”
- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

6.) Experimenter states the word.

“crack”
- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/k/, /r/, /a/, /k/”
“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in crack.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are four sounds in the word, but there are five letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Put the ck together in a box and explain that they make a sound together because both c and k can make the /k/ sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in crack as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

**Round Two- Practice Trial**

“Now, we are going to study those words again. This time I want you to remember how to say the words by stretching out their sounds and counting them, and writing letters for the sounds in boxes.

1.) Experimenter states the word.

“save”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /s/, /ã/, /v/.”
“*We hear three sounds in save.*”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“We’re count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Cross out any letters that don’t make a sound. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

2.) **Experimenter states the word.**

“*jab*”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“*Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /j/ /a/ /b/.*”

“We hear three sounds in jab.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“We’re count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”
- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

3.) Experimenter states the word.

“gate”.
- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /g/, /ä/, /t/.”

“We hear three sounds in gate”
- Experimenter displays the spelling of the word.
- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”
- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Cross out any letters that don’t make a sound. Say the word when you finish.”
- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

4.) Experimenter states the word.

“hence”.
- Students and Experimenter stretch the word and hold up a finger for each sound together.
“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /h/, /ɛ/ /n/, /s/.”

“We hear four sounds in hence.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Cross out any letters that don’t make a sound. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

5.) Experimenter states the word.

“heap”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /h/, /ɛ/ /p/.”

“We hear three sounds in heap.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.
“Now you try to put the letters that make each sound into the boxes without my help. Cross out any letters that don’t make a sound. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

6.) Experimenter states the word.

“crack”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /k/, /r/, /a/, /k/.”

“We hear four sounds in crack.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. You might have to put two letters together in a box. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

**Session 2**
Round 1- Learning Trial

1.) Experimenter states the word.

“clop”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/k/, /l/, /o/, /p/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in clop.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in clop as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

2.) Experimenter states the word.

“lock”
- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/l/, /o/, /k/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in lock.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, but there are four letters. We are going to put two letters together in a box because c and k make the same sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in lock as you write the letters that make each sound into a box on your sheet. Say the word when you finish”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

3.) Experimenter states the word.

“toad”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/t/, /o/, /d/”

“See how my mouth moves from one sound to the next (repeat word)”
- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in toad.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, but there are four letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the a and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in toad as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

4.) Experimenter states the word.

“harm”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/h/, /a/, /r/, /m/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”
“There are four sounds in harm.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in harm as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

5.) Experimenter states the word.

“meld”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/m/, /e/, /l/, /d/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in meld.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”
“We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in meld as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

6.) Experimenter states the word.

“mile”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/m/, /i/, /l/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in mile.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, but there are four letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the e and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.
“Now you say the sounds in miles as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

7.) Experimenter states the word.

“soak”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/s/, /o/, /k/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in soak.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, but there are four letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the a and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in soak as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.
“Good job.”

8.) Experimenter states the word.

“fend”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/f/, /e/, /n/, /d/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in fend.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in fend as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

9.) Experimenter states the word.

“far”
- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/f/, /a/, /r/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in far.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, and there are three letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in far as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

Round 2 - Practice Trial

1.) Experimenter states the word.

“clop”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /c/, /l/, /o/, /p/.”
“*We hear four sounds in clop.*”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“*Let’s count the number of letters in the word.*”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“*Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.*”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“*Watch as I say each sound and write the letters that make each sound into the boxes.*” Say the word altogether.

“*OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.*”

2.) **Experimenter states the word.**

“*lock*”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“*Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /l/, /o/, /k/.*”

“*We hear three sounds in lock.*”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“*Let’s count the number of letters in the word.*”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“*Now you try to put the letters that make each sound into the boxes without my help. Put two letters together that make the same sound. Say the word when you finish.*”
- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

3.) Experimenter states the word.

“toad”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /t/, /o/, /d/.”

“We hear three sounds in toad.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish. Cross out any letters that don’t make a sound.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

4.) Experimenter states the word.

“harm”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.
“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /h/, /a/, /r/, /m/.”

“We hear four sounds in harm.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

5.) Experimenter states the word.

“meld”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /m/, /e/, /l/, /d/.”

“We hear four sounds in meld.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.
“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

6.) Experimenter states the word.

“mile”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /m/, /i/, /l/.”

“We hear three sounds in mile.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Cross out any letters that don’t make a sound. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

7.) Experimenter states the word.

“soak”.
- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /s/, /o/, /k/.”

“We hear three sounds in soak.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish. Cross out any letters that don’t make a sound.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

8.) Experimenter states the word.

“fend”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /f/, /e/, /d/.”

“We hear four sounds in fend.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.
“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

9.) Experimenter states the word.

“far”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /f/, /a/, /r/.”

“We hear three sounds in far.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”
Session 3

Round 1- Learning Trial

1.) Experimenter states the word.
   “cold”
   - Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound
   “/c/, /ɔ/, /l/, /d/”
   “See how my mouth moves from one sound to the next (repeat word)”
   - Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.
   “Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”
   “There are four sounds in cold.”
   - Experimenter displays the spelling of the word.
   - Students and Experimenter count the number of letters in the word.
   “Let’s count the number of letters in the word. One, two….”
   “We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.
   - Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.
   “Now you say the sounds in cold as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”
   - Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.
   “Good job.”

2.) Experimenter states the word.
   “mince”
- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/m/, /i/, /n/, /s/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in mince.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two….”

“We counted that there are four sounds in the word, but there are five letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the e and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in mince as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

3.) Experimenter states the word.

“koap”—pseudoword for experiment (rimes with soap)

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/k/, /o/, /p/”

“See how my mouth moves from one sound to the next (repeat word)”
- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in koap.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two…. ”

“We counted that there are three sounds in the word, but there are four letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the a and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in koap as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

4.) **Experimenter states the word.**

“help”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/h/, /e/, /l/, /p/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”
“There are four sounds in help.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two….”

“We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in help as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

5.) Experimenter states the word.

“tight”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/t/, /i/, /t/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in tight.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two….”
"We counted that there are three sounds in the word, but there are five letters. That means that two letters doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box." Say the word altogether. Cross out the gh and explain that they don’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

"Now you say the sounds in tight as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letters that don’t make a sound."

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

"Good job."

6.) Experimenter states the word.

"kelp"

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

"/k/, /e/, /l/, /p/"

"See how my mouth moves from one sound to the next (repeat word)"

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

"Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear."

"There are four sounds in kelp."

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

"Let’s count the number of letters in the word. One, two...."

"We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box." Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.
“Now you say the sounds in kelp as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

7.) **Experimenter states the word.**

“**cleat**”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/c/, /l/, /ɛ/, /t/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in cleat.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are four sounds in the word, but there are five letters. That means that one letter doesn’t make a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether. Cross out the a and explain that it doesn’t make a sound.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in cleat as you write the letters that make each sound into a box on your sheet. Say the word when you finish. Also cross out the letter that doesn’t make a sound.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.
“Good job.”

8.) Experimenter states the word.

“sip”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/s/, /i/, /p/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in sip.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are three sounds in the word, and there are three letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in sip as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

9.) Experimenter states the word.

“lept”
- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/l/, /e/, /p/, /t/”

“See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are four sounds in lept.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two....”

“We counted that there are four sounds in the word, and there are four letters. That means that each letter makes a sound. Watch as I say each sound and write the letters that make each sound into a box.” Say the word altogether.

- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes.

“Now you say the sounds in lept as you write the letters that make each sound into a box on your sheet. Say the word when you finish.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

**Round 2- Practice Trials**

1.) Experimenter states the word.
“cold”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /c/, /o/, /l/, /d/.”

“We hear four sounds in cold.”
- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

2.) Experimenter states the word.

“mince”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /m/, /i/, /n/, /s/.”

“We hear four sounds in mince.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish. Cross out any letters that don’t make a sound.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.
“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

3.) Experimenter states the word.

“koap”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /k/, /o/, /p/.”

“We hear three sounds in koap.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish. Cross out any letters that don’t make a sound.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

4.) Experimenter states the word.

“help”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /h/, /e/, /l/, /p/.”
“We hear four sounds in help.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

5.) Experimenter states the word.

“tight”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /t/, /i/, /t/.”

“We hear three sounds in tight.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish. Cross out any letters that don’t make a sound.”
- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

6.) Experimenter states the word.

“kelp”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /k/, /e/, /l/, /p/.”

“We hear four sounds in kelp.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

7.) Experimenter states the word.

“cleat”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.
“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /c/, /l/, /ē/, /t/.”

“We hear four sounds in cleat.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish. Cross out any letters that don’t make a sound.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

8.) Experimenter states the word.

“sip”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /s/, /i/, /p/.”

“We hear three sounds in sip.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.
“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”

9.) Experimenter states the word.

“lept”.

- Students and Experimenter stretch the word and hold up a finger for each sound together.

“Now look in your mirror as we stretch and count the number of sounds we hear together. Hold up a finger for each sound that you hear. /l/, /e/, /p/, /t/.”

“We hear four sounds in lept.”

- Experimenter displays the spelling of the word.

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes.

“Now you try to put the letters that make each sound into the boxes without my help. Say the word when you finish.”

- Experimenter says the sounds and writes the letters into the boxes and students check their work.

“Watch as I say each sound and write the letters that make each sound into the boxes.” Say the word altogether.

“OK. Now check your work with mine. Change anything you need to so that it matches my work and then I’ll put a checkmark next to it.”
Appendix O

Flashcard Reading with Meaning Clarification Script

Name: _________________   ID#:____________________    Date:_________________

- “I am going to teach you to read some words. Pay close attention because later I am going to ask you to read the words on your own. Let’s practice. First, I will show you a card, point to the word, and say the word (DO THIS WITH PRACTICE CARD). Then I will gesture for you to say the word (DO THIS). Then, I will show you another card, and I’ll read the sentence on that card while I point to each word (DO THIS). Now let’s begin.”

Study Trial

- Experimenter shows spelling on first card, points to word, and says word. “______________”

- Experimenter gestures for student to say the word. If necessary, “You say it.”

- Experimenter shows a second card and reads the sentence while pointing to each word written on the card to clarify the meaning of the word. “______________________________”

- Experimenter states, “You point to the word _____ in the sentence.”

- Experimenter points to the word and says word. “__________”

- (Repeat for all 8 words.)

Test Trial #1

- “Now I’m going to show you each card that you saw before, and I want you to read each word on your own. Then I’ll read the sentence that goes with each word.”

- Experimenter shows the spelling. ______________

- Student reads the word (give 3 seconds). **Circle: CORRECT   INCORRECT, said________**

- Experimenter tells student the word: “(Yes), that says ………..”

- Experimenter shows a second card and reads the sentence while pointing to each word written on the card to clarify the meaning of the word. “______________________________”
- Experimenter states, “You point to the word ______ in the sentence.”
- Experimenter points to the word and says word.
- (Repeat for all 8 words.)

**Test Trial #2**

- Experimenter shows the spelling. ________________
- Student reads the word (give 3 seconds). **Circle: CORRECT  INCORRECT, said________**
- Experimenter tells student the word: “(Yes), that says ..........”
- Experimenter shows a second card and reads the sentence while pointing to each word written on the card to clarify the meaning of the word. “______________________________”
- Experimenter states, “You point to the word ______ in the sentence.”
- Experimenter points to the word and says word.
- (Repeat for all 8 words.)

**Test Trial #3**

- Experimenter shows the spelling. ________________
- Student reads the word (give 3 seconds). **Circle: CORRECT  INCORRECT, said________**
- Experimenter tells student the word, “(Yes), that says ..........”
- Experimenter shows a second card and reads the sentence while pointing to each word written on the card to clarify the meaning of the word. “______________________________”
- Experimenter states, “You point to the word ______ in the sentence.”
- Experimenter points to the word and says word.
- (Repeat for all 8 words.)
Test Trial #4

- Experimenter shows the spelling. _______________

- Student reads the word (give 3 seconds). **Circle: CORRECT  INCORRECT, said_______**

- Experimenter tells student the word, “*(Yes), that says ..........*”

- Experimenter shows a second card and reads the sentence while pointing to each word written on the card to clarify the meaning of the word. “_______________________________”

- Experimenter states, “*You point to the word _____ in the sentence.*”

- Experimenter points to the word and says word.

- (Repeat for all 8 words.)
Appendix P

Flashcard Reading without Meaning Clarification

Name: ___________________   ID#: ___________________   Date: ___________________

- “I am going to teach you to read some words. Pay close attention because later I am going to ask you to read the words on your own. Let’s practice. First, I will show you a card, point to the word, and say the word (DO THIS WITH PRACTICE CARD). Then I will gesture for you to say the word (DO THIS). Then, I will show you another card, and I’ll read the word again (DO THIS). ”

Study Trial

- Experimenter shows spelling, points to the word, and says word. “______________”

- Experimenter gestures for student to repeat the word. If necessary “You say it.”

- Experimenter shows the spelling again on a second card, points to the word, and Experimenter states the word. “______________”

- Experimenter says, “You point to the word________.”

- Experimenter says, “Yes, that’s the word __________.”

- (Repeat for all 8 words.)

Test Trail #1

- “Now I’m going to show you a card, and I want you to read the word on your own. Then I’ll read the word again.”

- Experimenter shows the spelling. ______________

- Student reads the word (give 3 seconds). Circle: CORRECT  INCORRECT, said________

- Experimenter tells student the word, “That says ………..”

- Experimenter shows the spelling again on a second card, points to the words, and states the word. “______________”

- Experimenter says, “You point to the word________.”
- Experimenter says, “Yes, that’s the word ________.”
- (Repeat for all 8 words.)

Test Trial #2

- Experimenter shows the spelling. ______________

- Student reads the word (give 3 seconds). **Circle: CORRECT  INCORRECT, said________**

- Experimenter tells student the word, “That says ………..”

- Experimenter shows the spelling again on a second card, points to the word, and states the word. “______________”

- Experimenter says, “You point to the word________.”

- Experimenter says, “Yes, that’s the word ________.”

- (Repeat for all 8 words.)

Test Trial #3

- Experimenter shows the spelling. ______________

- Student reads the word (give 3 seconds). **Circle: CORRECT  INCORRECT, said________**

- Experimenter tells student the word, “That says ………..”

- Experimenter shows the spelling again on a second card, points to the word, and states the word. “______________”

- Experimenter says, “You point to the word________.”

- Experimenter says, “Yes, that’s the word ________.”

- (Repeat for all 8 words.)

Test Trial #4

- Experimenter shows the spelling. ______________
- Student reads the word (give 3 seconds). **Circle: CORRECT  INCORRECT, said**

- Experimenter tells student the word, “*That says ...........*”

- Experimenter shows the spelling again on a second card, points to the word, and states the word. “______________”

- Experimenter says, “*You point to the word*****.”

- Experimenter says, “*Yes, that’s the word ********.”

- (Repeat for all 8 words.)
Appendix Q

Flashcard Reading Score Sheet Set A

Study Trial

<table>
<thead>
<tr>
<th>Word</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>farm</td>
<td>Check off__________</td>
</tr>
<tr>
<td>heat</td>
<td>Check off__________</td>
</tr>
<tr>
<td>gave</td>
<td>Check off__________</td>
</tr>
<tr>
<td>clock</td>
<td>Check off__________</td>
</tr>
<tr>
<td>told</td>
<td>Check off__________</td>
</tr>
<tr>
<td>since</td>
<td>Check off__________</td>
</tr>
</tbody>
</table>

Test Trial #1

<table>
<thead>
<tr>
<th>Word</th>
<th>Circle: CORRECT</th>
<th>INCORRECT, said__________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>gave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>farm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>since</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>heat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>told</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Trial #2

<table>
<thead>
<tr>
<th>Word</th>
<th>Circle: CORRECT</th>
<th>INCORRECT, said__________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>since</td>
<td></td>
<td></td>
</tr>
<tr>
<td>heat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>told</td>
<td></td>
<td></td>
</tr>
<tr>
<td>farm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Test Trial #3

gave    Circle: CORRECT  INCORRECT, said____________________

farm    Circle: CORRECT  INCORRECT, said____________________

clock   Circle: CORRECT  INCORRECT, said____________________

told    Circle: CORRECT  INCORRECT, said____________________

since   Circle: CORRECT  INCORRECT, said____________________

heat    Circle: CORRECT  INCORRECT, said____________________
Appendix R

Flashcard Reading Score Sheet Set B

Study Trial

kept Check off________
crab Check off________
might Check off________
soap Check off________
held Check off________
fence Check off________

Test Trial #1

kept Circle: CORRECT INCORRECT, said__________________
might Circle: CORRECT INCORRECT, said__________________
fence Circle: CORRECT INCORRECT, said__________________
soap Circle: CORRECT INCORRECT, said__________________
crab Circle: CORRECT INCORRECT, said__________________
held Circle: CORRECT INCORRECT, said__________________

Test Trial #2

might Circle: CORRECT INCORRECT, said__________________
crab Circle: CORRECT INCORRECT, said__________________
kept Circle: CORRECT INCORRECT, said__________________
held Circle: CORRECT INCORRECT, said__________________
soap Circle: CORRECT INCORRECT, said__________________
fence Circle: CORRECT INCORRECT, said__________________
Test Trial #3

kept Circle: CORRECT INCORRECT, said__________________
soap Circle: CORRECT INCORRECT, said__________________
fence Circle: CORRECT INCORRECT, said__________________
held Circle: CORRECT INCORRECT, said__________________
might Circle: CORRECT INCORRECT, said__________________
crab Circle: CORRECT INCORRECT, said__________________
Appendix S

Flashcard Target Words and Sentences for Meaning Trials

Gave

1.) The boy gave the ball to the dog.
2.) The girl gave the bat to the boy.
3.) Her mom gave her a hug.
4.) Sam gave Tom a toy car.
5.) I gave the money to my dad.

Held

1.) He held the door open for the lady as she entered the restaurant.
2.) The meeting will be held in the principal’s office.
3.) She held onto her mother’s hand as they crossed the street.
4.) Her birthday party will be held in the park.
5.) Will the school concert be held in the gym or the cafeteria?

Told

1.) The gym teacher told the children to play ball outside.
2.) The principal told the children to stand in line.
3.) Mother told the sisters to eat their dinner now.
4.) Father told Jim to go to bed.
5.) The coach told the boys to stop fighting.

Kept

1.) He kept his money inside the box so no one would take it.
2.) She kept working on the puzzle but it was too hard to solve.
3.) The elephant in the circus kept sniffing the clown’s red hair.
4.) The men **kept** pushing the car until the motor started.

5.) Tom **kept** the candy bar but threw away the wrapper.

Since

1.) I have stopped running ever **since** I hurt my knee.

2.) Can you bring this card to grandma **since** you will see her tonight?

3.) **Since** it is raining we have to play indoors.

4.) The car got a ticket **since** it was parked on the wrong side of the street.

5.) **Since** you are sick, you can’t go to school.

Might

1.) I **might** play with Tom if he comes.

2.) She **might** sing a song if we ask her.

3.) Bill and Bob **might** get wet if it rains.

4.) Dad **might** go to the store if we need milk.

5.) We **might** have to move to another school.

Farm

1.) We went to a **farm** for a school field trip.

2.) At the **farm** we saw pigs, horses, and chickens.

3.) Old MacDonald had a **farm**. Eee yi eee yi oh.

4.) The boy drove the tractor on the **farm**.

5.) The cowboys live on a big **farm** out west in Colorado.

Soap

1.) Please buy **soap** when you go to the grocery store.

2.) You should wash your hands with **soap** and water after using the bathroom.

3.) The bottle of **soap** spilled all over the bathroom floor.
4.) I prefer to use soap that smells like peppermint.

5.) Babies need a special kind of soap that is gentle on their skin.

Heat

1.) The heat from the sun felt good on our cold skin.

2.) Heat the butter in the microwave to melt it.

3.) The fire was big enough to heat the entire room.

4.) Cook the food over high heat on the stove.

5.) The heat from the sun made us sweat as we ran around the park.

Crab

1.) I saw a crab at the beach last week.

2.) My mom is going to make crab cakes for dinner.

3.) Children have fun catching crabs at the beach.

4.) How many legs does a crab have?

5.) I hurt my foot when I stepped on a crab and he bit me.

Clock

1.) What time does the clock say?

2.) We need to leave for home when the clock points to five.

3.) The clock broke when the boy dropped it.

4.) The loud ticking of the clock keeps me from falling asleep.

5.) Cinderella had to leave the party when the clock struck midnight.

Fence

1.) The workers built a fence around the school building.

2.) Can that little dog jump over the tall fence?
3.) The boy fell and broke his leg when he tried to climb the fence.

4.) Tom will paint the fence white tomorrow.

5.) She was too short to see over the fence.
Appendix T

Orthographic Mapping for Post Assessment Script

Name: ___________________  ID#: ___________________  Date: ___________________

“First we are going to stretch the sounds in words. Watch me as I stretch the sounds in the word man, like this ./m/ /a/ /n/ As I say each sound I will hold up a finger for that sound, /m/ /a/ /n/ (hold up finger for each as you say it). Watch how my mouth moves as I say each sound: mmmmaaaaannnn: first my lips are closed to say mmmmm, then my mouth opens to say aaaaa, then my tongue lifts and touches the roof of my mouth to say nnnnn. (Open mouth as you say the sounds so children can see movement.)

We can see these movements of our mouth in a mirror. Here is a mirror. You say and stretch out the word man and watch your mouth move. (Children do it. Provide reinforcement, feedback till all can do it.)

“Now put your mirrors down, and let’s begin. Watch my mouth as I make the sounds in the first practice word.”

- Experimenter states the word.

“rave”

- Experimenter stretches the sounds. (connect the sounds, don’t break between sounds) while holding up a finger for each sound

“/r/, /ā/, /v/. See how my mouth moves from one sound to the next (repeat word)”

- Students and Experimenter stretch the sounds together by saying each sound and holding up a finger for each sound.

“Now look in your mirror as we say the sounds in the word together. Hold up a finger for each sound you hear.”

“There are three sounds in rave.”

- Students and Experimenter count the number of letters in the word.

“Let’s count the number of letters in the word. One, two, three, four.”

“This is interesting. We counted that there are three sounds in the word, but there are four letters. That means that either two letters make one sound or one letter doesn’t make any sound. Watch as I say each sound and write the letters that make each sound into a box.”
- Experimenter speaks the sounds as she writes the letters that correspond with each sound into the Elkonin boxes. Write R in first box, A in second box, and V in third box.

“Each box represents one sound. Since there are only three sounds in “rave”, we can only fill in three boxes. Notice how the ‘e’ is not put in a box because it doesn’t make a sound on its own. I am going to cross this letter out. Sometimes letters are left out and sometimes more than one letter can go in each box if there are two or more letters that make a sound. Now you say the sounds in rave as you write the letters that make each sound into a box on your sheet.”

- Students say the sounds and write the letters that correspond with each sound into the Elkonin boxes on their sheet.

“Good job.”

“Let’s try this with some more words.”

1.) Experimenter says the next word.

“CAVE. How many sounds do you hear?” Answer: _____________

“OK. Now write the letters that make each sound into their own box below.”

- Student maps letters into boxes.

2.) Experimenter says the next word.

“MELT. How many sounds do you hear?” Answer: _____________

“OK. Now write the letters that make each sound into their own box below.”

- Student maps letters into boxes.

3.) Experimenter says the next word.

“LIGHT. How many sounds do you hear?” Answer: _____________

“OK. Now write the letters that make each sound into their own box below.”

- Student maps letters into boxes.

4.) Experimenter says the next word.
“BOAT. How many sounds do you hear?” Answer: ____________

“OK. Now write the letters that make each sound into their own box below.”
- Student maps letters into boxes.

5.) Experimenter says the next word.

“STOP. How many sounds do you hear?” Answer: ____________

“OK. Now write the letters that make each sound into their own box below.”
- Student maps letters into boxes.

6.) Experimenter says the next word.

“DANCE. How many sounds do you hear?” Answer: ____________

“OK. Now write put the letters that make each sound into their own box below.”
- Student maps letters into boxes.
Appendix U

Orthographic Mapping Post Assessment Worksheet

Name: ________________   ID#:____________________    Date:_________________

Practice Words

RAVE

1.) CAVE

2.) MELT
3.) LIGHT

4.) BOAT

5.) STOP

6.) DANCE
Appendix V

Word Consciousness: Spelling Script Set A

Name: ____________________________  ID#: ____________________________  Date: ____________________________

“Now we are going to spell the words we read on the flashcards. I will say the word, and then I want you to say the word, and then you will write the spelling of the word as best you can. Let’s begin.”

- The first word is: gave...You say it. (Child repeats). Now write gave.

- The second word is: clock...while. You say it. (Child repeats). Now you write clock.

- The third word is: told...You say it. (Child repeats). Now you write told.

- The fourth word is: heat...You say it. (Child repeats). Now you write heat.

- The fifth word is: farm...You say it. (Child repeats). Now you write farm.

- The sixth word is: since...You say it. (Child repeats). Now you write since.
Appendix W

Word Consciousness: Spelling Worksheet Set A

Name: ___________________  ID#: ___________________  Date: _________________

1.) __________________________________________

2.) __________________________________________

3.) __________________________________________

4.) __________________________________________

5.) __________________________________________

6.) __________________________________________
Appendix X

Word Consciousness: Spelling Script Set B

Name: ___________________   ID#: ___________________   Date: ___________________

“Now we are going to spell the words we read on the flashcards. I will say the word, and then I want you to say the word, and then you will write the spelling of the word as best you can. Let’s begin.”

- The first word is: soap…You say it. (Child repeats). Now you write soap.
- The second word is: held…You say it. (Child repeats). Now you write held.
- The third word is: might…You say it. (Child repeats). Now you write might.
- The fourth word is: fence…might. You say it. (Child repeats). Now you say fence.
- The fifth word is: crab…You say it. (Child repeats). Now you write crab.
- The sixth word is: kept…You say it. (Child repeats). Now you write kept.
Appendix Y

Word Consciousness: Spelling Worksheet Set B

Name: _________________    ID#:____________________    Date:_________________

1.) __________________________________

2.) __________________________________

3.) __________________________________

4.) __________________________________

5.) __________________________________

6.) __________________________________
Appendix Z

Word Consciousness: Sentence Production Task Script Set A

Name: ____________________  ID#: ____________________  Date: ____________________

“I am going to say a word, and I want you to use the word in a sentence. I will write down the sentence that you say. Here’s an example. The word is away. So I will make up the sentence, I am going to fly away on an airplane. Let’s begin”

1.) Farm: ______________________________________________________________

2.) Told: ______________________________________________________________

3.) Heat: ______________________________________________________________

4.) Since: ______________________________________________________________

5.) Clock: ______________________________________________________________

6.) Gave: ______________________________________________________________
Appendix AA

Word Consciousness: Sentence Production Task Script Set B

Name: ___________________   ID#: ___________________   Date: ___________________

“I am going to say a word, and I want you to use the word in a sentence. I will write down the sentence that you say. Here’s an example. The word is away. So I will make up the sentence, I am going to fly away on an airplane. Let’s begin”

1.) Might:__________________________________________________________

2.) Held: ____________________________

3.) Soap: _____________________________

4.) Kept: ____________________________

5.) Fence: ___________________________

6.) Crab: ____________________________
Appendix BB

Parent Consent Form

CITY UNIVERSITY OF NEW YORK

The Graduate Center

Department of Educational Psychology

PARENTAL/LEGAL GUARDIAN PERMISSION FORM FOR
CHILD’S PARTICIPATION IN RESEARCH

Project Title: The Effect of Orthographic Mapping and Context on Sight Word Learning for Native and Nonnative English-Speakers

Principal Investigator: Katharine Pace Miles
PhD Candidate
Graduate Center
Educational Psychology Department
365 Fifth Avenue
New York, NY 10016
716-574-0960

Faculty Advisor: Dr. Linnea C. Ehri
Distinguished Professor
Graduate Center
Educational Psychology Department
New York, NY 10016
212-817-8294

Site where study is to be conducted: Local Public or Private School, Brooklyn, NY

Introduction/Purpose: Your child is invited to participate in a research study. The study is conducted under the direction of Katharine Pace Miles, PhD student, Graduate Center, CUNY. The purpose of this research study is to investigate the effect of mapping letters to sounds in words on students’ ability to read words automatically. The results of this study may improve teaching methods of sight word instruction for native and nonnative English-speakers.

Procedures: Approximately 150 individuals are expected to participate in this study. Each child will complete a set of literacy measures, three sessions of either a letter-sound training or high quality book reading session, and a posttest session of reading, spelling, and using words in meaningful ways. The time commitment of each participant is expected to be 30 minutes for the literacy measures, 30 minutes for the letter-sound training or book reading sessions, and 30 minutes for the posttests. Each session will take place at your child’s school on separate days. The study will not interfere with your child’s classroom work. The sessions will be scheduled
around instructional time and will serve as an enhancement to the literacy instruction already being provided in the classroom.

**Possible Discomforts and Risks:** Your child’s participation in this study may involve mental fatigue. To minimize these risks your child will be able to take a break between the tasks. If your child is frustrated as a result of this study you should contact Katharine Pace Miles at 716-574-0960 or kpace@gc.cuny.edu.

**Benefits:** There are direct benefits of participating in this study. Students may learn how to better map letter-sound relationships in order to more securely store words in memory for later retrieval in the letter-sound training condition, and students will benefit from engaging with the the high level vocabulary and thoughtful discussion questions posed in the book reading condition. The skills learned in these sessions may allow students to generalize this knowledge to support their literacy acquisition.

**Alternatives:** If you choose not to have your child participate in the study he/she will read independently outside of the classroom with adult supervision while the study takes place.

**Voluntary Participation:** Your child’s participation in this study is voluntary, and you may decide to withdraw your child from participation without prejudice, penalty, or loss of benefits to which you are otherwise entitled. If you decide to remove your child from the study, please contact the principal investigator Katharine Pace Miles to inform them of your decision.

**Financial Considerations:** Participation in this study will involve no cost. For your child’s participation in the study the class will receive a healthy food party (fruits, vegetables, health chips and dips, etc.) at the completion of the data collection process. Also, the teacher will receive a copy of the letter-sound and book reading curricula to use in the future.

**Confidentiality:** The information obtained from your child will be collected via written document. The collected records will be accessible to Katharine Pace Miles and Linnea Ehri. The researchers will protect your child’s confidentiality by coding the data. The collected data will be stored in a locked cabinet, and the electronic data files will be kept on a secure network. Consent forms will be kept separate from the data. The data collected for this study will be stored for three years.

**Contact Questions/Persons:** If you or your child have any questions about the research now or in the future, you should contact the Principal Investigator, Katharine Pace Miles, 716-574-0960, kpace@gc.cuny.edu. If you or your child have any questions concerning your child’s rights as a participant in this study, you may contact Kay Powell, IRB Administrator, The Graduate Center, CUNY, (212) 817-7525, kpowell@gc.cuny.edu.

**Statement of Consent:**
“I have read the above description of this research and I understand it. I have been informed of the risks and benefits involved, and all my questions have been answered to my satisfaction. Furthermore, I have been assured that any future questions that I may have will also be answered
by the principal investigator of the research study. I voluntary agree to allow my child to participate in this study.

By signing this form I have not waived any of my legal rights to which my child would otherwise be entitled.

I will be given a copy of this statement.”

<table>
<thead>
<tr>
<th>Printed Name of the Child-subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printed Name of Subject’s Legal Guardian</td>
</tr>
<tr>
<td>Signature of Subject’s Legal Guardian</td>
</tr>
<tr>
<td>Date Signed</td>
</tr>
<tr>
<td>Printed Name of Person Explaining Form</td>
</tr>
<tr>
<td>Signature of Person Explaining Form</td>
</tr>
<tr>
<td>Date Signed</td>
</tr>
<tr>
<td>Printed Name of Investigator</td>
</tr>
<tr>
<td>Signature of Investigator</td>
</tr>
<tr>
<td>Date Signed</td>
</tr>
</tbody>
</table>
Appendix CC

Child Assent Form

CITY UNIVERSITY OF NEW YORK

The Graduate Center

Department of Educational Psychology

ASSENT TO PARTICIPATE IN A RESEARCH PROJECT

Project Title: The Effect of Orthographic Mapping and Context on Sight Word Learning for Native and Nonnative English-Speakers

Principal Investigator: Katharine Pace Miles
PhD Student
Graduate Center
Educational Psychology Department
365 Fifth Avenue
New York, NY 10016
716-574-0960

Faculty Advisor: Dr. Linnea C. Ehri
Distinguished Professor
Graduate Center
Educational Psychology Department
New York, NY 10016
212-817-8294

Child’s Name: ________________

You are invited to participate in Katharine Pace Miles’s research study. The reason for this study is to better understand how students learn to read words. There will be about a hundred students that will participate in this study.

What will happen to me in this study?
In this study you will read and spell some words. Next, you will move letters into boxes as we stretch out the sounds in words or you will listen to a book being read. Then, I will ask you to read some words on flash cards. We will meet at your school five days in a row for 30 minutes each time.

Will I get hurt?
You may get tired or mad if you can’t read the words. If this happens, just let me know if you need to take a break. If you are upset by anything in this study you should tell me, your parent/guardian, or someone else you know right away.

**Will anything good happen to me?**
You may learn how the sounds and letters in words go together, or you may learn new words in the stories you hear. For your participation in this study I will give your class a healthy food party.

**What if I do not want to do this?**
You don’t have to be in this study. No one will be mad at you if you don’t want to do this. If you don’t want to be in this study, just tell us. If you want to be in this study, just tell us. Remember, it is ok to say yes now and change your mind later. Nothing will happen to you if you decide to stop.

**Will anyone know I was involved?**
Your name and the fact that you are in the study will not be told to anyone.

**Who can I talk to about this study?**
You can ask questions any time. You can ask now. You can ask later. You can talk to me or someone else, like ___________________.

**Do you want to participate in this study?** □ Yes □ No

---

**PERSON CONDUCTING ASSENT**

I have explained the study to ______________________________ (name of child) in language he/she understands, and he/she has agreed to be in the study.

_________________________ ________________________________ __________
Name of Person Conducting Assent (print) Signature Person Conducting Assent Date
Signed

_________________________ ________________________________ __________
Name of Investigator (print) Signature Person Investigator Date
Signed
References


   Acquisition of letters and phonemic awareness. *Handbook of early literacy research, 2*, 113-131.


