DO PICTURES IMPAIR SIGHT WORD LEARNING IN BEGINNING READERS?

by

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Abstract

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In two experiments, the impact of pictures on learning to read words was examined in kindergartners, first graders, and second graders (N=72). The written words were either simplified spellings (e.g., DLR for dollar) or conventional spellings. The words were learned either with or without pictures of their meaning. In the first experiment, forty kindergarten and first grade students were assigned to groups and were taught to read 10 words. One group was taught to read simplified spellings of the words, half accompanied by pictures, and half without pictures present. The other group was taught the 10 words in their conventional spellings, also with pictures either present or absent. It was hypothesized that kindergartners, presumed to be in the partial alphabetic phase of reading would learn to read simplified spellings of words by sight equally well either with or without pictures, whereas they would learn to read conventional spellings better without pictures present. It was hypothesized that first graders, presumed to be full alphabetic readers, would not be distracted by the pictures in either the simplified or conventional spelling conditions because they would process the conventional spellings automatically. Results indicated that both kindergarteners and first graders were distracted by the presence of pictures when learning sight words, both in the simplified

and conventional spelling conditions. Experiment 2 utilized the same design with full alphabetic students in the second grade. In addition, half of the students' attention was directed at the spellings of the words. Results provided mixed support for the hypothesis that the second graders would not be distracted by the pictures in learning to read the words. Pictures did not distract sight word memory when students' attention was directed at letter-sound correspondences in the words during learning. However, second graders were distracted by the presence of pictures when they had learned conventional spellings of words without attending to letter-sound relations in words during word learning.

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Chapter 1: Introduction

There is much concern regarding fundamental reading skills of American youth (Pressley & McCormick, 1995). A substantial amount of research has focused on the acquisition of literacy- that is, how children grow from emergent readers learning letter sounds and words into independent readers. One of the accomplishments that is crucial for early reading success is the development of strategies for decoding words to comprehend the meaning of print (Paris & Cunningham, 1996).

Skilled readers are able to process words effortlessly (Ehri, 1987). These readers possess a large lexicon of sight words; that is, words whose printed forms automatically activate pronunciations and meanings in memory. When readers possess a large sight word vocabulary, they are able to devote cognitive processing to the meaning of text rather than to the identification of individual words. Likewise, accurate letter processing may be a prerequisite to automatic word processing (Guttentag & Haith, 1978). If readers have to analyze each letter within a word they may lack sufficient attentional capacity to analyze the word as a whole accurately, and retain it in memory (Laberge & Samuels, 1974).

Ehri (1999) has proposed four phases that readers move through when learning to read new sight words. The names of the phases reflect the level of alphabetic knowledge that is possessed and utilized by the reader when reading words and securing them in memory. In the pre-alphabetic phase of reading, readers have little knowledge of letter names or sounds, so words are recognized by salient visual cues. For example, they might remember the word *dog* by the tail at the end, or the word *look* by the two eyes in the middle (Ehri, 2005a; Ehri & McCormick, 1998). Partial alphabetic readers have

some letter-name and letter-sound knowledge and limited phonemic segmentation skill, so they can form connections between some of the letters they see and sounds they hear in words. The partial letter cues that partial alphabetic phase readers most often use when reading and spelling words are those that are most salient, usually the initial or the initial and final consonants of words (Ehri & Wilce, 1985; Treiman, 1993). Full alphabetic readers are able to learn sight words by forming complete connections between the letters in a word's spelling and the sounds that those letters represent in the word's pronunciation. At this phase, readers are able to decode unfamiliar words, they can generate spellings that represent all of the phonemes, and they can remember correct spellings of words better than partial phase readers (Ehri, 2005a). Consolidated phase readers become familiar with recurring letter patterns in words, such as the spellings of rimes and syllables, and use these patterns to secure more and more sight words in memory.

When children are first learning to read, it is common practice to present new words with pictures representing those words. One of the ways sight words are taught to children is through the use of flashcards that display a word printed along with a picture of the word. These materials are readily available for students in Pre-K through 3rd grade. Many basal series (e.g., Harcourt, 2005 and McGraw-Hill, 2005) include Dolch sight words on flashcards as part of their balanced literacy programs. However, this may have an inhibitory effect on the rate of word learning, as some experimental studies have suggested (e.g., Samuels, 1967; Saunders & Solman, 1984; Solman & Singh, 1992).

Samuels (1967) explains this problem in terms of a *focal attention hypothesis*, which posits that pictures may divert attention from printed words. That is, when words

and pictures are presented together, the pictures function as distracting stimuli and interfere with the learning of the printed word. Others have explained the interference of pictures on learning to read new sight words as a *blocking effect*, whereby associations made between a picture of a word and its pronunciation interfere with the formation of associations between the printed word and its pronunciation (e.g., Singh & Solman, 1990; Solman & Singh, 1992; Didden & Prinsen, 2000).

However, research supporting these explanations has been done with beginning readers or poor readers. To set up orthographic images in memory, readers must remember how letters symbolize sound segments detected in a word's pronunciation (Ehri and Wilce, 1980). In reading predictable text, Johnston (2000) found that readers only attended to minimal print cues to accurately "read" the simple and familiar patterned language of the text. She cites Ehri and Sweet's (1991) conclusion that word learning by novice readers was negatively affected by the "greater salience of other non-print cues such as the pictures, and the absence of pressure to process print cues [that these non-print cues allow]" (p.455). If there are cues other than print available, novice readers will use them to recognize words.

During the full alphabetic phase of reading, beginning readers are able to form connections between the letters in words and the sounds that they represent in the words' pronunciations, and this secures the spelling of the words in the reader's memory (Ehri & Wilce, 1979), regardless of whether pictures are present (Rosental & Ehri, 2008) .

When a word is already a part of a person's sight word lexicon, pictures no longer interfere with the reading of the word. There is a great deal of research on the automaticity of word recognition indicating that once a reader has committed a word to

her sight word memory, she is able to process the word with little or no attention. In fact, in a Stroop task, it is the printed word that interferes with the naming of a picture of a competing object (e.g., Ehri, 1977; Ehri & Wilce, 1979; Guttentag & Haith, 1978).

The purpose of this study was to examine whether or not picture cues interfere with young readers in the partial alphabetic phase and in the full alphabetic phase of reading when they are learning new sight words, which require attention to the orthography of a word before it can be stored in memory as a sight word. The study consisted of two experiments, Experiment 1 conducted as a pilot study, and Experiment 2 as a follow-up study.

In Experiment 1, forty kindergarten and first grade students were randomly divided into four groups and taught to read 10 words. Two of the groups were taught to read simplified spellings of the words (e.g., APL for *apple*) and two of the groups were taught to read complete spellings. Half of the words were taught with pictures present and the other half without pictures. It was expected that kindergartners would be in the partial alphabetic phase and first graders would be in the full alphabetic phase of development. The questions of interest were whether both kindergartners and first graders would learn to read simplified spellings of words better with or without pictures present, and likewise whether they would learn to read complete spellings of words better with or without pictures present.

It was hypothesized that kindergartners might learn to read simplified spellings of sight words equally well regardless of whether pictures were present, but they would learn complete spellings better without pictures present. It was also hypothesized that first graders would not be distracted by the pictures in learning either the simplified or the

complete spellings of words. Results showed that both kindergarten and first grade readers learned words better when no pictures were present regardless of the type of spelling.

One problem with Experiment 1 was that the performance of first graders on the pretests raised doubt that they qualified as readers in the full phase of development. Thus, the purpose of the Experiment 2 was to utilize the same design in order to examine whether second graders, who are demonstrated to be in the full alphabetic phase of reading, would show a different pattern of performance. In Experiment 2, second graders were taught to read words written conventionally or with simplified spellings, presented either with pictures or without pictures. In addition, half of the students had their attention drawn to the printed words and were asked to verify that each word that was seen mapped the sounds heard in the word's pronunciation. Specifically, it was expected that second graders would not be affected by the presence or absence of pictures in learning to read both simplified and complete spellings of words, particularly when they were directed to process the grapho-phonemic mapping relations between spellings and pronunciations of words as they learned to read them.

Chapter 2: Literature Review

Phases of Sight Word Learning

Words may be read in a variety of ways (Ehri, 1991, 1994, 1995, 2005a). Words can be read by decoding, which involves identifying the sounds of letters and blending the sounds to form pronunciations of words. Another way to read unfamiliar words is to read them by analogy, which involves recognizing how the spelling of an unfamiliar word is similar to a word already known. Another way to read words is by prediction, which involves using context and letter cues to guess unfamiliar words. Finally, words can be read by sight, which involves using memory to read words that have been read before. When a word is read by sight, the spelling, pronunciation, and meaning of the word are activated immediately when the word is seen. When words are read instantly by sight, readers do not expend any attention or effort decoding the words (LaBerge & Samuels, 1974).

Readers learn sight words by forming grapheme-phoneme connections, that is, by forming connections between letters in spellings and sounds in pronunciations of the words (Ehri, 1992, 1998, 2005a; Share, 1999, 2004). In order to learn a sight word, a reader must look at the spelling, pronounce the word, distinguish separate sounds, or phonemes of the word, and recognize how the letters, or graphemes, match up to those sounds (Ehri, 1992, 1998, 2005a; Share, 1999, 2004). This grapheme-phoneme connection is a powerful mnemonic that allows the reader to store the word in memory (Ehri, 1992, 1998; Ehri & Wilce, 1979). Once words are stored in memory as sight words, readers can recognize and name them immediately.

Ehri (1999, 2005a, 2005b) has described four phases that children move through

in learning how to read words. The phases are labeled to reflect the alphabetic knowledge that is used to retain the word in memory. First, in the *pre-alphabetic phase* words are "read" by remembering selected visual cues. Children do not use the alphabetic system. In the *partial alphabetic phase*, names and/or sounds of the letters in the alphabet are learned. Children use these to remember how to read words. However, only some of the letters and sounds in a word, usually the first and final letter-sounds, are used. In the *full alphabetic phase,* readers can learn sight words by forming complete connections between letters in spellings and phonemes in pronunciations. In the *consolidated phase,* readers retain more and more sight words in memory. As they become familiar with letter patterns that recur in different words, the grapheme-phoneme connections in these words become consolidated in memory into larger units, and these larger units are used to store words in memory.

Students in the partial alphabetic phase of reading have a limited knowledge of the alphabetic system, and remember how to read words by using partial alphabetic cues. Because they are unable to segment the word's pronunciation into all of its phonemes (Ehri, 2005a), beginners can match only some of the letters in words to sounds in their pronunciations (Ehri, 1991, 1994). Partial alphabetic readers remember how to read sight words by forming connections often only between the first and final letter-sounds, which are easier to detect (Ehri, 2005a, 2005b). When generating spellings of words, partial alphabetic readers will produce some of the letters of words, usually the initial consonant and the final consonant, often omitting vowels (Ehri & Wilce, 1985; Ehri, 1998).

In the full alphabetic phase of reading, readers have full knowledge of the alphabetic system and are able to utilize this knowledge when decoding unfamiliar

words, and when generating spellings of words. Readers in the full alphabetic phase can learn sight words by forming complete connections between letters in spellings and phonemes in pronunciations (Ehri, 2005a, 2005b, Ehri & Wilce, 1987).

Ehri and Wilce (1987) conducted an experiment to obtain information about how partial alphabetic reading differs from full alphabetic reading. Beginning readers who use phonetic-cue reading read words by forming and storing association between some of the letters in words' spellings and some of the sounds in their pronunciations (Ehri & Wilce, 1987). Cipher readers have acquired phonemic-segmentation skill and understand how spellings systematically correspond to pronunciations. They can use use this knowledge to decode new words (Ehri & Wilce, 1987). All of the students who participated in the study were partial alphabetic readers, and half of them were converted to full alphabetic readers through training. In their experiment, 30 Kindergarten students were matched by reading ability (i.e., letter naming ability, decoding skill, word identification) to form 15 pairs, and then mates were randomly assigned to two groups. During training, students in the full alphabetic treatment group were taught to read several sets of similarly spelled words, mostly nonsense syllables, to a criterion. The words were similarly spelled in order to force the students to learn to pay attention to all the letters as they sounded out the words (e.g., SAB, SAP, SAM). The students in the partial alphabetic training group were taught to produce isolated sounds for each of the nine consonant letters that made up spellings of the words taught to the full alphabetic training group. During posttests, the students were taught to read 15 real words composed of the consonant letters that were taught during training. After the first study trial, in which the experimenter read each word and the student repeated it, the students

were presented each word and were given 5 seconds to read the word before the experimenter read the word. Learning trials were continued to a criterion of two perfect trials or a maximum of seven test trials. After the learning trials, the student's ability to spell the 15 words was measured. Other posttests included a letter-sound decoding task similar to the pretest measure, and a misspelling detection task, in which subjects were shown 10 nonsense-word spellings (e.g., RAB) and were asked whether the word matched a pronunciation (i.e., "Does this say 'sab'?"). If the students detected a mismatch (none of the spellings matched) the students were asked to explain what was wrong.

Ehri and Wilce (1987) found that most students who were full alphabetic trained readers were able to learn to read the entire set of 15 similarly spelled words whereas the partial alphabetic trained readers had great difficulty learning to read very many of the words accurately and consistently. Partial alphabetic readers who read words correctly on one trial would often subsequently forget the word or confuse it with another word. By analyzing misreadings, the authors found the partial alphabetic readers often mixed up words on the basis of partial letter cues, primarily initial letters. Errors were also made when words shared first and final letters, and shared the first two letters. Ehri and Wilce (1987) found that every full alphabetic reader attempted to sound out and blend letters in at least one word, while only three partial alphabetic readers did.

Ehri and Wilce (1987) also found that full alphabetic readers, who had better decoding skill and who had learned to read more words, outperformed partial alphabetic readers on the spelling measures. Full alphabetic readers wrote more correct letters, including more vowels, and more consonant clusters. However, partial alphabetic readers

were able to spell the initial and final consonants of most words, which suggests that these letters served as the cues that they used during the word-learning task.

The Role of Pictures in Learning to Read Words

All American preschool and school age children are introduced to picture books. These young readers are just becoming aware of the concepts of prints, including the idea that the author's story is actually written in the text, and not in the pictures. Pictures are thought to encourage emergent readers to read and to provide a more concrete focus for those who are more visual learners. However, research on the role of pictures in the acquisition of literacy shows that pictures accompanying text actually distract low skilled readers rather than improve their word accuracy and comprehension. For instance, in 1979, Clay reported that beginning readers often did not understand that print rather than pictures told the story, and they were confused about the direction that one reads print on the page (cited in Paris and Cunningham, 1996).

Samuels (1967) found that pictures may be used as prompts when the reader cannot read a word in text, but pictures may cause readers to miscue and may divert attention from printed words. He conducted two experiments. In the first experiment, 30 first-graders were randomly assigned to read four words with either no picture, a simple picture, or a complex picture present. The words were typed at the bottom of cards, with no picture above the word for the no picture groups. For the simple picture group, there was a black and white drawing portraying the object that the word symbolized above the typed word, and for the complex picture group, the word was typed at the bottom of the card and above each word was a colorful picture which had been cut out of a reading primer depicting other objects besides the taught word. The study consisted of ten

learning trials and ten test trials. During the learning trial, each card was shown to the child for 4 seconds before the child was told the word. The child was awarded a correct response if he said the appropriate word before feedback was given. During test trials, no pictures were present for any of the groups and no feedback was given. With no pictures present on the test trials, the no-picture group recognized significantly more words than both the simple picture group and the complex picture group. There was no difference between the simple picture group and the complex picture group. Findings thus showed that pictures did interfere with word learning.

In the second experiment, 52 first-grade students were tested. Students with similar word recognition scores were paired, and mates were randomly assigned to two groups. The groups were given classroom reading instruction under a no-picture or picture condition. The reading material for the no-picture and picture conditions was the same, a story 106 words long containing 50 different words. The children in the picture condition opened a book with the text of the story on the right side of the book and a picture from a reading primer on the left side. In the no-picture condition, the children saw the text on the right side and the left side was blank. The word recognition pre-test used to match the students and the word recognition post-test were the same and consisted of 50 words that appeared in the story. Instructions for both groups consisted of one silent reading and one oral reading. The students were instructed to raise their hands during silent reading if they were unable to read any word, and the experimenter would whisper the words to the children who requested help. The results showed that on posttests with no pictures present poor readers who were taught the words without pictures present were able to read more words than the poor readers who were taught the

words with pictures present. Among better readers the difference was not significant. These findings indicate that pictures may interfere with word learning for poorer readers but not for better beginning readers.

However, Samuel's (1967) study has some limitations. The criteria used to distinguish good and poor readers was not reported. In both of these experiments, it was not reported whether the posttests assessed the student's ability to read the target words from memory by sight, or by decoding the words. Better readers might have shown no difference in their word learning on the posttests in the picture and no picture conditions because they were able to decode any words they had not learned sufficiently with pictures during training. During both the pre-test and the post-test the students were given 10 seconds to respond, thus allowing time for either approach to be used. In addition, a delayed posttest assessing long term learning was not given.

Samuels (1967) suggests that the less capable students were affected more by distracting picture stimuli than were the more capable students. Alternatively, it is possible that the poor readers were in the partial-alphabetic phase of reading and hence were not focusing on the orthography of the words they were learning. Once a child moves into the full-alphabetic phase, the pictures may no longer be more salient than the word's orthography. This could explain Samuel's findings of no significant difference in reading acquisition between the picture and no-picture condition among the better readers.

In two experiments, Saunders and Solman (1984) consider Samuels' focal attention hypothesis when investigating the effects of pictures on learning to read a set of isolated, similar, common nouns. In the first experiment, they designed a study that

included kindergarten students, with fourteen students randomly assigned to each of five groups. The children in four of the groups learned each word using a picture of the thing represented by the word. One of the groups that learned the words with pictures was presented each word one second prior to its picture, and had their attention drawn to the fact that the word and the picture represented the same thing. In the second picture group, students were presented with the picture and the word together, with their attention drawn to the association between the picture and the word. In the third picture group, the word was present to the children prior to the picture, but no attention was drawn to the association between the picture and the word, and in the forth picture group, the word was presented together with the picture, and no attention was drawn to the association. One of the five groups acted as a control by learning the words without pictures. The study consisted of four acquisition and test trials involving five words that looked similar in that they shared the same first and last letters and had similar lengths and shapes.

The results indicated that both the instruction to associate the word and the picture, and the viewing of the word prior to the presentation of the picture failed to improve performance. It was also found that the children who learned the words without pictures recognized more words on the test trial than the children in the picture groups. These findings indicated that pictures fail to facilitate the learning of new sight words and in fact interfered with word learning regardless of how the words and pictures wee presented.

The kindergarten children in this study were not assessed in their reading ability prior to the word-learning trials, other than their inability to recognize the five stimulus

words. Therefore, the results could be due to differences across groups, in students' reading ability, rather than the presence or absence of pictures. That is, because the groups were not shown to be comparable in reading ability before the word-learning trials, it cannot be ruled out that the students who learned more words in this study may have already been the better readers. It is important to note that the kindergarten children in this study were most likely in the partial alphabetic phase of reading, and hence would rely on initial and/or final consonants of words to recognize them. They would therefore have difficulty distinguishing between the words they were taught (*shop, ship, step, stamp,* and *sheep*).

In their second study, Saunders and Solman (1984) used four groups of kindergarten children. The children in two of the groups learned words with pictures. One group was shown the picture one second before the word (the primed group) and one group was shown the picture one second after the word (the non-primed group). The other two groups learned the words without pictures, with one group shown a blank card 1 second prior to the word and the other shown a blank card 1 second after the word. The results showed no difference in performance between the primed and the non-primed conditions. The children in the no-picture groups outperformed the children in the picture groups. Thus, both of these studies show that kindergartners' word learning is disrupted by the presence of pictures and they learn to read words better when no pictures are present, regardless of whether words are seen before the pictures appear, and regardless of whether their attention is directed at the written words accompanying the pictures during learning.

Singh and Solman (1990) studied the effect of pictures when students with mental

retardation were learning to read new words. The researchers taught eight students with mental retardation to read 16 nouns in four conditions in an alternating treatments design. The conditions included: a picture presented alone followed by the presentation of a picture and a written word together; a word presented alone; a word enhanced in size and presented alone followed by the word and a picture; the enhanced word presented alone. In the picture conditions, the students were asked, "What is that word?" when the words were presented with the pictures. After training when the words were presented in isolation, students read the smallest percentage of words correctly in the condition in which the pictures had been presented alone and then were followed by the presentation of a picture and the written word together. Six of the 8 students read the highest percentage of words correctly in the two conditions in which the words had been presented without pictures. The authors conclude that pictures inhibit some students' learning of new words. They explain this inhibition in terms of a blocking effect; students' prior associations between spoken words and their pictures block their ability to subsequently create associations between spoken words and the words' printed forms.

Didden and Prinsen (2000) replicated and extended the work of Singh and Solman (1990) which showed that pictures can interfere with the learning of sight words by students with moderate mental retardation. In their study, 6 students were taught 20 new words in each of five conditions using an alternating treatments design. This study included the four conditions utilized by Singh and Solman (1990) plus a condition in which a word was presented alone and then the word and its picture were presented. The results showed that five of the six students reached the intervention criterion in conditions in which words were presented without extra stimulus prompts (i.e., pictures).

Solman and Singh (1992) conducted another two experiments showing that pictures blocked the learning of sight words by normally developing young children (mean age of 5.6 years in experiment 1 and 5.5 years in experiment 2). Both experiments were within-subjects repeated measures designs, in which 16 children were taught 12 words (concrete nouns), six in the presence of pictures and six in their absence. There were two conditions in which the words were presented on cards with pictures: an enhanced salience condition, in which a large picture was presented above a small printed word, and a reduced salience condition, in which a small picture was presented above a large printed word. There were also two no-picture conditions: a large word alone condition and a small word alone condition. In a series of randomly ordered learning and test trials, each child learned three different words in all four conditions. Learning and test trials continued until each child achieved the criterion of three consecutive correct responses for each of the words in at least one of the conditions.

In the first experiment, the cards were presented to the students for intervals of five seconds. The second experiment varied slightly from the first, in that the words without pictures were presented to the children for intervals of four seconds, and the words with pictures were presented to the children for intervals of eight seconds, so that the words without pictures did not have an advantage of the children having extra time to process the word due to the absence of additional stimuli.

In Solman and Singh's (1992) studies, the percentage of correct responses was calculated for each presentation condition (i.e., the number of correctly named words divided by the total number presented). Comparisons of the picture and no picture conditions showed that twice as many words were correctly recognized in the no picture

conditions in both experiments. The authors found no reliable differences between the different levels of salience. Solman and Singh (1992) concluded that the students' prior associations between the pictures and the spoken word blocked the students from making new associations between the printed word and the spoken word. However, another explanation is possible: the kindergarten students in this study may have lacked the necessary knowledge of the alphabetic system to retain these words in memory. Partial alphabetic readers may not have control of the spelling conventions inherent in the words used in this study. For example, initial blends (e.g., tree, clock), final blends (e.g., hand), digraphs (e.g., shoe, fish), and consonant-controlled vowels (e.g., comb, bird) are spelling conventions that would not be expected to be utilized by partial alphabetic readers when reading words.

Spontaneous Processing of Orthography

Research has suggested that when children have reached a certain level of reading ability, they will attend to the spellings of new words and secure them in memory (Ehri & Wilce, 1979; Share, 2004; Rosenthal & Ehri, 2008).

Share (1999, 2004) posits a "self-teaching" model, which proposes that when a new word is correctly identified through decoding, that is, when it is translated into its spoken form, the reader has the opportunity to acquire the specific orthography of the word in memory. Sounding out and blending phonemes when first attempting to read a new word draws a reader's attention to the order and identity of the letters, securing the word in memory. The number of times a reader must be exposed to a word in order to secure it in memory varies, but a single exposure to a word may be sufficient for older

readers beyond second grade (Share, 2004).

Share (2004) conducted three experiments involving students in first grade and in third grade. The studies exposed students to one or another member of each pair of matched homophonic target pseudowords (e.g., kado vs. cato), representing fictitious names for places, animals, fruits, and other categories. The words were embedded in short stories, and each student's ability to recall the version of the word seen rather than the phonemic alternative was measured.

In experiment one, 36 third-grade students read three texts aloud, and were exposed to the target words either once, twice, or four times. The students' orthographic learning of these words was measured either three, seven, or thirty days after they read the short stories. Students were asked to spell the words, to name the words as they were presented on a computer screen one at a time, and to choose the "correct" spelling of the target word when the homophones were presented together. Results showed that the students were successful in spelling the words they had seen even after a single encounter, and were able to identify the correct spellings of the words. For these third-grade students, the number of times the words were exposed did not have an effect on whether the students were able to recall the spellings, and the spellings were recalled three, seven, and thirty days later. These findings indicate that for readers with strong decoding skill, a single exposure to a new word may be sufficient for the word to be remembered.

In experiment two, Share (2004) studied younger readers whose reading skill was not as developed. The first-grade students in experiment two were exposed to the target pseudowords either twice or four times, and their ability to retain orthographic

information about the words was measured after three and seven days. In the spelling and word choice posttests, there was no evidence of orthographic learning.

Share (2004) conducted a third experiment to see if more exposure to words would allow early readers to secure spellings in memory. First-graders' ability to remember new real words, which would have greater meanings to the students, was also measured. In the third study, posttests were administered only once, after a seven day delay. Again, the young readers did not display any evidence of orthographic learning. The first graders did not recall significant information regarding the spellings of the new words they were exposed to during the readings of the texts.

Ehri and Wilce (1979) also found that the effect of seeing spellings on the ability to remember pronunciations was stronger for students with greater knowledge of printed language. In four experiments, orthography was shown to have mnemonic value for beginning readers. First and second graders were taught four consonant-vowel-consonant (CVC) nonsense words as oral responses. Children were taught to associate the nonsense words with either the alphabet letter that corresponded to the initial consonant sound, or with geometric figures or numbers. During study and feedback trials, students in different conditions were also shown spellings or misspellings of the CVC words. In one experiment, children heard the word and were told to imagine the spellings, rather than seeing them.

In all four experiments, Ehri and Wilce (1979) found that students learned the nonsense words fastest when spellings were seen or imagined. Also, first and second graders with larger reading-related capabilities (i.e., alphabet letter naming accuracy and speed; phonemic segmentation) benefited from spellings in learning the nonsense

syllables, while those with smaller capabilities did not. The students that were able to decode the spellings to sounds were successful in remembering the words; unsuccessful decoders were not. The authors conclude that when readers have the alphabetic knowledge necessary to map print to sounds, they use that capability spontaneously. When students are presented with spellings of words that match their knowledge of the alphabetic system, they will use those spellings to remember words.

In two experiments, Rosenthal and Ehri (2008) examined whether and how orthography contributes to the acquisition of words and their meanings, and whether words' orthographies would improve students' memories for pronunciations and meanings of new vocabulary words. In the first experiment, 20 second graders were taught 12 low frequency CVC nouns. These new vocabulary words were taught to students by presenting them with pictures representing the words on cards. Students were told the word and sentences that explained the word's meaning. Six of the words were taught with spellings present (the written word printed beneath the picture) and six were taught without spellings. No attention was drawn to the written word. Test trials involved presenting the students with pictures and testing their memories for the pronunciation of the spoken word, and presenting students with the six spoken words and testing students' memories for their definitions. The vocabulary posttest, given one day later, included a word production task, in which students listened to the core definitions of each word and recalled its pronunciation, and a spelling production task, in which students heard each word and wrote its spelling. Students were also given a recognition matching task, requiring them to choose the correct word from a set of words printed across the top of a page in order to complete sentences.

Results of the first experiment revealed that both pronunciations and definitions were learned more quickly with spelling aids than without aids. On the vocabulary posttests, students recalled the spoken words significantly better in the spelling than in the no-spelling condition, and students wrote the words more accurately if they had seen the spellings than not.

In their second experiment, Rosenthal and Ehri (2008) replicated and extended the results of their first experiment. In this study, 32 fifth graders were taught ten multi-syllabic words in spelling and no-spelling conditions. Vocabulary posttests included an oral cloze task, a spoken word recall test, a definition recall test, a meaning recognition test, and a spelling test. Again, the researchers found that during word learning trials, word learning was superior in the spelling-present condition. It was also found that higher level readers outperformed lower level readers, and the advantage provided by seeing written words over not seeing written words was much greater among higher readers than among lower- ability readers.

Showing that students also learned the pronunciations of new words better when presented with spellings, provides further evidence that students were relying on the orthography of the word, and not on the picture of the word, in order to remember it. Students in both experiments were full alphabetic readers, and attended to the printed word without any prompting, indicating that for these readers, pictures did not distract from the printed word. In fact, it was the printed word that enabled the students to remember the pronunciations and the meanings of the words. These studies show that full alphabetic readers spontaneously attend to and remember spellings of unfamiliar words.

Effect of Context on Word Learning Performance

Many factors can undermine the formation of connections between the spellings of words and their pronunciation in memory. It has been established that pictures may distract beginning readers from learning new sight words (e.g., Samuels, 1967; Saunders & Solman, 1984; Solman & Singh, 1992). Other research has indicated that the context of a new word influences whether the word's orthography will be attended to and secured in memory (e.g., Ehri & Roberts, 1979; Ehri & Wilce, 1980; Johnston, 2000).

Ehri and Roberts (1979) taught 16 words to first graders, either printed in the context of meaningful sentences or printed in isolation on flashcards, and found that the students who learned the words on flashcards demonstrated faster word recognition and more complete orthographic retention than students who read the words in meaningful sentences. However, the children who learned the words in the context of sentences learned more about the semantic identities, that is, the meanings of the words. When readers learn words in context, they can use contextual cues to guess an unfamiliar word, and less attention is given towards decoding the word. When subsequently presented the word out of context, the reader is less likely to remember the word. In contrast, during isolated word training, "readers have more time to study words as separate units, to analyze letter details, to note how letters map sounds, and to store more complete images in their lexicons" (p. 684). Ehri and Roberts (1979) showed that students who learned words in isolation learned to pronounce and the spell the printed words better. These early readers were forced to attend to the spellings of the words when they did not have the support of context to help them to figure out the words.

Ehri and Wilce (1980) conducted a study to determine whether the findings of

Ehri and Roberts (1979) would generalize to another class of words. Function words (i.e., preposition, conjunctions, auxiliary and past-tense verbs, relative pronouns) are words that are dependent upon contexts for their meaning. The design of the study was similar to that used by Ehri and Roberts (1979). First graders practiced reading function words in meaningful sentences or in lists. Results showed that children who read function words in meaningful sentences learned more about their syntactic/semantic identities, whereas children who read the words in lists learned more about their orthographic identities. Children who read the words in lists outperformed those who read the words in context in spelling the target words, recognizing correct spellings, and reading the words quickly and accurately.

Both of these studies (Ehri & Roberts, 1979; Ehri and Wilce, 1980) involve early readers. Results show that context can divert attention from the spelling of the word and hinder the word from being stored in memory as a sight word. Their results are in accordance with Share's (1999, 2004) self-teaching model, which proposes that word-specific orthographic knowledge is necessary for skilled visual word recognition.

Johnston (2000) showed that beginning readers learn more words when those words are removed from the supportive context offered by predictable text. Predictable texts support word recognition by illustrations, patterned repetitive language, and rhythm and rhyme, allowing children to anticipate and quickly memorize the story. In this study involving first grade students, three reading treatments were compared: repeated readings of predictable texts, sentence strip and word card activities, and word bank activities. Sentence strip and word card activities involved the children manipulating sentence strips to rebuild a previously read story. Word bank activities involved the children identifying

known words on unillustrated copies of a previously read story. Words that were identified were given to the children on small cards to add to their personal collections, which they reviewed during instructional time. Results showed that the children working with isolated words in a word bank activity learned more words than when they worked with sentence strips, and learned more words using sentence strips than when they read and reread the words in predictable books. The simple and familiar patterned language of the predictable text did not require the children to attend to more than minimum print cues while reading them. Minimum print cues are not sufficient to fully retain words in memory as sight words (Ehri, 1992; Johnston, 2000).

Bruck and Treiman (1992) compared the effectiveness of training beginning readers to make analogies based on rimes, consonant-vowel units, or vowels. Children in the rime-based group learned the words more quickly than the children in the other groups, but they performed the poorest when their memory for the words was measured. Because rime-based analogies are easy to make, children who received the rime training may not have spent sufficient time processing the grapheme-phoneme connection that is necessary to secure the words in memory.

From these findings, it is evident that context works like pictures to undermine the formation of connections between the spellings of words and their pronunciations in memory. Context props up performance during learning but undermines memory for the words when the context is no longer present.

Effects of Pictures on Other Reading Processes

Some research has evaluated the effects of pictures on reading performance in

terms of fluency and comprehension. These studies are not concerned with the effect of pictures on learning to read new words. There have been conflicting results from the research evaluating the effects of pictures on reading performance, and some studies have explored the effects that different types of pictures have on both reading accuracy and reading comprehension, according to an extensive review of the research done by Filippatou and Pumfrey (1996).

In 1978, Dale Willows conducted extensive research on whether or not pictures are distracting to less skilled readers. In two studies Willows (1978a) examined the influence of pictures in the periphery of text on children's reading speed and accuracy, and found consistent results in both. She based these two studies on the results of one of her previous studies done in 1974, where she demonstrated that there is an inverse relationship between reading ability and susceptibility to visual distraction. The goals of the first experiment were: to examine the influence of background pictures on the speed and accuracy of second-grade children's reading; to determine whether the semantic association of a background picture to the word printed on it affects reading performance; and to relate susceptibility to distraction by background pictures to reading ability. There were 32 children in the study, and they could all read the 15 test words aloud quickly and accurately. They were then shown the words superimposed on either a related or an unrelated picture. They were timed to see how long it took to read all fifteen words, and were scored for accuracy.

In the second experiment, Willows (1978a) wanted to determine the extent to which the reading ability effects in the first experiment might be accounted for by more general intellectual factors (i.e., development), so she replicated the first experiment

using third grade students as participants. Also, Willows wanted to determine whether interference by pictures would be reduced when the words were printed below the pictures, rather than on top of them. Thirty-four students were put into two groups, picture-behind and picture-above.

In these two experiments, Willows (1978a) found consistent results: words were read more slowly with pictures present; and unrelated pictures produced more interference than related pictures. Also, Willows found that the magnitude of both of these effects was inversely related to reading ability, which increased with age. That is, Willows found that the lower-skilled readers suffered more interference from pictures than did the higher skilled readers. There was no overall effect of picture location on either measure (time, errors) after the effect of reading ability was partialed out.

In another study, Willows (1978b) tested whether the difficulty of the words being read influenced the extent to which readers at different levels are influenced by pictures. Testing third graders in a no-picture, related-picture, and unrelated-picture conditions, Willows found that the reading performance of poor readers as a group was influenced negatively by the presence of pictures (i.e., more miscues, less fluent), while normal and good readers were much less affected by them.

Willows was not studying the effect of pictures on beginning readers learning sight words. Rather, the interest was in the reading performance of students in terms of their fluency and susceptibility to distraction. Her participants were second and third grade students, most likely in the full alphabetic phase of reading.

Rusted and Coltheart (1979) studied the effect of pictures on the retention of novel words and prose passages for both good readers and poor readers. Focusing on the

recall of factual material, they wanted to test whether the children used pictures as an alternative to the written words rather than in addition to them. Rusted and Coltheart's (1979) findings revealed that for both good readers and poor readers, the presence of pictures enhanced recall of the prose passage, but had no effect on the recognition and pronunciation of novel words. They also observed that there were systematic differences in the strategies used by good and poor readers. Good readers recalled more of the features not contained in the pictures than did poor readers. These findings are similar to Willow's results (1978), that poorer readers are more distracted, or rely more heavily on pictures.

Filippatou and Pumfrey (1996) concluded in their review that picture effects are expected to vary as a function of relevant student characteristics (i.e., student's reading ability). How they vary, however, is not clear. The authors outline four contrasting views in how pictures may affect pupils with different reading abilities. First, the *general compensatory framework* suggests that pictures are superfluous for higher skilled readers and will not aid memory, and that less skilled readers will benefit from pictures. Second, the *selective compensatory framework* assumes that pictures serve to compensate for skills not naturally engaged by readers. Less skilled readers who do not make connections while reading, or lack comprehension, will benefit from relational pictures (pictures of what is happening in the text); higher skilled readers who focus the main ideas or the series of events rather than details will benefit from partial pictures. The *general enrichment view* is that pictures will enhance the recall of both relational and details for higher skilled readers, but will have no effect for less skilled readers. Finally, the *selective enrichment* approach suggests that the use of pictures will benefit whatever

the reader focuses on. That is, low skilled readers will benefit from partial pictures that focus on detail, and higher skilled readers will benefit from relational pictures, since these readers tend to make more connections while they read.

In summary, pictorial strategies are not uniformly beneficial in all learning situations. Nor do Filippatou and Pumfrey (1996) distinguish effects on word decoding, sight word memory, and reading comprehension when presenting these alternative views. However, the general consensus of the literature that examines the influence of the presence of pictures on readers supports the hypothesis that the level of reading development will be a determining factor in how significant that influence will be.

Chapter 3: Experiment 1

In order for students to become fluent readers, they must retain in memory an extensive lexicon of words that can be recognized automatically. With a considerable sight word vocabulary, readers are able to read with appropriate speed, and are able to allocate more cognitive resources to processing the meaning of text.

The purpose of the first experiment was to examine the effect of pictures on word learning when partial alphabetic and full alphabetic readers were taught to read new sight words. Kindergarten students were considered to be representative of partial alphabetic readers and first-graders were considered full alphabetic readers. In a counterbalanced, repeated measures design, kindergarten and first-grade students were taught ten new sight words. Half of the students were taught words written with conventional spellings and half were taught words written with simplified spellings. Students learned to read the words when they were presented on cards; they saw pictures for five of the words, but did not see any pictures for the other five words. The question of interest was whether pictures would distract or limit students' processing of the written words and hence interfere with their memory for the new words, and whether this effect would differ depending on the students' phase of reading development.

Hypotheses

Two hypotheses were tested. One was that kindergarten students, who were expected to be in the partial alphabetic phase of reading, would learn to read conventional spellings of words by sight less effectively with picture cues than without picture cues. The explanation is that the picture cues would distract these students from focusing on the orthography of the words, hence preventing them from fully processing and retaining

the words in memory. In addition, because their knowledge of the orthographic system is limited, they would not be able to retain conventional spellings of words in memory. However, it was hypothesized that they might learn simplified spellings of sight words regardless of the presence of pictures, because words presented in this form would be consistent with the way these readers use and remember letter cues when reading words. Another hypothesis tested was that first grade students, who were expected to be in the full alphabetic phase of reading, would show no difference in learning sight words with or without picture cues. It was expected that these readers would spontaneously process the orthography of the words, so the pictures would not serve as distractors in either the simplified or conventional spelling conditions. Alternatively, if the presence of pictures operates as a distractor regardless of the extent of children's knowledge of the orthographic system, as previous studies with beginning readers have suggested, then children in both phases were expected to suffer from the presence of pictures and to fail in learning to read the words as well as children who learn the words without pictures.

Method

Participants

Forty kindergarten and first-grade students whose parents gave written consent participated in this study. The students were from two New York City schools, a public school in Manhattan and a private school in Brooklyn, both serving working-class to middle-class populations (neither school received Title 1 funding). There were 20 kindergarten students, 8 boys and 12 girls; 8 of the kindergarten students were of European descent, 7 were African-American, and five were Latin American. Mean chronological age of the kindergarten students was 66.4 months. There were 20 first-

grade students, 11 boys and 9 girls; 6 of the first-grade students were of European descent, 5 were African-American, four were Latin American, and 5 were of mixed descent. The mean chronological age of the first graders was 78.3 months.

Materials and Procedures

Students were trained and tested individually. During the first session, several pretests were administered. During the second session, students were given several trials to learn to read a set of 10 words. During the final session conducted three days later, their memory for the words was posttested with a spelling task and a word reading task.

Pretests. Several pretests were administered in the following order.

1. Letter Knowledge. Children's accuracy to name 26 randomly ordered capital letters and 26 randomly ordered lower-case letters was assessed. Also, their accuracy to say the sounds of letters was assessed. First, students were handed a card displaying the capital letters of the alphabet and asked to name the letters. Possible scores ranged from 0 to 26. Next, students were handed another card with the lower case letters of the alphabet and were asked to name the letters. Possible scores ranged from 0 to 26. The students were then given a card with capital letters and asked for the sound each letter makes. They were asked for both long and short vowel sounds. Possible scores ranged from 0 to 31.

2. Invented Spelling. Children were asked to spell 12 words from the ECLAS-2 spelling assessment (Grade 1, Spring, List A) [see Appendix C]. The words included spelling conventions that are known to distinguish more from less advanced spellers. The words were: man, hat, cup, glad, dish, bump, rock, spot, went, bone, landed, and pay. The children were told the words, were given the words in sentences, and were told the

words again before they wrote them. Each word was worth 2 points if spelled entirely correctly. If the word was misspelled but the targeted spelling convention was present, one point was given. For example, "glad" spelled G-L-D would be worth one point, since the speller correctly wrote the initial blend. The split half reliability for this test was .78.

3. Word Reading. Children read a graded list of words of increasing difficulty from the Woodcock Reading Mastery Tests- Revised, Form G (1987). They were given 5 seconds to respond before moving on to the next word. The score was either 1 or 0 for each word. The assessment ended when the child failed to read six consecutive words. The WRMT-R word identification subtest has a publisher-reported split half reliability of .98.

4. Nonword Reading. Children were given a card and told that the words on the card are made-up words. They were asked to read the list of 22 made up words from the ECLAS-2 (Appendix C), which assessed their control of decoding conventions (e.g.., bim, juff, spog, deak, pasking). Knowledge of 10 decoding conventions was assessed (e.g., c-v-c words, initial consonant blend, long-vowel digraph). Students were given a point for every word read correctly. Possible scores ranged from 0 to 22. The split half reliability for this test was .93.

Word Learning Treatments

In order to form treatment groups, students' composite pretest scores were ordered from high to low. The first two students were randomly assigned first to a simplified or conventional spelling condition, and then to a word set group. The next two students were randomly assigned the same way, and so on. This was done to create four

groups (A, B, C, D) that were comparable in literacy skills.

Each group was taught the same 10 words, five of the words with pictures and five of the words without pictures. The 10 words were divided into two sets of five words, the "bubble" set and the "blanket" set. Assignment of the word sets to picture or no picture conditions was counterbalanced across the groups. Two of the groups learned to read simplified spellings of all the words, and two of the groups learned to read complete conventional spellings of all the words. One simplified group (Group A) and one conventional group (Group C) learned to read the "bubble" set with pictures and the "blanket" set without pictures. The other simplified group (Group B) and the other conventional group (Group D) learned to read the "bubble" set without pictures and the "blanket" set with pictures.

The "bubble" set consisted of the following words, with simplified spellings preceding conventional spellings: BBL, BUBBLE; RVR, RIVER; TBL, TABLE; NDL, NEEDLE; DMD, DIAMOND. The "blanket" set consisted of the following words: BKT, BLANKET; RTL, RATTLE; TKT, TICKET; NBR, NUMBER; DLR, DOLLAR.

Each group practiced reading 10 words printed on cards. First, there was a study trial, where the student was shown each card, told the word, and asked to repeat it. Subsequent trials were test trials. For each test trial, the cards were shuffled and the child was asked to read each word. The student was corrected if there was a miscue. The 10 words were reviewed by each child in this way until he or she could recognize all of them correctly on the list for three successive trials. The number of trials to criterion that included the three perfect trials was scored separately for words learned with pictures and for words learned without pictures. Also, the number of words read correctly on each of

the first five trials was scored.

Posttests. Three days after the two sets of words were taught, the following posttests were given to assess what students remembered about the words they learned to read.

1. Spelling Production. A spelling test of the ten target words was given to see what orthographic representation the child had acquired in memory. Students were asked to write each word on a sheet of paper. Students were reminded to write the words just like they saw them during the word learning task. They were told the word, had the word read aloud in a sentence, and heard the word repeated again before they wrote it. The number of correct letters appearing in simplified spellings and in conventional spellings was scored. The split half reliability for this test was .92.

2. Sight Word Recognition. The ten target words were mixed in with the Boder sight word task to assess automaticity of word recognition (Appendix D). Students were asked to read a list of words on a card. Each word to be read was exposed while the rest of the words were covered with a piece of paper. Words that were read immediately (i.e., judged to be within one second) as soon as they were exposed were scored as sight words with 1 point for each. Students were also given a separate score for the total number of words read correctly, both immediately and after a pause. Children received 1 point for each word read correctly, referred to as the untimed measure. The alpha reliability for this test was .81.

Design

The design involved a two-factor experiment with random assignment and repeated measures on one factor. The independent variables were spelling type

(simplified vs. conventional spelling) and picture type (presence vs. absence of pictures accompanying words). The picture type was a repeated measure. Students were assigned randomly to independent groups with word set ("bubble" set or "blanket" set) counterbalanced for picture type among the groups. ANOVAs were calculated to compare students' performance during the learning trials and on the posttests. It was expected that students in the partial alphabetic phase of reading (i.e., kindergartners) would learn fewer words taught in their full spellings with pictures than without pictures. However, there would be no effect of the pictures for partial-phase students learning words in their simplified spellings, because they would be capable of processing the entire orthography of each word. It was expected that students in the full alphabetic phase of reading (i.e., first-graders) would learn the words regardless of the presence of pictures.

Results

Characteristics of Students on Pretest Measures

Mean scores on the pretests are given in Table 1. Students received a composite *z*-score based on the sum of their pretests. This was done separately for each grade. The decoding scores of students in kindergarten were not included in the composite pretest score due to the very high percentage of 0 scores (see Table 1). Also, letter/sound knowledge of first graders was not included in their composite scores due to the very high percentage of students knowing 100 percent of the letters and their sounds. Within each grade, composite scores were used to rank order students before assigning pairs randomly to Groups A, B, C, and D.

ANOVAs were conducted on the separate pretest measures to determine whether

there were significant differences between mean pretest scores of the kindergarten and first grade students. The kindergarteners and the first graders differed significantly on all pretest measures except for the composite *z*-scores, which were calculated separately for each grade. Letter naming was not included due to the very high percentage of students able to name 100 percent of the uppercase letters (100 percent of the students). All of the students in the first grade were able to name all of the lowercase letters, and 95 percent of the kindergartners were able to name at least 24 of the lowercase letters. Table 1 shows the test statistics.

Performance of the kindergartners on the pretests supported the assumption that most of these students were partial alphabetic phase readers. They knew the majority of letter sound relations, but their word reading and spelling abilities were weak, and most kindergartners were unable to decode any nonwords. In contrast, performance of the first graders on the pretests was less supportive of the assumption that they were full alphabetic phase readers. These students showed much variability in their word and nonword reading and spelling scores, indicating that they were mixed in terms of their phase of word reading.

An ANOVA was calculated to compare the four treatment groups (A through D) on pretest measures. The four groups did not differ significantly on any of the pretest measures (see *F*-values in Table 2) which is not surprising since the students were assigned randomly to groups after being ranked by their composite *z*-scores.

Performance During Word Learning Trials

A preliminary analysis was conducted in order to determine whether performance

differed as a function of which word set, the "bubble" set or the "blanket" set, was learned with versus without pictures. Students who learned the "bubble" set with pictures and the "blanket" set without pictures, were compared to students who learned the "bubble" set without pictures and the "blanket" set with pictures. An ANOVA was conducted with Grade (K vs. 1st), Spelling Type (simplified vs. conventional), and Word Set Group (Group A/C vs. Group B/D) as the independent variables. The dependent measure was the difference between the number of trials to criterion in learning words with pictures and the number of trials to criterion in learning words without pictures (a repeated measure). Test statistics are reported in Table 3. Results revealed a significant main effect of Grade, Word Set, and intercept. No other main effects or interactions were significant. The effect of the intercept factor indicates that the difference favoring faster word learning with pictures than without pictures was significant.

The mean difference between the number of trials with versus without pictures was greater for the kindergarten students (M = 5.45, SD = 2.9) than for first graders (M = 3.05, SD = 4.2). These findings support the expectation that pictures would interfere more with word learning in Kindergartners than in first graders. The main effect of Word Set showed that the difference between learning the words with and without pictures was greater in Groups A/C who learned the "bubble" set with pictures and the "blanket" set without pictures (M = 5.60, SD =3.7) than in Groups B/D who learned the reverse word sets with and without pictures (M =2.90, SD = 3.4). However, Word Set did not interact with Grade or Spelling Type.

An item analysis of the mean number of trials to criterion for each word learned with pictures and without pictures in the two sets is presented in Table 4. From the final

column of this table, it is apparent that the advantage of learning words with pictures compared to no pictures (i.e., fewer trials to criterion) held across all the words. The source of the main effect of Word Set is evident in Table 4. The "blanket" set of words learned without pictures took more trials to learn than the "bubble" set learned without pictures. In fact, the trials to criterion (TTC) means of every word in the "blanket" set were higher than the TTC means of every word in the "bubble" set. The same difference between word sets was not apparent when pictures accompanied the words (see Table 4). To determine whether word frequency explained this difference, a correlation between TTC scores and a rank ordering of words based on frequency count in English (Carol, Davies, & Richman, 1971) was calculated. Results revealed no relationship, $r = .01$, $p > .05$. Why this occurred is not clear. This variable, Word Set, did not interact with any of the main variables of interest, and the difference favoring learning with pictures over no pictures was apparent for every word. Therefore, the variable Word Set was dropped from further analysis.

Word Learning

During the word learning task, the students' responses were recorded in order to assess whether the presence of pictures had an influence on learning the words to criterion. A three-way ANOVA was conducted, with Grade (K vs. 1st), Spelling Type (simplified vs. conventional spelling), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependent variable was trials to criterion. Test statistics are reported in Table 5. Mean performance is reported in Table 6. Results revealed significant main effects of Grade and Picture, and a significant

interaction between Picture and Grade. No other main effects or interactions were significant.

From Table 6, it is apparent that first graders learned the words in fewer trials than kindergartners. Learning was faster with pictures than without pictures for both kindergarten and first-grade students. Post hoc paired samples *t*-tests showed that it took significantly more trials to reach criterion reading words without pictures than with pictures both for first grades students, $t(19) = -3.56$, $p<.01$, and for kindergarten students, $t(19) = -5.67$, $p<.01$. However, kindergartners were especially slow in learning the words without pictures compared to their speed with pictures and compared to first graders' speed learning words both with and without pictures. In other words, the absence of pictures made learning to read the words much harder for kindergartners than for first graders compared to their word learning with pictures. This was indicated by the significant interactions. The absence of any main effect or interaction involving spelling type indicates that the above findings held similarly for simplified and conventional words.

The number of words read correctly across trials was also examined. A four-way ANOVA was conducted, with Picture Condition (present vs. absent), Grade (K vs. 1st), Spelling Type (simplified vs. conventional), and Trials (1-5) as the independent variables. The dependent variable was the number of words read correctly per trial. Test statistics are reported in Table 7. Mean performance is reported in Table 6. Results revealed significant main effects of Grade and Picture, and a significant interaction between Picture and Grade. Also, results revealed a significant main effect of Trial, and a significant interaction between Picture and Trial.

From Table 6, it is apparent from mean performance across the first five trials that first graders read more words correctly than kindergarten students did. Post hoc paired samples *t*-tests showed that on average significantly more words were read with pictures than without pictures by first graders $t(19) = 3.34$, $p<.01$, and by kindergarteners, $t(19) = 8.10$, $p<.01$, confirming that the main effect held at both grade levels. The Picture by Grade interaction arose because the difference favoring the picture over the no picture condition was greater for the kindergarten students than for first graders (i.e., mean difference of 1.38 versus 0.69 correct). The findings mirror those on the trials to criterion measure.

An explanation for the significant interaction between trials and pictures can be drawn from Figures 1 and 2. Words learned with pictures were read almost perfectly from the first trial whereas words learned without pictures took several trials before they were read almost perfectly.

Posttest Performance

Words Read- Timed and Untimed

One posttest assessed whether the trained words were read as sight words (i.e., words read immediately). An ANOVA was conducted, with Grade (K vs. 1st), Spelling Type (simplified vs. conventional spelling), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependent variable was the number of words read immediately. Test statistics are reported in Table 8. Mean performance is reported in Table 9. Results revealed significant main effects of Grade and Picture, and a significant interaction between Picture and Spelling Type. No other

main effects or interactions were significant.

From the means in Table 9, it is apparent that first graders outperformed kindergartners. Also students read more words that they learned without pictures than words they learned with pictures. Regarding the significant interaction, the difference favoring learning with no pictures was greater for simplified spellings than for conventional spellings (see Table 9). However, a post hoc paired samples *t*-test showed that the difference was significant favoring no pictures for both simplified spellings, $t(19)=-6.25$, $p<.01$, and for conventional spellings, $t(19)=-2.93$, $p<.05$.

One problem with these data evident in Table 9 is that there were many scores of zero. In other words, many children failed to read any words immediately upon seeing them three days after they had learned to read the words. This was particularly true among kindergartners learning words with pictures. This violates the assumption of normality needed to conduct an ANOVA. A mixed binomial regression analysis was conducted to confirm that more words were read by sight when learned without pictures than with pictures. The model comparison is reported in Table 10. Mean performance is reported in Table 9. It is apparent in Table 10 that the Grade by Picture interaction model was the best model because it has the lowest BIC (239.9). Results of the test indicate that sight word reading scores were significantly higher when words had been learned without pictures than with pictures. Post hoc paired samples *t*-tests showed that the difference was significant favoring no pictures for both kindergarteners, $t(19)=-4.41$, $p<.01$, and for first graders, $t(19)=-4.40$, $p<.01$. It can be seen in Table 10 that the Spelling by Picture interaction model has a BIC value of 240.9. This difference between BIC values (1.0) is a relatively small change, suggesting that the model with 239.9 is only "slightly

preferred" to the one with 240.9. These two models are almost equivalent to each other in terms of their ability to account for the data. These results support the results revealed by the ANOVA (see Table 8).

The number of untimed words that students were able to read, either by sight or after a pause, was also measured. An ANOVA was conducted with Grade (K vs. 1st), Spelling Type (simplified vs. conventional spelling), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependent variable was the number of words read untimed. Test statistics are reported in Table 11. Mean performance is reported in Table 12. As in the timed word analysis, results revealed significant main effects of Grade and Picture, and a significant interaction between Picture and Spelling Type. No other main effects or interactions were significant.

From Table 12, it is apparent that the benefit to word learning provided by the absence of pictures was greater when students learned to read simplified spellings of words than when they learned to read conventional spellings. In fact, post hoc t-tests revealed that the difference was significant in the case of simplified spellings, $t(19) = -6.99$, $p<.01$, but fell short of significance in the case of conventional spellings, $t(19) = -1.45$, $p>.05$.. However, a limitation of this analysis is that there were many scores of zero, particularly among kindergartners learning words that had been accompanied by pictures.

To verify these results, performance of only those students who read at least one word correctly in both the picture and the no picture conditions was examined. An ANOVA was conducted with Spelling Type (simplified vs. conventional spelling), and Picture (present vs. absent) as the independent variables. The latter was a repeated

measure. The dependent variable was the number of words read untimed. Results revealed significant main effects of Picture, $F(1,19)= 10.50$, $p<.01$, and a significant interaction between Picture and Spelling Type, $F(1,19)= 7.00$, $p<.05$. Mean performance is reported in Table 12 where it is apparent that with the zero scores excluded from untimed word readings, the same pattern was evident. Post hoc *t*-tests comparing word reading with pictures and no pictures revealed a significant difference in the case of simplified words, $t(9) = -5.51$, $p< .01$, but not in the case of conventional words, $t(10) = -.36$, $p >.05$. These results indicate that children remembered how to read simplified spellings much better when they had learned them with no pictures than with pictures. However, the difference favoring no pictures fell short of significance for conventional spellings.

Another source underlying the significant interaction between spelling type and picture presence is evident in Table 12 (bottom). Opposite effects were obtained depending upon whether simplified or conventional spellings were learned with or without pictures. When simplified spellings had been learned with pictures, they were read less accurately than conventional spellings on the posttest, whereas when simplified spellings had been learned without pictures, they were read more accurately than conventional spellings. One possible explanation why simplified spellings were read better than conventional spellings learned without pictures is that readers had to work harder at remembering how to read the simplified spellings because the spellings lacked letters for all the phonemes in words and there were no pictures to prompt the words. This served to strengthen their memory for the simplified spellings. Some evidence for this is shown in Figure 2 where first graders took somewhat longer to learn to read

simplified spellings without pictures than conventional spellings without pictures. One possible reason why conventional spellings were read better than simplified spellings when both had been learned with pictures is that the spellings differed in their decodability. Simplified spellings could not be decoded because they lacked letters for all the phonemes whereas conventional spellings could be decoded. When children saw these words on the posttest, although their decoding skill was limited, it enabled somewhat greater success with the conventional spellings.

A question of interest was how students' word reading improved under untimed compared to timed scoring. A comparison of means in Tables 9 and 12 reveals that the mean increase in words read untimed compared to timed conditions was greater when conventional spellings were read in the picture condition (i.e., mean difference = .65) than when words were read in the other three conditions (i.e., mean differences ranging from .15 to .23). In other words, having more time to read words by applying a decoding strategy produced the biggest gain when words were spelled conventionally and when they had been learned with pictures. The reason why simplified spellings did not show a similar increase is that they lacked vowels and so could not be decoded. The reason why conventional spellings that were learned with no pictures did not show a similar increase is that children had already applied a decoding strategy to learn to read them during training.

Spelling Performance

An ANOVA was conducted on the performance of those students who had been taught to read simplified spellings. The proportion of students who spelled no words correctly ranged from 60% to 100% across the different conditions. This violates the

assumption of normality needed to conduct an ANOVA on the number of words correctly recalled. Therefore, the dependant measure was the number of letters recalled correctly with Grade (K vs. 1st), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. Test statistics are reported in Table 13. Mean performance is reported in Table 14. Results revealed no significant main effects or interactions. From mean values, it is apparent that kindergartners and first graders recalled about the same number of letters in simplified spellings, and the presence of pictures made little difference in their recall of these letters. A mean of 77% of the letters was recalled correctly.

Another ANOVA was conducted on the number of correct letters recalled when students had been taught conventional spellings. The independent variables were Grade (K vs. 1st) and Picture (present vs. absent). The latter was a repeated measure. Test statistics are reported in Table 15. Mean performance is reported in Table 14. Results revealed significant main effects of Grade and Picture. The interaction was not significant. From Table 14, it is apparent that first graders recalled many more letters correctly in conventional spellings of words than kindergartners (i.e., 59% vs. 36%). Also, more letters in conventional spellings were recalled correctly when they were learned without pictures than with pictures. The fact that the grade and picture variables influenced recall when conventional spellings were taught but not when simplified spellings were taught suggests that spelling performance did not reflect learning processes in the latter case. Children may have been simply inventing these spellings rather than recalling them.

Discussion

Results of Experiment 1 provide evidence indicating that the presence of pictures affects the ability of beginning readers to commit new sight words to memory. When words were learned without pictures, these students read more words by sight and by a combination of sight and decoding on posttests than when words were learned with pictures. It is thought that kindergarten and first-grade students learned words better when pictures were not present, because the presence of pictures distracted students from focusing on the orthography of the words and retaining them in memory. Superior memory for words learned without pictures on the posttest occurred despite the fact that children had read these words fewer times correctly during the learning trials than pictured words which were read almost perfectly on every trial.

One hypothesis was that the kindergarten students would not be distracted by pictures when learning to read simplified spellings of words. Results did not support this. Pictures did have a significant negative influence on the kindergarten student's reading simplified spellings of words. Kindergarten students who were taught simplified spellings of words learned more words when pictures were not present. It may be that in order for beginners to form connections in memory to read words regardless of the presence of picture prompts, they must be able to process connections between spellings and pronunciations automatically. Children in the partial alphabetic phase may not be sufficiently practiced or adept at processing grapheme-phoneme mapping relations to support automatic processing when they read words. Rather the connection forming process requires focused attention. The longer learning times that were required to remember how to read simplified spellings without pictures suggests that greater

attention and effort were involved (see Figures 1 and 2).

Likewise, it was hypothesized that first-grade students would not be distracted by the pictures when learning to read new sight words. However, this hypothesis was not supported. First-grade students learned more words as sight words when the words were presented in the no picture condition.

These findings are consistent with Samuels' (1967) conclusion that students recognize significantly more words when they are presented without distracting stimuli and with the conclusion of Saunders and Solman (1984) that children learn more words when they are presented without pictures than with pictures. The present study provided evidence from posttests conducted after a delay of three days, measuring students' ability to read words under both timed and untimed conditions.

When the number of words read either by sight or by decoding on the posttest was measured (i.e., the untimed condition), the results were similar to those for the words read by sight only. More words were read when no pictures had been present during learning. Under the untimed condition, students read more words in their simplified spellings when no pictures had been present than when pictures had been present. For words learned in their conventional spellings, the difference in the number of words learned also favored the no picture condition; however, this difference did not reach statistical significance. The explanation for this finding is that decoding allowed students to correctly read more words when they were conventionally spelled.

For the spelling posttest, results revealed that for students taught the conventionally spelled words, more letters in words that were learned under the no picture condition were spelled correctly than words learned under the picture condition.

However, there was no statistical difference in the number of letters spelled correctly for the students who were taught the simplified spellings, in either the picture present or picture absent conditions.

In order for students to become fluent readers, they must establish in memory a substantial lexicon of words that can be recognized automatically. With a considerable sight word vocabulary, readers are able to read with appropriate speed, and are able to allocate more cognitive resources to the meaning of text. Readers learn sight words by forming connections between letters in spellings and sounds in pronunciations of the words (Ehri, 1992, 1998, 2005). Their ability to make these grapheme-phoneme connections is dependent on the readers' knowledge of the alphabetic system. Readers in the partial alphabetic phase form connections between only some of the letters and sounds when reading words, whereas full alphabetic readers are able to form complete connections between letters in spellings and phonemes when learning new words.

The purpose of Experiment 1 was to examine the effect that pictures had when partial alphabetic and full alphabetic readers were taught to read new sight words. The question of interest was whether pictures would distract students from the written words and interfere with learning to recognize the new words, and whether this effect would differ depending on the reading level of the students.

It was expected that kindergarten students would be in the partial alphabetic phase of reading and that the first-grade students would be in the full alphabetic phase of reading. An important question raised is to what extent we can consider the first graders in this study full alphabetic readers. On the pretest measures, first-graders had low nonword decoding scores (see Table 1). On the posttests, strong decoding skill was not

apparent. First grade students reading conventionally spelled words under the untimed condition were successful in decoding the words on average only 45% of the time. If they were fully capable decoders, they would have been able to consistently read the words in their full spellings in the untimed condition. Very likely the complete spellings of words that students were taught were beyond their knowledge of the alphabetic system, so the first-graders in this study were not able to connect all the letters to sounds when learning them; instead they continued to rely on partial grapheme-phoneme connections. Also, findings indicated that on the posttest these students remembered how to read more simplified than conventional spellings of words learned without pictures in the untimed condition. This also suggests word learning at the partial phase.

Although the first-graders showed limited memory for letters when spelling the words taught in the word learning task, results from the spelling posttests provide evidence indicating that these readers did have a firmer grasp of the alphabetic principle than the kindergarten students. The first graders who were taught conventionally spelled words used many more letters when spelling the words than Kindergarten students taught the same words.

Interestingly, first graders who were taught simplified spellings of words wrote several fewer letters on the posttest than first graders who were taught conventional spellings. As evident in Table 14, the means were 11.70 letters in simplified spellings vs. 17.20 letters in conventional spellings. This suggests that the first graders in this study were not simply inventing spellings of words based on their letter-sound knowledge but rather were remembering the letters they saw during the word learning task. In contrast, the kindergartners did not write more letters from conventional than from simplified

spellings. As evident in Table 14, they wrote on average 11.55 letters from the simplified spellings they had learned to read and 10.65 letters from conventional spellings. One explanation is that their partial knowledge of the alphabetic system limited their spelling memory to recalling partial spellings in both conditions. Interestingly, first graders recalled on average the same number of letters from simplified spellings as kindergartners (i.e., M = 11.50 vs. 11.55, or 77% respectively), indicating equal facility either remembering or inventing the simplified spellings.

The first-grade students in this study possessed more alphabetic knowledge than the kindergarten students, yet when learning new words, they did not focus on the complete orthography of the words, as full alphabetic readers would be expected to do. This may be what made them susceptible to distraction by pictures and what prevented them from retaining the words in memory as sight words. At some point in reading development, words are attended to automatically, and the presence of pictures should not distract readers from the printed word. More mature readers should be able to learn these words as sight words and not be distracted by the presence of pictures. Replicating this study with full alphabetic readers in the second grade was expected to provide evidence indicating when during reading development the complete orthography of words is processed and remembered. The second experiment was conducted to examine this question.

Chapter 4: Experiment 2

Rationale and Hypotheses

The purpose of Experiment 2 was to utilize the same design as the first experiment in order to examine effects for older children who are demonstrated to be in the full alphabetic phase of reading. One question of interest was whether students who are in the full alphabetic phase will show the same effect of pictures on word learning shown by younger students. According to Ehri's (2005) word learning theory, connections between graphemes in spellings and phonemes in pronunciations need to be activated to secure spellings in memory. The expectation was that full phase readers would focus on the orthography of the words automatically, and that the presence of pictures would not serve as distractors in either the simplified or conventional spelling conditions. In order to assess whether the full phase readers were able to commit a full representation of the words in memory and thereby recognize the target words by sight, the Experiment 2 utilized a t-scope procedure in which students read the target words as the words were flashed on a computer screen for 0.05 seconds. Presenting words in this way prevented students from decoding the words during this sight word assessment. The present study also examined whether directing students' attention to the words written on the cards would enhance their memory for spellings of the words and would eliminate differences which might otherwise be found.

Method

Participants

The participants were second-grade students (N=32) from three New York City public schools in upper Manhattan. Within these schools, 81% to 94% of the students

qualified for free or reduced lunch. Children with no known cognitive or behavioral disabilities who returned signed parent consent forms were considered for participation. Sixteen of the participants were female; 16 were male. Sixteen were African American, twelve were Latin American, and four were of mixed descent. Mean chronological age of the participants was 90.6 months. The students were screened using a battery of tests (described below) to assess their phase of word reading development. The participants included only those students who could not read any of the target words on the initial pretest screening. A total of 49 second graders who returned signed parent consent forms were screened. Seventeen were eliminated from the study because they were able to read at least one of the target words on the initial pretest screening.

Materials and Procedures

Pretests. Several pretests were administered in the following order.

1. Sight Word Recognition. Children read 10 conventionally spelled target words mixed with 25 Boder sight words (see Appendix E). Words were presented tachistoscopically on a computer screen. The student was asked to fixate on a point on the screen. The word then appeared at the center of the screen for 0.05 seconds, immediately replaced by hash marks (####). The student had 5 seconds to respond before the next word was presented. The numbers of target words and Boder words read correctly were scored separately. The split half reliability for this test was .72. Students who read any of the target words were eliminated from the study.

2. Letter Knowledge. Children's accuracy and speed to name 26 randomly ordered letters, as well as their accuracy to say the sounds of letters was assessed. Students were handed a card displaying all 26 letters. The students were asked to name

the letters as quickly as possible. Time and accuracy were recorded. Possible score: 0-26.

The students were then given another card with the letters printed in capital letters in random order. They were asked for the sound each letter makes. They were asked for both long and short vowel sounds. Possible score: 0-31.

3. Invented Spelling. Children were asked to spell 20 words from the ECLAS-2 spelling assessment (Grade 2, Spring, List A) [see Appendix F]. The words included spelling conventions that are known to distinguish more from less advanced spellers (i.e., man, cup, dish, rock, went, landed). The children were told the word, given the word in a sentence, and told the word again before writing it. Each word was worth 2 points if spelled entirely correctly. If the word was misspelled, but the spelling convention was present, 1 point was given. For example, "glad" spelled G-L-D would be worth one point, since the speller correctly wrote the initial blend. Possible score: 0-40. The split half reliability for this test was .74.

4. Word Reading. Children read a graded list of words from the Woodcock Reading Mastery Tests- Revised (1987). The students read a list of words increasing in difficulty. The researcher pointed to each word and asked the student what word it is. S/he was given 5 seconds to respond before moving on to the next word. The score was either 1 or 0 for each word. The assessment ended when the child failed to read six consecutive words within one page. The WRMT-R word identification subtest has a publisher-reported split half reliability of .98.

5. Nonword Reading. Children were given a card and told that the words are made-up words. They were asked to read a list of 20 made up words from the ECLAS-2

(Appendix F), which assesses their control of decoding conventions (e.g.., bim, juff, spog, deak, pasking) and 10 nonwords analogous to the target words (bicket, rable, tumber, nollar, dattle, bliver, ranket, tubble, niamond, deedle). Students' knowledge of ten decoding conventions was assessed (e.g., c-v-c words, initial consonant blend, long-vowel digraph), as well as their ability to decode words similar to the target words. Students were given a point for every word read correctly. Two separate scores were given: possible score on ECLAS-2 nonword reading, 0-30; possible score on analogous nonword reading, 0-10. The split half reliability for this test was .83.

Word Learning Treatments

Four word learning treatments were compared. Each student was taught to read five words accompanied by pictures depicting the meanings of the words and five words without pictures. Half of the students learned to read full conventional spellings of the 10 words, and half learned to read simplified spellings of the 10 words (e.g., TKT for ticket). The particular sets of 5 words learned with and without pictures were counterbalanced across students.

During word learning, half of the students were asked to show how the spellings of words appearing either with or without pictures mapped onto the pronunciations of words (attention group). The other half learned to read the words without this step (no attention group). Prior to the first study trial, students in the attention group were taught to read words while using their fingers to segment the words by exposing just those letters that symbolized each syllable on the card as they read the syllables aloud. They were taught to show the letters in the first syllable that corresponded to the sounds they were saying, and to then expose the rest of the letters that corresponded to the second

syllable of the word. Students in the attention group were trained to do this with three practice words (e.g., LITTLE, LTL; MUFFIN, MFN; TUNNEL, TNL). Students did not have any difficulty performing this task.

Students were trained individually. Each child learned to read 10 words printed on cards in capital letters, half accompanied by pictures of the words and half without pictures. First, there was a study trial, where the student was shown each card, told the word, and asked to repeat it. If the student was in the attention group, the student was presented the card, told the word, and asked to repeat it while exposing the letters of syllables of the word, in the manner that was taught. If the student did not perform the segmentation correctly, the correct segmentation of the word was modeled and the student was asked to repeat it.

Subsequent trials were test trials. For each trial, a deck of pre-shuffled cards was shown, one card at a time, and the child was asked to read each word. If the student was in the attention group, the student was asked to read each word while exposing the syllables of the words with his or her finger, in the manner taught. The student was corrected if there was a miscue. Miscues were recorded. The words were reviewed by each child in this way until he or she could recognize all of the words in the deck correctly and immediately for three successive trials. There were five pre-shuffled decks, each with a different word order, which were recycled as necessary. Scored were the numbers of trials to criterion that included the three perfect successive trials. Students in the attention condition had to show mapping relations correctly as well as read the words correctly to achieve three perfect trials.

In order to form treatment groups, the composite pretest scores of students were

ordered from high to low. The first pair of students was randomly assigned to either the simplified or conventional spelling condition, followed by random assignment, one member to the "bubble" word set and the other to the "blanket" word set. The next two students were assigned to the other spelling condition not filled by the first pair, either the simplified or the conventional condition. Members of the pair were then randomly assigned, one to the "bubble" word set and the other to the "blanket" word set.

The "bubble" set consisted of the following words, with simplified spellings preceding conventional spellings: BBL, BUBBLE; RVR, RIVER; TBL, TABLE; NDL, NEEDLE; DMD, DIAMOND. The "blanket" set consisted of the following words: BKT, BLANKET; RTL, RATTLE; TKT, TICKET; NBR, NUMBER; DLR, DOLLAR.

This assignment procedure yielded the following four groups of students: One simplified group (Group A) and one conventional group (Group C) which learned to read the "bubble" set with pictures and the "blanket" set without pictures. The other simplified group (Group B) and the other conventional group (Group D) learned to read the "bubble" set without pictures and the "blanket" set with picture. The picture/ no picture manipulation was varied within subjects.

Students within each group were randomly assigned to an attention or no attention condition, so that half of the students in each word set group were asked to show how spellings of the words mapped onto pronunciations during the study and test trials. The other half of the students in each word set group were not asked to map spellings onto the words' pronunciations (no attention group).

Because of the assignment procedure, it was expected that the groups would be comparable in literacy skills. There were 4 second graders assigned to each of the 8

groups (Group A-attention; Group A-no attention; Group B-attention; Group B-no attention; Group C-attention; Group C-no attention; Group D-attention; Group D-no attention).

Posttests. Three days after the word learning session, the following posttests were given to assess what students remembered about the words they learned to read.

1. Word Recognition By Sight: Children read the 10 target words mixed with the Boder sight word task. They were presented with the target words they learned, either in simplified spellings or conventional spellings (see Appendix G). Words were presented tachistoscopically on a computer screen. The student was asked to fixate on a point on the screen. The word then appeared on the center of the screen for 0.05 seconds, immediately replaced by hash marks (####). The student had 5 seconds to respond before the next word was presented. The numbers of target words read correctly was scored. The alpha reliability for this test was .70.

2. Spelling Production. A spelling test of the 10 target words was given to see whether students had retained orthographic representations in memory. Students were asked to write each word on a sheet of paper. Students were reminded to write the words just like they saw them during the word learning task three days earlier. They were told the word in isolation and in a sentence. The word was repeated again and they wrote it. Their spellings were scored in terms of the number of correctly recalled words and letters. They received 1 point for each letter that was correctly written as they had learned it, either as a simplified or a conventionally spelled word. The split half reliability for this test was .95.

3. Word Recognition By Sight or Decoding: Words were presented to the students

on cards one at a time. Target words were mixed with the Boder words used in the previous t-scope task (see Appendix H). Scored were words that were read correctly regardless of time (untimed). The alpha reliability for this test was .55. The lower reliability is likely a result of ceiling effects on the test.

4. Nonword Reading. The nonword reading task that was administered as a pretest was re-administered as a posttest. Children were given a card and told that the words on the card are made-up words. They were asked to read a list of 30 made up words from the ECLAS-2 (see Appendix F), which assesses their control of decoding conventions (e.g.., bim, juff, spog, deak, pasking) and 10 nonwords analogous to the target words (bicket, rable, tumber, nollar, dattle, bliver, ranket, tubble, niamond, deedle). Students' knowledge of ten decoding conventions was assessed (e.g., c-v-c words, initial consonant blend, long-vowel digraph), as well as their ability to decode words similar to the target words. Two separate scores were given: possible score on ECLAS-2 nonword reading, 0-30; possible score on analogous nonword reading, 0-10. The split half reliability for this test was .61.

Design

For this experiment, ANOVAs were calculated to compare students' performance during the learning trials and on the posttests. The independent variables were spelling type (simplified vs. conventional), attention to spelling (present vs. absent) and presence of pictures (present vs. absent). The latter was a repeated measure. Students' pattern of performance was compared to students' performance in Experiment 1. It was expected that the second-grade students in Experiment 2 would be in the full alphabetic phase of reading and would learn the conventional spellings of words regardless of the presence of

pictures. It was also examined whether students who had their attention directed to the spellings of the words would outperform those who did not.

Results

Characteristics of Students on Pretest Measures

Mean scores of the sample on the pretests are given in Table 16. Students received a composite *z*-score based on the sum of their pretests. Letter/sound knowledge was not included in their composite scores due the very high percentage (97%) of students knowing 100 percent of the letters and their sounds. Composite scores were used to rank order students before assigning pairs randomly to experimental groups.

Performance of the second-grade students supported the assumption that these students were full phase readers. Compared to the kindergarten and first-grade students in Experiment One (see Table 1), these students showed strength in their word reading and decoding ability. They were able to read many more words by sight and were able to decode many more nonwords.

An ANOVA was calculated to compare the four treatment groups (attention vs. no attention by simplified vs. conventional spellings) on pretest measures. The experimental groups did not differ significantly on any of the pretests (see *F*-values in Table 16) which is not surprising because the students were assigned randomly to groups after being ranked by their composite *z*-scores.

Performance During Word Learning Trials

An ANOVA was conducted in order to determine whether performance differed as a function of which word set, the "bubble" set or the "blanket" set, was learned with versus without pictures. Students who learned the "bubble" set with pictures and the

"blanket" set without pictures, were compared to students who learned the "bubble" set without pictures and the "blanket" set with pictures. The ANOVA included Attention (present vs. absent), Spelling Type (simplified vs. conventional), and Word Set Group (Group A/C vs. Group B/D) as the independent variables. The dependent measure was the difference between the number of trials to criterion in learning words with pictures and the number of trials to criterion in learning words without pictures (a repeated measure). Test statistics are reported in Table 17. Mean performance as a function of all three variables (Attention, Spelling Type, and Picture Presence) is reported in Table 18. Results revealed a significant main effect of Attention and Spelling Type. No other main effects or interactions were significant. The significant effect of the intercept factor indicates that the difference favoring faster word learning with pictures than without pictures was significant.

The mean difference between the number of trials with pictures and without pictures was greater for the students in the no attention condition (*M* difference = 1.75, *SD* = 1.69) than in the attention condition (*M* difference = 0.56, *SD* = 0.56). In addition, the mean difference between the number of trials with pictures and without pictures was greater for students who learned simplified spellings of words (*M* = 1.75, *SD* = 1.62) than for students who learned conventional spellings of words (*M* = 0.57, *SD* = 1.53). These findings indicate that students took longer to learn to read the words without pictures when they did not pay attention to the spellings of words compared to attending to spellings, and when the words were simplified spellings rather than conventional spellings. There was no main effect of Word Set and Word Set did not interact with Attention or Spelling Type. As a result, Word Set was dropped from further analysis.

From means in Table 18, it is apparent that students read words accompanied by pictures almost perfectly from the outset. The mean number of trials to reach criterion was close to the minimum of 3 trials across all of the conditions when words were accompanied by pictures. Performance was closest to perfect in reading conventional spellings of the words.

To examine for interactions not assessed in the previous analysis, a three-way ANOVA was conducted, with Spelling Type (simplified vs. conventional spelling), Attention to Spelling (present vs. absent), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependent variable was trials to criterion. Test statistics are reported in Table 19. Mean performance is reported in Table 18. Results revealed significant interactions between Picture and Attention and between Picture and Spelling Type. No other interactions were significant.

Regarding the Picture by Attention interaction, from Table 18, it is apparent that word learning without pictures took longer when no attention was directed at the words' orthography than when attention was activated. A *t*-test revealed that the difference was statistically significant, $t(30) = -2.24$, $p<.05$. This indicates that the step of having students segment the words into syllables as they practiced reading the words over trials was effective in speeding up their word learning when no pictures were present. However, attention made no such difference to word learning when pictures were present, mainly because words were read almost perfectly. Also, word learning took significantly longer when words were learned without than with pictures in both the attention condition, $t(15) = -2.18$, $p<.05$, and the no attention condition, $t(15) = -4.13$, $p<.01$. However, the difference was greater with no attention.

Regarding the Picture by Spelling Type interaction, from Table 18 it is apparent that word learning without pictures took longer when simplified spellings were the words learned than when conventional spellings were learned. A *t*-test revealed that the difference was statistically significant, $t(30) = 2.53$, $p<.05$. This indicates that it was harder to remember how to read simplified spellings lacking vowels than conventional spellings that could be decoded when no pictures accompanied the words being learned. A *t*-test comparing means for no picture versus pictures revealed a statistically significant difference for simplified spellings, $t(15) = -4.35$, $p<.01$, but not for conventional spellings, $t(15)=-1.95$, $p>.05$. As in Experiment 1, these findings show that more effort was required to learn to read simplified spellings than conventional spellings from memory without pictures. In contrast, there was little difference when pictures were present because they propped up performance.

Posttest Performance

Words Read- Timed and Untimed

On one posttest, a t-scope procedure was used to assess whether the trained words were read as sight words (i.e., words read in 0.05 seconds). An ANOVA was conducted, with Attention (present vs. absent), Spelling Type (simplified vs. conventional spelling), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependent variable was the number of words read immediately. Test statistics are reported in Table 20. Mean performance is reported in Table 21. Results revealed a significant three-way interaction between Attention, Word Type, and Picture. No other main effects or interactions were significant.

From Table 21, it is apparent that opposite effects occurred for different levels of all three variables. For simplified spellings, more words were read by sight when they were learned without pictures than with pictures when attention was directed at the words during learning. However, when no attention was directed, more words were read when accompanied by pictures than with no pictures. For conventional spellings, the opposite pattern was observed. Fewer words were read by sight when they were learned without pictures than with pictures when attention was directed at the words during learning. However, when no attention was directed, fewer words were read when accompanied by pictures than with no pictures. To determine whether pairs of means differed statistically, *t*-tests were conducted. Post hoc *t*-tests revealed only one statistically significant difference, favoring the no picture condition over the picture condition for students who learned conventionally spelled words and who did not have their attention drawn to the words, $t(7)=-2.66$, $p< .05$ (see Table 21). It was expected that these second graders, being in the full alphabetic phase, would process grapho-phonemic connections of words automatically to store them in memory and would be able to read the words by sight on the posttest regardless of whether pictures had accompanied the words during learning. Findings were mixed. On the one hand, some findings were supportive. The prediction of no differences in the reading of words as a function of picture presence held in three of the four conditions. As evident in Table 21, differences between means fell short of significance when students read simplified spellings both with and without attention directed at the words, and when students read conventional spellings with attention directed at the words. Although the pattern of means favoring either pictures or no pictures varied inconsistently across these three conditions as reflected in the significant

three-way interaction, in two of the conditions, the means favored the picture over the no picture condition, which is opposite of the suppressive effect expected of pictures on word learning. On the other hand, findings were not supportive of the hypothesis as one condition did reveal a statistically significant difference showing a suppressive effect of pictures on word learning. Students in the no attention condition who read conventional spellings of words learned to read significantly fewer of these words by sight when they were accompanied by pictures than when they were not. This does not support the hypothesis that the words would be learned equally well by full phase readers regardless of the presence of pictures. One conclusion that might be drawn is that, in the case of conventional spellings of words, the full phase readers learned to read the words equally well by sight regardless of the presence of pictures when their attention was focused on the spellings of the words during learning whereas when their attention was not focused on print, pictures exerted an influence and suppressed memory for the words.

The number of words that students were able to read, either by sight or after a pause, referred to as the untimed measure, was also assessed. This task followed the t-scope task. Students read the words previously taught but this time on cards. The words were mixed in with other words from the Boder test. An ANOVA was conducted with Attention (present vs. absent), Spelling Type (simplified vs. conventional spelling), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependant variable was the number of words read untimed. Test statistics are reported in Table 22. Mean performance is reported in Table 23. Results revealed no significant main effects or interactions. It is apparent in Table 23 that ceiling effects precluded the detection of differences. Students remembered how to read most of the

words.

Spelling Performance

An ANOVA was conducted on the performance of students who were taught simplified spellings. The dependant measure was the number of letters correctly spelled as taught, with Attention (present vs. absent), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. Test statistics are reported in Table 24. Mean performance is reported in Table 25. Results revealed no significant main effects or interactions. From mean values, it is apparent that students taught simplified spellings of words recalled about the same number of letters whether or not their attention was drawn to the spellings of the words during word learning, and the presence of pictures made little difference in their recall of these letters. Letters were recalled to a high degree of accuracy.

Another ANOVA was conducted on the number of correct letters recalled when students had been taught to read conventional spellings. The independent variables were Attention (present vs. absent) and Picture (present vs. absent). The latter was a repeated measure. Test statistics are reported in Table 26. Mean performance is reported in Table 25. Results revealed no significant main effects or interactions, indicating that students recalled conventional spellings to the same extent regardless of how they learned the words. Children recalled 92% of the letters in simplified spellings and 78% in conventional spellings.

The number of words spelled correctly (i.e., exactly as they had been taught) was also measured. An ANOVA was conducted with Attention (present vs. absent), Spelling

Type (simplified vs. conventional), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependant variable was the number of words spelled exactly as taught. Test statistics are reported in Table 27. Mean performance is reported in Table 25. Results revealed no significant main effects or interactions.

It is apparent in Table 25 that students did not spell many words exactly as they had been taught. The number of students spelling no words correctly as taught ranged from 25% to 50% across conditions. This is surprising given that many students were able to recall a large number of taught letters. To understand this discrepancy, examples of the more common errors produced during the spelling posttest were examined. These are shown in Table 28. It is apparent upon inspection that some students who were asked to write conventionally spelled words wrote phonetic spellings of words. They had difficulty correctly spelling schwa vowel sounds, and they omitted double consonants in conventional spellings. A possible explanation is that for students who learned conventionally spelled words, it was challenging for them to generate exact representations of words when they had not practiced writing those words. For students who learned simplified spellings of words, they often spontaneously generated more letters than had been taught, particularly vowels which had not appeared in those words. The difficulty that students exhibited remembering the complete spellings of words they were taught to read suggests that they may have lacked orthographic knowledge of the relevant spelling patterns needed to retain accurate grapho-phonemic representations of the words in memory. For example, lack of knowledge of the rule governing consonant doubling may have limited their memory for these consonants.

Analogous Nonword Decoding Performance

Students were posttested on their ability to decode nonwords that were analogous to the conventional spellings of target words that were taught during word training. An ANOVA was conducted with Attention (present vs. absent), Spelling Type (simplified vs. conventional), and Picture (present vs. absent) as the independent variables. The latter was a repeated measure. The dependent variable was the number of analogous nonwords correctly decoded. Test statistics are reported in Table 29. Mean performance is reported in Table 30. Results revealed a significant main effect of Attention, and a significant interaction between Attention and Spelling Type. No other significant main effects were found. *T*-tests were conducted to localize the interaction effect (reported below).

From Table 30, it is apparent that students who had their attention directed to conventional spellings of words during word learning were able to decode significantly more analogous nonwords than students whose attention was not directed at conventionally spelled target words. A post hoc *t*-test revealed that this difference favoring the attention condition reached statistical significance, $t(14)=4.00$, $p<.01$. In contrasts, the attention manipulation exerted no effect on analogous decoding when simplified spellings had been learned. Among students who had their attention directed to spellings of words during word learning, those who learned to read conventional spellings of words were able to decode significantly more analogous nonwords than those who were taught simplified spellings of words. A post hoc *t*-test revealed that this difference was statistically significant, $t(14)=3.29$, $p<.01$. It is apparent in Table 30 that students who were taught simplified spellings of words were able to decode almost the same number of analogous nonwords regardless of whether they had their attention

directed to simplified spellings during word learning. These findings suggest that only the group who learned analogous real words by analyzing their constituent syllables during the learning trials applied their word knowledge to read the nonwords by analogy. Those who learned the words as wholes without directing attention to letter parts read the words no better than students who had not been taught analogous spellings of the real words but only simplified spellings sharing only a few consonant letters and no vowels with the nonwords.

Discussion

Results of Experiment 2 provided some evidence indicating that the presence of pictures did not impair the ability of full-alphabetic readers to commit new sight words to memory if students had their attention drawn to the spellings of words. It was hypothesized that the second graders would not be distracted by the pictures and would learn to read new sight words regardless of the presence of pictures. Results supported this hypothesis when students had their attention drawn to the spellings of words. When words were learned with pictures present in the attention condition, the pictures did not distract these second-grade students from focusing on the orthography of the words and retaining them in memory well enough to read them by sight. On the posttest assessing sight word learning with the t-scope procedure, the absence of a main effect of pictures supported the hypothesis that the presence of pictures would not erode word learning performance in second graders. However, the picture variable interacted with the attention and spelling-type variables. Post-hoc *t*-tests revealed that students who did not have their attention drawn to the spellings of words read significantly fewer words by sight when words were learned with pictures than when words were learned without

pictures. This finding did not support the hypothesis. In point of fact, pictures served as a distractor even for these more mature readers. Although conventional spellings of words were read better by sight on the posttest when they were learned without pictures than with pictures, it is important to note that this did not result because the words learned with pictures were read fewer times during learning. In fact they were read more times. During the learning trials, children reached criterion sooner in the picture than in the no picture condition. However, learning with those words did not stop but continued until students reached criterion in reading the other non-pictured words. Thus, they were exposed to both sets of words the same number of times and in fact read the pictured words more times correctly than the non-pictures words. This rules out word reading differences as the explanation why students in the no attention condition read conventional spellings that were not pictured better on the sight word posttest than words that were pictured. As indicated above, the finding that sight word reading was better when the words were learned without pictures than with pictures does not support the hypothesis that pictures would not affect learning among the full phase readers.

During the word learning trials, students who had their attention directed to the spellings of the words learned words in fewer trials than students who did not have their attention directed to the spellings of the words. This advantage was seen for words learned without pictures but not for the words learned with pictures where there were no differences. An explanation is that memory for the words learned without pictures benefited and grew more quickly when students attended to and analyzed their orthographic parts then when they did not. In contrast, memory for the words learned with pictures was bolstered so much by the presence of pictures than there was little room

for attention to exert an additional effect.

During spelling posttests, students who learned simplified spellings as well as students who learned conventionally spelled words did not recall more letters when words had been taught without pictures than when words had been taught with pictures. However, a very small percentage of words were correctly recalled as taught during the spelling posttest. This indicates that although the second graders were able to read the words, the words may have been beyond these students' orthographic knowledge and so they did not have complete representations of words in memory. Lack of complete representations may have impaired their ability to read the words by sight within 0.05 seconds of seeing the words. Analysis of spelling errors showed that students did not remember patterns involving doubled letters that were present in four of the 10 words, and schwa vowel spelling patterns that were present in all of the words. Knowledge of these patterns would be expected of children at the next phase of development, the consolidated alphabetic phase, rather than the full alphabetic phase which is characterized by grapheme-phoneme correspondences rather than larger unit spelling patterns.

On the other hand, students were quite successful at decoding nonwords that were spelled analogously to the conventional spellings that were taught, with accuracy scores ranging from 70% to 94% across the four word type by attention conditions (see Table 30). This suggests that their decoding skills were developed sufficiently to read nonwords with these spelling patterns. Future research needs to be directed at clarifying the relationship between children's knowledge of the orthographic system as it contributes to their nonword decoding as well as spelling memory skills and how these skills influence their ability to retain words in memory well enough to read them by sight.

Chapter 5: General Discussion

The purpose of these experiments was to examine the effect that pictures had when partial alphabetic and full alphabetic readers were taught to read new sight words. The students who participated in Experiment 1 were in kindergarten and first grade. Although the first grade students in Experiment 1 significantly outperformed the kindergarten students on the pretest measures (Table 1), results of Experiment 1 provided evidence indicating that the first grade students showed more behaviors characterizing partial alphabetic phase readers than full alphabetic phase readers; on average they had only limited nonword decoding skill and whole word spelling skill; they were unable to retain the words in memory as sight words, particularly when the words were presented with pictures.

The second grade students who participated in Experiment 2 were clearly in the full alphabetic phase of reading. These students were able to read taught words on the untimed posttest measure, even when the words had been learned with pictures during word learning, and even when their attention had not been drawn to the spellings of the words during word learning. This indicates that they had focused on the spellings of the words and stored them in memory. Also, their ability to read words analogous to the target words during the posttests showed that they had developed sufficient orthographic knowledge of the words. When students did have their attention drawn to the words during word learning, pictures did not interfere with their ability to read the words in 0.05 seconds by sight.

Effect of Pictures on Sight Word Learning for Partial Alphabetic and Full Alphabetic Readers

The kindergarten and first grade students in Experiment 1, shown to be in the partial alphabetic phase of reading, learned to read words by sight better when pictures were not present during word learning. The presence of pictures distracted the partial alphabetic readers from focusing on the orthography of the words and retaining them in memory. It was expected that pictures would affect partial alphabetic readers' learning to read conventionally spelled words by sight, and results supported this hypothesis.

It was also expected that simplified spellings of words would be consistent with partial alphabetic readers' facility with the alphabetic principle, therefore pictures would not exert an influence over partial alphabetic readers' ability to learn to read simplified words by sight. However, in Experiment 1 partial alphabetic readers learned to read words by sight better when the words were learned in the absence of pictures for both conventional and simplified spellings of words. When unfamiliar words are presented with pictures, the pictures distract partial alphabetic readers from focusing on the orthography of the word, regardless of whether the word is simplified or conventionally spelled. The distraction away from the orthography caused by the presence of pictures may interfere with the amount of practice processing grapheme-phoneme mapping relations that is necessary for children in the partial alphabetic phase to support automatic processing when they read words.

The second grade readers in Experiment 2, who were demonstrated to be in the full alphabetic phase of development, were able to form complete connections between letters in spellings and phonemes in pronunciations, and hence were able to retain

representations of words in memory sufficient for supporting sight word reading. Second grade students were able to learn to read simplified spellings of words by sight regardless of the presence of pictures. When students had their attention drawn to the spellings of words, second grade students were able to learn to read conventional spellings of words by sight regardless of the presence of pictures. However, when second graders did not have their attention drawn to the spellings of conventionally spelled words, more words were read by sight when the words had been presented without pictures than when they had been learned with pictures, which does not support the hypothesis that pictures would not affect word learning among full phase readers. In the case of conventionally spelled words, full phase readers in second grade may need to have their attention focused on the spellings of the word during word learning when pictures are present in order for the orthography of the word to be sufficiently processed so that the word can be secured in sight word memory.

The findings of Experiment 1 and Experiment 2 are in accordance with the studies reviewed (i.e., Samuels, 1967; Saunders & Solman, 1984; Singh & Solman, 1990; Didden et al., 2000; Solman & Singh, 1992). All of these studies examined the influence of pictures in learning to read new words. However, the students in previous studies were either very young or very poor readers, or they were learning to read words that were beyond their command of the alphabetic system. Experiment 2 examined whether the presence of pictures influenced more mature readers in the full alphabetic phase of reading in the same way.

The results of Experiment 1 support Samuels (1967) findings that pictures may divert the attention of early readers away from printed word and interfere with word

learning. Samuels' (1967) focal attention hypothesis suggests that less capable students are able to identify words in practice because they are attending to the picture cues and so they are not attending to the graphic features of the printed word. They are distracted from the printed word by the pictures and these distracting stimuli interfere with word learning. However, it is possible that younger students are more susceptible to distracting stimuli because they are partial alphabetic readers, and their use of partial alphabetic cues is what is interfering with their ability to secure the words in memory.

The second grade students in Experiment 2, who demonstrated greater facility with the alphabetic system, read fewer conventionally spelled words by sight on the t-scope when they had been learned in the presence pictures and when they had not had their attention drawn to the spellings of the words. However, when they did attend to the spelling of the words during word learning the pictures no longer served as distractors and the students were able to secure the words in memory as sight words. It can be interpreted that even full alphabetic readers who have demonstrated facility with the alphabetic principle may require focused attention on the orthography of unfamiliar, conventionally spelled words in order to sufficiently process those words, if the words are being learned in the presence of pictures. If unfamiliar words are learned without distracting stimuli such as pictures, full alphabetic readers may have the necessary knowledge of the orthographic system to process conventionally spelled words during word learning to secure new words in sight word memory.

Effects of Pictures on Other Measures of Word Learning

The presence of pictures during word learning did not influence whether students

were able to decode the analogous nonwords. The full alphabetic readers in Experiment 2 were able to decode nonwords that were analogous to the target words which had been taught during word learning. This indicates that full alphabetic phase readers possess sufficient knowledge of the orthographic principle to decode words containing similar spelling conventions to words they had been taught, regardless of the presence of pictures.

Although pictures did not influence students' ability to decode nonwords analogous to the target words taught, there was an influence of whether students' attention had been drawn to the spellings of words during word learning. Students who were taught conventionally spelled words and who had their attention drawn to the spellings of the words during word learning outperformed students who were taught conventionally spelled words and who did not have their attention drawn to the spellings of the words. This indicates that when students are learning new words, directing their attention to the way that the spellings of the syllables of the words map onto the pronunciation of words similar to the manner of the attention condition of Experiment 2 may facilitate students' ability to read new analogous words, as well.

In both experiments, students were assessed on their ability to read words taught with or without pictures under an untimed condition. In other words, their ability to read the words either by sight or by decoding the new words was measured. The influence of the presence of pictures during word learning on students' ability to decode the words was mixed. In Experiment 1, among the partial alphabetic students who were able to decode words, words learned without pictures were read better than words learned with pictures. The difference favoring words learned without pictures present was evident for

simplified spellings. However, the difference favoring words learned without pictures did not reach statistical significance for conventional spellings. This finding is likely because decoding allowed students to correctly read more words when they were conventionally spelled.

In Experiment 2, the presence of pictures during word learning did not influence students' ability to read the words by a combination of sight or decoding during the posttests. It is interesting to note, however, that among the students who had their attention focused on the spellings of the words during word learning and who read conventionally spelled words, the words that were taught without pictures were read perfectly during the untimed word reading measure. Also, 87.5% of the students who had their attention focused on the spellings of words and who read conventionally spelled words read the words that had been taught in the presence of pictures perfectly. The full alphabetic readers in second grade were able to use their knowledge of grapheme-phoneme connections to successfully read the new words by a combination of either sight or decoding when they had their attention focused on spellings during word learning and when they did not. This indicates that although the presence of pictures influenced whether full alphabetic second graders were able to commit unfamiliar conventionally spelled words to sight word memory, pictures did not interfere with their ability to learn to read those words by a combination of either by sight word reading or decoding.

Effect of Pictures on Spelling

In Experiment 1, pictures did not exert an effect on spelling performance for students who were taught simplified spellings of words. One explanation for why

pictures did not interfere with students' ability to recall simplified spellings is that the students in Experiment 1 were in the partial alphabetic phase of reading, hence the simplified words were consistent with the way that these readers process the spellings of words. Therefore, it is possible that the partial alphabetic readers were inventing the simplified spellings rather than recalling what they had been taught during word learning. However, students taught conventionally spelled words recalled more letters when the words were learned without pictures. This was true for both kindergarten and first grade students who were taught conventional spellings of words. It is possible that the conventionally spelled words were so beyond the partial alphabetic readers' knowledge of the orthographic system that pictures exerted more of an influence when the kindergarten and first grade students were trying to recall the letters of conventionally spelled words that were learned during word learning.

The presence of pictures during word learning did not influence the number of letters that the second grade students wrote during the spelling posttest in Experiment 2. Nor did the presence of pictures during word learning influence the number of word spellings correctly recalled as taught during word learning. The discrepancy between the high number of letters recalled and the low number of words recalled as taught indicates that the second grade students in Experiment 2 were generating spellings of words, rather than recalling the words as they had been taught during word learning.

The posttest performances of students in Experiment 2 also reveal a discrepancy between the students' ability to spell the new words and their decoding ability, indicating different levels of orthographic facility for the words. Students' spellings of the target words revealed that students did not remember spelling patterns involving doubled

letters, as well as schwa vowel spelling patterns. However, students were successful at decoding nonwords that were analogous to the conventional spellings that were taught, indicating their decoding skills were satisfactorily developed to allow them to decode words with these spelling patterns. The question of how children's knowledge of the orthographic system contributes to their nonword decoding as well as spelling memory skills and how these skills influence their ability to retain words in memory well enough to read them by sight awaits future research.

Strengths, Limitations, and Directions for Future Research

One strength of the present study was its use of random assignment and a repeated measures, counterbalanced design. Every student in Experiment 1 and Experiment 2 was taught the same 10 words, with half of the students learning 5 of the words with pictures and the other half of the students learning the other 5 words with pictures. Another strength of this study is the wide range of ages (i.e., students in kindergarten through second grade), thus yielding a sample which is representative of students in both the partial and full phases of reading development.

However, the wide range of ages in participants also contributed to floor effects on tasks which were especially challenging for kindergartners (i.e., word reading under timed condition), and in ceiling effects on tasks which were relatively easy for second grade students (i.e., untimed word reading). Future research may benefit from more extensive use of the mixed binomial regression analysis, which was used to confirm an analysis of variance of timed word reading in Experiment 1. The mixed binomial regression analysis would also serve to increase power. A limitation of Experiment 2 is

the sample size; 32 students yielded eight groups with four students per group. More power may have resulted in more of the differences that were found reaching statistical significance.

An additional strength of the present study is its comparison of words taught in their simplified spellings and conventional spellings. Students in the partial and full phases of reading development differ in their alphabetic knowledge. By teaching students who are in the partial and full alphabetic phases of reading new words presented in ways that may or may not correspond to the way they rely on the alphabetic principle, evidence is provided to indicate whether partial alphabetic cues are sufficient to secure words in memory. Results of Experiment 1 indicate that even partial alphabetic cues (i.e., simplified spellings of words) were not sufficient to secure words in memory for partial alphabetic readers when they were learned in the presence of pictures. However, results of Experiment 2 indicate that full alphabetic readers were able to store these simplified spellings of new words in memory and to recognize them by sight, regardless of whether they were learned with pictures.

A third strength of the present study is that it distinguished between the ability to read words under timed and untimed conditions on the posttests. The t-scope procedure used in Experiment 2 provided a sensitive measure that revealed students' ability to recognize words instantaneously. However, a limitation of this study is that the t-scope procedure was not used in Experiment 1 to assess partial alphabetic readers' ability to read words by sight. Rather a less precise procedure was used to assess sight word reading.

Another limitation of the present study is that the attention condition studied in

Experiment 2 was not investigated in Experiment 1. It would have been interesting to see whether the attention condition would have had an effect on the partial alphabetic readers in Experiment 1.

One issue raised is what constitutes distracting stimuli for students when learning to read new sight words. Pictures presented with words that represent those words may serve as distracters because students are able to correctly identify the word without focusing on the print. In other words, readers can look at the relevant pictures instead of the print to name the word. However, if words were presented with irrelevant pictures that did not represent the printed word, students' attention may remain focused on the print. This question awaits future research. A possible experiment may involve investigating the rate of sight word learning when words are presented with relevant pictures, with irrelevant pictures, and with no pictures present.

Variation in the performance of second graders in Experiment 2 on the posttest measures raises the issue of which is the most indicative measure to determine facility with the alphabetic principle. On the one hand, students were able to successfully read the words under an untimed condition, and they were able to generalize their word learning to the reading of analogous nonwords. These findings indicate behaviors expected of full alphabetic readers. On the other hand, they showed limited ability to form complete representations of the words in memory, as indicated by the timed word learning measure and the spelling task. This issue regarding discrepancies among measures within the full alphabetic phase of reading awaits further research.

A related question of interest is what role the difficulty level of the word plays when students are committing new words to sight word memory. The target words in this

study consisted of spelling patterns (i.e., double consonants, syllabic *–le*, schwa vowel sounds) that are not completely transparent. It is likely that the difficulty level of the word influences how completely the full alphabetic reader is able to form a representation of the word in memory. In other words, the difficulty of the word may determine whether the reader is able to store a sufficient representation of the word in memory in order to recognize it, but if it is not entirely consistent with a reader's knowledge of the orthographic system, the representation may not necessarily be sufficient in order to spell the word.

Implications for Instruction

Once words are completely established in memory, they are thought be recognized automatically and immediately processed when they are read. It is necessary for readers to have a large sight word vocabulary; that is, a large number of words that the reader is able to recognize automatically. The findings of the present study carry implications for teaching new words to readers so that they are committed to memory and are able to be recognized and read automatically. A direct implication is that when readers are moving from the partial alphabetic phase of reading to the full alphabetic phase of reading, it is necessary for them to attend to the entire orthography of the word to secure the word in memory and that providing accompanying pictures may interfere with this. However, once students have reached a point in reading development where they begin to spontaneously process the printed word, pictures may no longer serve as distracting stimuli.

The use of pictures when teaching new words must be considered. Pictures can

be powerful mnemonic devices. Due to their salience, they can effectively be used to help connect words with their semantic associations in memory. Picture books play a valuable role in reading development; they may excite young readers to become interested in books and may motivate them to want to learn how to read. Pictures may influence young readers' comprehension of stories. However, when it comes to learning to read words, image associations are less powerful mnemonically than letter-sound associations (Ehri, 1994). Pictures and icons are frequently used by educators in primary classrooms. Pictures are used by teachers when labeling the classroom environment, to present daily schedules, and when introducing new words to readers. This may be beneficial for pre-alphabetic readers, but for students in the partial alphabetic phase of reading who have not yet reached the full alphabetic phase, this may be a maladaptive practice. The pictures may be interfering with students focusing on the orthography of the words and thus incorporating them into their sight word vocabularies.

Educators must carefully consider the desired outcome of instruction. Building up a substantial sight word vocabulary is one of the challenges of becoming a fluent reader. This research is important if an objective of instruction is to increase readers' sight word vocabularies, particularly when trying to "close the gap" between good and struggling readers. Results indicate the necessity of a reader to focus on the orthography of an unfamiliar word in order to sufficiently process the grapheme-phoneme relations so that the word is committed to memory. For struggling readers who lack fluency, and who may have a tendency to be more easily distracted by competing stimuli like pictures, the influence of pictures on the learning of sight words must be considered.

Focused attention to the spellings of words during word learning must be

considered. When readers are in the full alphabetic phase of reading, they can learn sight words by forming complete connection between letters in spellings and phonemes in pronunciation. Results of Experiment 2 indicate that full alphabetic readers will benefit from instruction to attend to the orthography of the word during word learning.

Additionally, another way to read unfamiliar words is to read them by analogy, which involves recognizing how the spelling of an unfamiliar word is similar to a word already known. The students in the attention condition of Experiment 2 who were taught conventionally spelled words were able to decode more analogous nonwords during the posttests than students who did not have their attention drawn to the spellings of the words. This suggests that when students are learning new words, directing their attention to the way that the spellings of the syllables of the words corresponds to the pronunciation of words may benefit students' ability to read new analogous words, as well.

Table 1

Mean Performance, Standard Deviations, Ranges and Test Statistics on Literacy Pretest Measures in Experiment 1

Pretest	Grade		
	Kindergarten Mean (*SD*) [Range]	First Grade Mean (*SD*) [Range]	*F*
Pretest composite[a]	10.36 (1.50)	10.02 (0.77)	
Letter/sound knowledge (Max = 31)	23.75 (6.41) [12.00 – 31.00]	28.56 (2.43) [23.00 – 31.00]	8.93**
Spelling (Max = 24)	3.45 (2.92) [0.00 – 11.00]	10.28 (4.85) [4.00 – 20.00]	28.26**
Word reading (WRMT-R)	3.65 (2.92) [0.00 – 12.00]	26.78 (12.17) [5.00 – 47.00]	67.73**
Decoding (Max = 22)	0.40 (0.88) [0.00 – 3.00]	3.67 (3.84) [0.00 – 14.00]	13.74**
Decoding % 0	80%	22%	

Note. N=20 (K) and N=20 (1st); **p<.01; *ns* not significant

[a]Composite *z*-score based on sum of pretests, calculated separately for each grade

Table 2

Test Statistics in ANOVA of Pretest Performances of Treatment Groups (A, B, C, and D) in Experiment 1

Source	*df*	Mean square	*F*
Between Groups			
Letter identification- uppercase	3	0.00	0.00*ns*
Letter identification- lowercase	3	1.90	1.62*ns*
Letter sound knowledge	3	2.43	0.08*ns*
Invented Spelling	3	15.62	0.56*ns*
Word Reading	3	12.50	0.06*ns*
Nonword Reading	3	4.81	0.47*ns*

*$p<.05$ **$p<.01$ *ns* not significant

Table 3

Test Statistics in ANOVA of the Difference in the Number of Trials to Criterion between Words Learned With Pictures and Words Learned Without Pictures with Grade, Word Type, and Word Set as Independent Variables in Experiment 1

Source	*df*	Mean Square	*F*
Between Subjects			
Intercept	1	722.50	60.33**
Grade (G)	1	57.60	4.81*
Spelling Type (S)	1	28.90	2.41*ns*
Word Set (W)	1	72.90	6.09*
G x S	1	6.40	0.53*ns*
G x W	1	3.60	0.30*ns*
S x W	1	4.90	0.41*ns*
G x S x W	1	0.00	0.00*ns*
Error	32	11.98	

*$p < .05$ **$p < .01$ *ns* not significant

Table 4

Mean Number of Trials to a Criterion of Three Successfully Correct Trials for Words Taught With Pictures and Without Pictures in Experiment 1

Word	*No Picture*	*Picture*	*Difference*
"Blanket" Set			
Number	5.80	3.11	+2.69
Blanket	5.45	3.06	+2.39
Dollar	5.40	3.11	+2.29
Ticket	5.39	3.33	+2.06
Rattle	5.55	3.50	+2.05
Mean	5.52	3.22	+2.30
Range	5.8 to 5.4	3.3 to 3.1	+2.7 to +2.3
"Bubble" Set			
River	4.78	3.00	+1.78
Diamond	4.06	3.00	+1.06
Needle	4.00	3.00	+1.00
Bubble	3.89	3.20	+0.69
Table	3.61	3.05	+0.56
Mean	4.07	3.05	+1.02
Range	4.8 to 3.6	3.2 to 3.0	+1.8 to 1.0

Note. Means are based on 20 observations in each cell.

Table 5

Test Statistics in ANOVA of Number of Trials to Criterion with Picture Condition, Grade, and Word Type as the Independent Variables in Experiment 1

Source	*df*	Mean Square	*F*
Between Subjects			
Grade (G)	1	39.20	4.72*
Spelling Type (S)	1	11.25	1.23*ns*
G x S	1	0.20	0.02*ns*
Error	36	9.18	
Within Subjects			
Picture Condition (P)	1	140.45	45.51**
P x G	1	16.20	5.25*
P x S	1	8.45	2.74*ns*
P x G x S	1	0.80	0.26*ns*
Error	36	3.09	

*$p < .05$ **$p < .01$ *ns* not significant

Table 6

Means and Standard Deviations of Number of Trials to Criterion During Word Learning and Mean Correct Per Trial Across the First Five Trials for Kindergarten and First Grade Students Under Picture and No Picture Conditions in Experiment 1

Conditions	Picture Mean (SD)	No Picture Mean (SD)	Overall Mean
Trials to Criterion			
Kindergarten	4.20 (2.29)	7.75 (2.43)	5.96
First Grade	3.70 (1.95)	5.45 (3.07)	4.58
Mean	3.95 (2.11)	6.60 (2.97)	5.28
Mean Correct Per Trial (1-5) (5 max)			
Kindergarten	4.75 (0.56)	3.37 (1.14)	4.06
First Grade	4.87 (0.39)	4.18 (1.14)	4.53
Mean	4.81 (0.48)	3.78 (1.14)	4.29

Note. There were 20 Kindergarten and 20 First graders.

Table 7

Test Statistics in ANOVA of Mean Number of Words Read Correctly Per Trial During First Five Learning Trials with Picture Condition, Grade, Word Type, and Trial as the Independent Variables in Experiment 1

Source	*df*	Mean Square	*F*
Between Subjects			
Grade (G)	1	21.62	7.70*
Spelling Type (S)	1	3.42	0.28*ns*
G x S	1	1.10	0.56*ns*
Error	36	2.81	
Within Subjects			
Picture Condition (P)	1	107.12	60.44**
P x Grade (G)	1	11.90	6.72*
P x Spelling Type (S)	1	4.20	2.37*ns*
P x G x S	1	.06	.04*ns*
Error	36	1.77	
Trials (T)	4	17.17	34.09**
T x G	4	.84	1.67*ns*
T x S	4	.37	.73*ns*
T x G x S	4	1.00	.72*ns*
Error	144	.50	
P x T	4	10.19	20.60**

Table 7 (Continued)

Test Statistics in ANOVA of Mean Number of Words Read Correctly Per Trial During First Five Learning Trials with Picture Condition, Grade, Word Type, and Trial as the Independent Variables in Experiment 1

P x T x G	4	.35	.70*ns*
P x T x S	4	.65	1.31*ns*
P x T x G x S	4	.61	1.23*ns*
Error (P x T)	144	.50	

*$p<.05$ **$p<.01$ *ns* not significant

Table 8

Test Statistics in Three-way ANOVA of Posttest Performance on Words Read Correctly (Timed) with Grade, Spelling Type, and Picture Condition as Independent Variables in Experiment 1

Source	*df*	Mean square	*F*
Between Subjects			
Grade	1	21.01	6.21*
Spelling Type	1	1.51	.45*ns*
Grade x Spelling Type	1	1.51	.45*ns*
Error	36	3.39	
Within Subjects			
Picture Condition (P)	1	35.11	40.19**
P x Grade (G)	1	1.01	1.16*ns*
P x Spelling Type (S)	1	3.61	4.14*
P x G x S	1	.31	.55*ns*
Error	36	.87	

*$p<.05$ **$p<.01$ *ns* not significant

Table 9

Means and Standard Deviations of Number of Simplified and Conventionally Spelled Words Read Correctly by Sight on the Posttest as a Function of Picture versus No Picture Conditions (Maximum score = 5) in Experiment 1

Conditions	Picture Mean (SD)	No Picture Mean (SD)	
Words Read (Timed)			Mean Difference[a]
Simplified	0.85 (1.27)	2.60 (1.60)	1.75**
Conventional	1.00 (1.49)	1.90 (1.71)	0.90*
Mean Difference	-0.15	+0.70	
Mean	0.93 (1.37)	2.25 (1.68)	
Kindergarten	0.30 (0.47)	1.85 (1.53)	1.55**
First Grade	1.55 (1.67)	2.65 (1.76)	1.10**
Mean Difference	-1.25	-0.80	
Mean	0.93 (1.37)	2.25 (1.68)	
Percentage of Zero Scores[b]			
Kindergarten	70%	30%	
First Grade	45%	10%	
Simplified	60%	15%	
Conventional	55%	25%	

[a]Post-hoc t-tests: *p<.05, **p<.01

[b]Percentage of scores in which no words were recalled.

Table 10

Model Comparison of Mixed Binomial Regression Models With Grade (G), Spelling Type (S), and Picture (P) as Independent Variables in Experiment 1

		logL	df	AIC	Delta-AIC	BIC	Delta-BIC
Null		-1.37.3	2	278.6	--	282.0	--
Main Effects	G, S, P	-111.0	5	232.0	1.2	240.4	7.4
Two-Way Interactions	GS	-110.6	6	233.2	0.0	243.3	4.5
	GP	-108.9	6	229.8	2.8	239.9	7.9
	SP	-109.4	6	230.8	1.8	240.9	6.9
	GP, GS	-108.5	7	231.0	1.6	242.8	5.0
	GS, SP	-109.1	7	232.2	0.4	244.0	3.8
	GP, SP	-107.6	7	229.2	3.4	241.0	6.8
	GS, GP, SP	-107.3	8	230.6	2.0	244.1	3.7
Three-Way Interactions	GSP	-107.3	9	232.6	0.0	247.8	0.0

Table 11

Test Statistics in Three-way ANOVA of Posttest Performance on Words Read Correctly (Untimed) with Grade, Word Type, and Picture Condition as Independent Variables in Experiment 1

Source	*df*	Mean square	*F*
Between Subjects			
Grade	1	36.45	10.87**
Spelling Type	1	.00	.00*ns*
Grade x Spelling Type	1	4.05	1.21*ns*
Error	36	3.35	
Within Subjects			
Picture Condition (P)	1	26.45	28.60**
P x Grade (G)	1	1.80	1.95*ns*
P x Spelling Type (S)	1	8.45	9.16**
P x G x S	1	.00	.00*ns*
Error	36	.93	

*$p<.05$ **$p<.01$ *ns* not significant

Table 12

Means and Standard Deviations of Number of Simplified and Conventionally Spelled Words Read Correctly Untimed on the Posttest as a Function of Picture versus No Picture Conditions (Maximum score = 5) in Experiment 1

Conditions	Picture Mean (SD)	No Picture Mean (SD)	
Words Read (Untimed)			Mean Difference[a]
Simplified	1.00 (1.26)	2.80 (1.61)	1.80**
Conventional	1.65 (1.81)	2.15 (1.69)	0.50*ns*
Mean Difference	-0.65	+0.65	
Mean	1.33 (1.58)	2.48 (1.66)	
Kindergarten			
% Zero[b]	60	20	
First Grade			
% Zero[b]	30	10	
Words Read (Untimed) With Zero Scores Excluded[c]			
Simplified	2.00 (1.05)	3.80 (1.23)	1.80**
Conventional	2.91 (1.51)	3.09 (1.45)	0.18*ns*
Mean Difference	- 0.91	+0.71	
Mean	2.48 (1.37)	3.43 (1.36)	

[a]Post-hoc t-tests: ***p*<.01; *ns* not significant

[b]Percentage of scores in which no words were recalled.

[c]Subjects read at least one word in both picture and no picture conditions. The number of subjects in the simplified condition was 10 and the conventional condition was 11.

Table 13

Test Statistics in the ANOVA of the Number of Letters Correctly Recalled in the Simplified Spelling Condition with Grade and Picture Condition as Independent Variables in Experiment 1

Source	*df*	Mean Square	*F*
Between Subjects			
Grade (G)	1	0.03	0.00*ns*
Error	18	25.69	
Within Subjects			
Picture Condition (P)	1	0.03	0.01*ns*
P x G	1	1.23	0.49*ns*
Error	18	2.46	

*$p<.05$ **$p<.01$ *ns* not significant

Table 14

Means and Standard Deviations of Number of Taught Letters that Were Recalled Correctly in Simplified and Conventional Spellings by Kindergarten and First Grade Students in the Picture and No Picture Conditions in Experiment 1

Letters Spelled	Picture Mean (SD)	No Picture Mean (SD)	Overall Mean (SD)
Simplified (15 max)			
Kindergarten	11.40 (4.12)	11.70 (4.12)	11.55 (4.12)
First Grade	11.70 (3.77)	11.30 (2.79)	11.50 (3.28)
Mean	11.55 (3.86)	11.50 (3.44)	
Conventional (30 max)			
Kindergarten	9.60 (6.22)	11.70 (4.79)	10.65 (5.51)
First Grade	17.20 (4.92)	18.30 (5.23)	17.75 (5.08)
Mean	13.40 (6.71)	15.00 (5.94)	

Note. There were 20 kindergartners and 20 first graders.

Table 15

Test Statistics in the ANOVA of the Number of Letters Correctly Recalled in the Conventional Spelling Condition with Grade and Picture Condition as Independent Variables in Experiment 1

Source	*df*	Mean Square	*F*
Between Subjects			
Grade (G)	1	504.10	9.22**
Error	18	54.68	
Within Subjects			
Picture Condition (P)	1	25.60	13.59**
P x G	1	2.50	1.33*ns*
Error	18	1.88	

*$p<.05$ **$p<.01$ *ns* not significant

Table 16

Mean Performance, Standard Deviations, Ranges of Pretest Scores on the Full Sample (N = 32) and Results of ANOVAS comparing the Four Treatment Groups (Attention/ No Attention Learning Condition by Simplified/Conventional Spelling Type) on Pretests in Experiment 2

Pretest	Mean (SD) [Range]	*F*-stat[a] (*df* = 3,28)
Spelling (Max=40)	22.09 (6.13) [14 – 36]	0.77 *ns*
Word Reading (T-Scope) (Max=25)	17.34 (3.02) [12 – 23]	0.42 *ns*
Word Reading (WRMT-R)	40.91 (6.98) [25 – 52]	0.43 *ns*
Grade equivalent	2.2	
Nonword Decoding (Max=30)	14.19 (3.66) [6 – 19]	0.63 *ns*
Analogous Nonwords (Max=10)	5.78 (2.70) [1 – 10]	0.97 *ns*

[a] Test to compare mean performance of four treatment groups on pretests.

Table 17

Test Statistics in ANOVA of the Difference in the Number of Trials to Criterion between Words Learned With Pictures and Words Learned Without Pictures with Attention, Word Type, and Word Set as Independent Variables in Experiment 2

Source	*df*	Mean Square	*F*
Between Subjects			
Intercept	1	42.78	23.74**
Attention (A)	1	11.28	6.26*
Spelling Type (S)	1	11.28	6.26*
Word Set (W)	1	0.03	0.02*ns*
A x S	1	0.03	0.02*ns*
A x W	1	0.28	0.16*ns*
S x W	1	2.53	1.41*ns*
A x S x W	1	1.53	0.85*ns*
Error	24	1.80	

*$p < .05$ **$p < .01$ *ns* not significant

Table 18

Means and Standard Deviations of Number of Trials to Criterion During Word Learning for Students Under Picture and No Picture Conditions in Experiment 2

Conditions	Picture Mean (SD)	No Picture Mean (SD)	Mean Difference[a]	Overall Mean
Trials to Criterion				
Attention to Spelling				
Attention	3.13 (0.50)	3.69 (1.08)	0.56 *	3.40
No Attention	3.13 (0.34)	4.88 (1.82)	1.75 **	4.00
Mean Difference[a]	0.00 *ns*	-1.19 *		
Mean	3.12 (0.42)	4.28 (1.59)		
Word Type				
Simplified	3.19 (0.54)	4.94 (1.70)	1.75 **	4.06
Conventional	3.06 (0.25)	3.63 (1.20)	0.57 *ns*	3.34
Mean Difference[a]	0.13 *ns*	1.31 *		
Mean	3.12 (0.42)	4.28 (1.59)		

Note. N=16 in each group. Minimum number of trials was 3.

[a] Post hoc t-tests: *<p.05, **p<.01, *ns* not significant

Table 19

Test Statistics in ANOVA of Number of Trials to Criterion with Picture Condition, Attention to Spelling, and Word Type as the Independent Variables in Experiment 2

Source	*df*	Mean Square	*F*
Between Subjects			
Attention to Spelling (A)	1	5.64	4.54*
Spelling Type (S)	1	8.27	6.65*
A x S	1	0.14	0.11*ns*
Error	28	1.24	
Within Subjects			
Picture Condition (P)	1	21.39	25.15**
P x A	1	5.64	6.63*
P x S	1	5.64	6.63*
P x A x S	1	0.02	0.02*ns*
Error	28	0.85	

*$p < .05$ **$p < .01$ *ns* not significant

Table 20

Test Statistics in Three-way ANOVA of Posttest Performance on Words Read Correctly (Timed) with Attention Condition, Word Type, and Picture Condition as Independent Variables in Experiment 2

Source	*df*	Mean square	*F*
Between Subjects			
Attention Condition (A)	1	0.39	0.15 *ns*
Spelling Type (S)	1	1.27	0.49 *ns*
A X S	1	0.17	0.01 *ns*
Error	28	2.59	
Within Subjects			
Picture Condition (P)	1	0.14	0.19 *ns*
P x Attention (A)	1	0.02	0.02 *ns*
P x Spelling Type (S)	1	0.14	0.19 *ns*
P x A x S	1	4.52	6.11 *
Error	28	0.74	

*$p<.05$ **$p<.01$ *ns* not significant

Table 21

Means and Standard Deviations of Number of Simplified and Conventionally Spelled Words Read Correctly by Sight on the Posttest as a Function of Picture versus No Picture and Attention versus No Attention Conditions (Maximum score = 5) in Experiment 2

Conditions	Picture Mean (SD)	No Picture Mean (SD)	
Words Read (Timed)			Mean Difference[a]
Simplified			
Attention	2.00 (1.07)	2.75 (1.49)	-0.75 (1.83) *ns*
No Attention	2.38 (1.51)	2.00 (0.93)	+0.38 (0.92)*ns*
Mean Difference[a]	-0.38 *ns*	+0.75 *ns*	
Overall Mean	2.19 (1.28)	2.37 (1.26)	
Conventional			
Attention	2.88 (1.64)	2.38 (1.19)	+0.50 (1.20)*ns*
No Attention	2.25 (1.17)	2.75 (1.17)	-0.50 (0.54) *
Mean Difference[a]	+0.63 *ns*	-0.37 *ns*	
Overall Mean	2.56 (1.41)	2.56 (1.15)	

Note. N = 8 in each group.

[a] Post hoc t-tests: *<p.05, **p<.01, *ns* not significant

Table 22

Test Statistics in Three-way ANOVA of Posttest Performance on Words Read Correctly (Untimed) with Attention, Word Type, and Picture Condition as Independent Variables in Experiment 2

Source	*df*	Mean square	*F*
Between Subjects			
Attention (A)	1	3.52	4.05 *ns*
Spelling Type (S)	1	2.64	3.04 *ns*
A x S	1	0.12	0.02 *ns*
Error	28	0.87	
Within Subjects			
Picture Condition (P)	1	1.89	3.83 *ns*
P x Attention (A)	1	1.27	2.57 *ns*
P x Spelling Type (S)	1	0.14	0.29 *ns*
P x A x S	1	0.39	0.79 *ns*
Error	28	0.49	

*$p<.05$ **$p<.01$ *ns* not significant

Table 23

Means and Standard Deviations of Number of Simplified and Conventionally Spelled Words Read Correctly Untimed on the Posttest as a Function of Picture versus No Picture and Attention versus No Attention Conditions (Maximum score = 5) in Experiment 2

Conditions	Picture Mean (SD) [% Max][a]	No Picture Mean (SD) [% Max][a]
Words Read (Untimed)		
Simplified		
Attention	4.50 (0.76) [62.5%]	4.50 (0.54) [50%]
No Attention	3.63 (1.41) [25%]	4.50 (0.93) [75%]
Mean	4.07 (1.09)	4.50 (0.74)
Conventional		
Attention	4.88 (0.35) [87.5%]	5.00 (0.00) [100%]
No Attention	4.25 (1.17) [62.5%]	4.62 (0.52) [62.5%]
Mean	4.57 (0.76)	4.81 (0.26)

Note. N = 8 in each group.

[a] Percentage of scores in which all words were recalled.

Table 24

Test Statistics in the ANOVA of the Number of Letters Correctly Recalled in the Simplified Spelling Condition with Attention and Picture Condition as Independent Variables in Experiment 2

Source	*df*	Mean Square	*F*
Between Subjects			
Attention (A)	1	3.78	0.26 *ns*
Error	14	14.64	
Within Subjects			
Picture Condition (P)	1	0.28	0.19 *ns*
P x A	1	0.78	0.54 *ns*
Error	14	1.46	

*$p<.05$ **$p<.01$ *ns* not significant

Table 25

Means and Standard Deviations of Number of Taught Letters that Were Recalled Correctly and Number of Words that Were Recalled Correctly in Simplified and Conventional Spellings Under Attention versus No Attention and Picture versus No Picture Conditions in Experiment 2

	Picture	No Picture	Overall
	Mean (SD)	Mean (SD)	Mean (SD)
Letters Spelled			
Simplified (15 max)			
Attention	13.75 (1.39)	13.25 (1.28)	13.50 (1.34)
No Attention	14.13 (3.48)	14.25 (4.06)	14.19 (3.77)
Mean	13.94 (2.57)	13.75 (2.96)	
Conventional (30 max)			
Attention	24.50 (2.78)	23.75 (3.01)	24.13 (2.90)
No Attention	22.38 (3.25)	22.37 (4.21)	22.38 (3.73)
Mean	23.44 (3.12)	23.06 (3.61)	
Words Spelled			
Simplified (5 max)			
Attention	1.25 (1.58)	1.38 (1.30)	1.32 (1.44)
No Attention	0.63 (0.74)	0.75 (0.89)	0.69 (0.82)
Mean	0.94 (1.24)	1.06 (1.12)	
Conventional (5 max)			
Attention	1.38 (1.30)	1.00 (1.20)	1.19 (1.25)
No Attention	1.13 (0.99)	0.88 (0.99)	1.01 (0.99)
Mean	1.25 (1.13)	0.94 (1.06)	

Note. N=8 in each group.

Table 26

Test Statistics in the ANOVA of the Number of Letters Correctly Recalled in the Conventional Spelling Condition with Attention and Picture Condition as Independent Variables in Experiment 2

Source	*df*	Mean Square	*F*
Between Subjects			
Attention (A)	1	24.50	1.38 *ns*
Error	14	17.82	
Within Subjects			
Picture Condition (P)	1	1.13	0.24 *ns*
P x A	1	1.13	0.24 *ns*
Error	14	4.70	

*$p<.05$ **$p<.01$ *ns* not significant

Table 27

Test Statistics in the ANOVA of the Number of Words Correctly Recalled as Taught with Attention, Word Type, and Picture Condition as Independent Variables in Experiment 2

Source	*df*	Mean Square	*F*
Between Subjects			
Attention (A)	1	2.61	1.26 *ns*
Spelling Type (S)	1	0.14	0.7 *ns*
A x S	1	0.77	0.37 *ns*
Error	28	2.10	
Within Subjects			
Picture Condition (P)	1	0.14	0.23 *ns*
P x A	1	0.02	0.03 *ns*
P x S	1	0.77	1.38 *ns*
P x A x S	1	0.02	0.03 *ns*
Error	28	0.56	

*$p<.05$ **$p<.01$ *ns* not significant

Table 28

Common Misspellings in Spelling Posttest in Experiment 2

Conventional	
Dollar	Doler (6), Dolr (2), Doller, Dolre, Dolar
Table	Tubl, Tabble, Tabel, Tabul, Tabbl, Tabl, Teble
Bubble	Buble (8), Bublle, Bobl, Bubbl, Bubule
Blanket	Blankit (4), Blaket (3), Blancet (2), Blacte, Blainkit
Number	Nuber (5), Numbr, Nubre, Numbre, Nummber, Nober, Nomber
Needle	Nedle (4), Netl (2), Nedl, Nedul, Nidl, Neddle, Nededing, Neetle, Neild
River	Rivre (2), Riaver, Rivr
Diamond	Dimen (2), Diming (2), Dimond, Dimind, Dimined, Dimund, Dimie, Doimen, Dimed, Dimend, Dimod, Dime, Daiment
Ticket	Tickit (4), Tiket, Tickite, Tecet, Tickent, Tike, Tikeit
Rattle	Ratle (4), Ratte (2), Ratal, Ralwl, Ratele, Ratl, Rotle
Simplified	
DLR (Dollar)	Dolr (4), Doler (2), Dol (2), Dllr, Dolar, Dor, Dollor, Doner, Dler, Dalr
TBL (Table)	Tabl (3), Tabol (2), Tebel (2), Table (2), Tebl, Tab, Tabe
BBL (Bubble)	Babl, Bobl, Bbo, Bubul, Bubl, Bub, Bubble, Bubbl, Bubol, Babol
BKT (Blanket)	Blk (2), Blt (2), Blncit, Blacit, Baket, Bankt, Blaket, Backe, Blanket, Blakit, Blki, Bakat, Blancet, Bakit
NBR (Number)	Number (4), Nubr (3), Nobr, Nombrer, Numb, Nabor, Nomber, Nube

Table 28 (Continued)

NDL (Needle)	Nedl (3), Ned, Nedel, Netl, Needle, Neld, Need
RVR (River)	River (2), Rir (2), Rvl, Rvbr, Rivr, Rever, Reivr, Rirer, Rivr
DMD (Diamond)	Dim (2), Dimind, Dimitn, Dmaend, Diemin, Dimd, Ded, Diate, Dimen, Dimid
TKT (Ticket)	Tick, Tik, Ticit, Tickt, Tigit, Tikit, Ticke, Ticket, Tit, Tike, Tiket, Tekit
RTL (Rattle)	Ratl (6), Ratle (2), Rat, Rattle, Ral, Rato, Rittle, Ratel

Note. Numbers in parentheses indicate the frequencies of particular spelling errors.

Table 29

Test Statistics in ANOVA of Decoding Posttests with Attention Condition and Word Type as the Independent Variables in Experiment 2

Source	*df*	Mean Square	*F*
Analogous Nonword Decoding			
Between Subjects			
Attention (A)	1	11.28	7.24*
Spelling Type (S)	1	2.53	1.63*ns*
A x S	1	11.28	7.24*
Error	28	1.56	
Within Subjects			
Picture Condition (P)	1	0.56	0.51 *ns*
P x A	1	0.00	0.00 *ns*
P x S	1	0.06	0.06 *ns*
P x A x S	1	0.25	0.23 *ns*
Error	28	1.11	

*$p < .05$ **$p < .01$ *ns* not significant

Table 30

Means and Standard Deviations of Number of Analogous Nonwords Correctly Decoded in Experiment 2

Conditions	Attention	No Attention	
	Mean (SD)	Mean (SD)	
Analogous Nonwords (max=10)			Mean Difference[a]
Simplified	7.63 (1.41)	7.63 (1.19)	0.00*ns*
Conventional	9.38 (0.52)	7.00 (1.60)	2.38**
Mean Difference[a]	-1.75**	+0.63*ns*	
Mean	8.50 (1.37)	7.31 (1.40)	

[a]Post-hoc t-tests: ***p*<.01; *ns* not significant

Figure 1

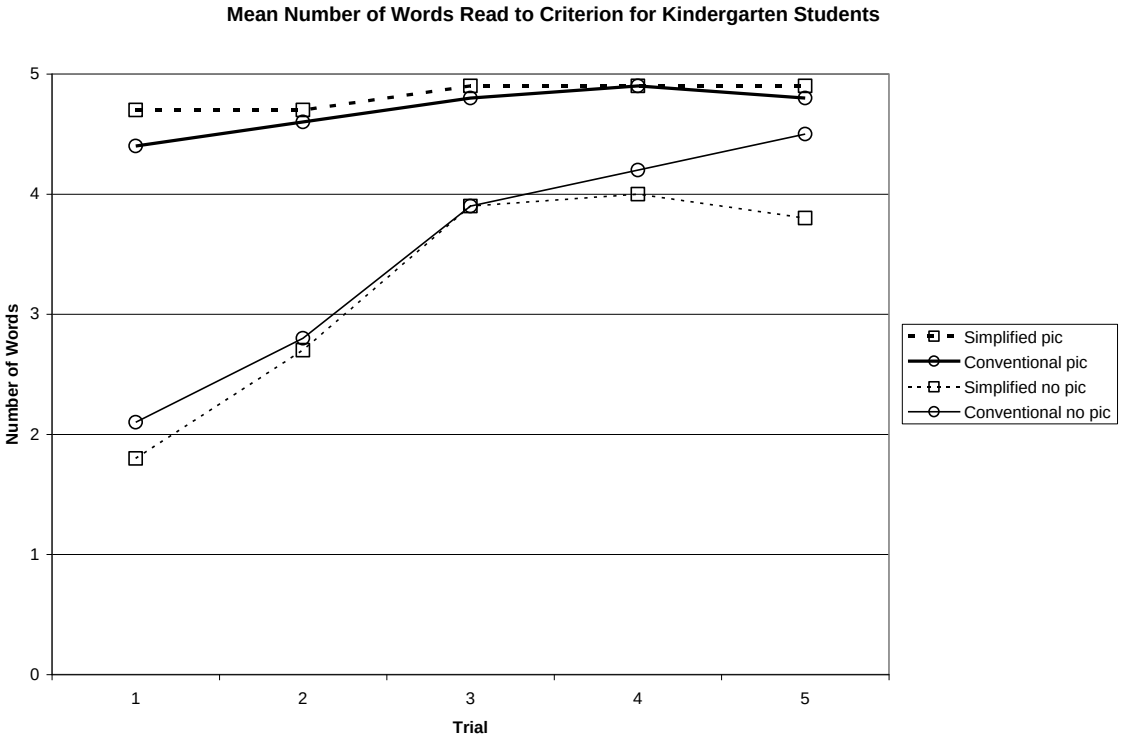
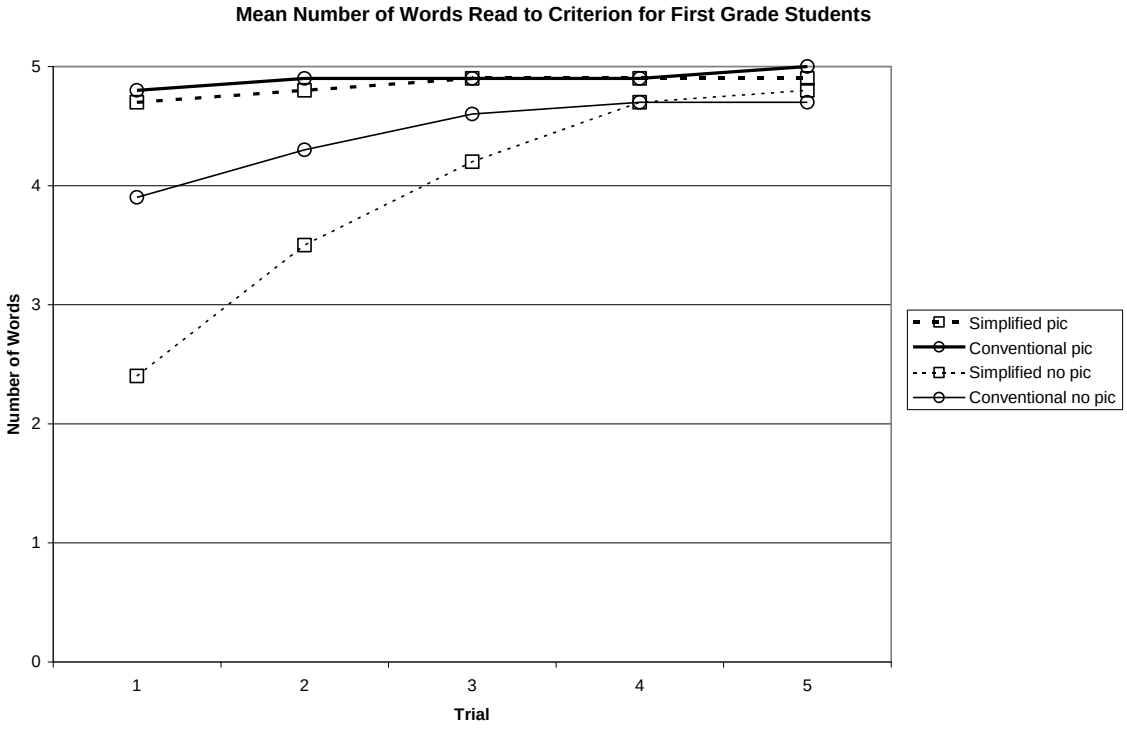


Figure2



Appendix A: Written Consent Form

To the Parents at _____,

Your child is invited to participate in a research study. The study will be conducted by Alicia Senia, a doctoral student in Educational Psychology at the Graduate Center of The City University of New York, under the advisement of Dr. Linnea Ehri, Distinguished Professor of Educational Psychology at the Graduate Center of the City University of New York. The purposes of the study are to examine how pictures influence the way early readers learn to read and spell new words. The study will include the following activities. During the first session, students will be asked to read and write words to show how much they have learned already. During the next session, the students will be taught to read a total of 10 new words. Three days later during the final session we will see how many words the students remember. Sessions will last approximately 20 minutes each.

Some of the words students learn to read will be presented with pictures, some will not. Students will be taught either conventional spellings of words or simplified spellings of words. The study poses no risks beyond those in everyday life. Each student will work individually with the researcher in a quiet space during school hours near the child's classroom. In scheduling sessions, the classroom teacher will be consulted with to insure that participants do not miss important instructional time. Approximately 60 students will participate in the study.

Children will benefit from the study by receiving individual attention, by showing off what they have learned, and by gaining knowledge about how to read and analyze words. Results of this study should advance our knowledge about how children learn to read new words and in turn improve literacy instruction in our schools.

Participation is voluntary. Choosing to participate or not will not affect the student's standing in the school in any way. Either parents or children may withdraw from the study at any time without any consequence. The identity of participants will remain anonymous by replacing names with code numbers on record sheets. The data will be stored in a locked cabinet at the university. Your child's performance will remain confidential and will not be released to anyone without your permission. Upon request, you can receive a summary of the study's results following its completion.

The research project has been approved by your child's principal and teacher. Your child cannot participate without your written permission. If you agree, please sign the form below and return it to your child's teacher as soon as possible. You may keep the second copy for your files.

If you have any questions about the project, you may call Alicia Senia at (212) 876-9768 or email at ASenia@gc.cuny.edu. You may also direct questions to Dr. Linnea Ehri at (212) 817-8294, LEhri@gc.cuny.edu. If you have questions about your child's rights as a participant in this study, you can contact Kay Powell, IRB Administrator, The Graduate Center/City University of New York, (212) 817-7525, kpowell@gc.cuny.edu.

I agree to let my child (record name) _____ participate in the study described above.

_____ _____
(Signature of parent or guardian) (Date)

_____ _____
(Signature of Researcher) (Date)

Appendix B: Script for Obtaining Oral Consent from Participants

PI: Hi my name is Alicia and I am working on a big homework project to study how children learn to read and write words. Your Mom and Dad (**or whatever is appropriate given the child's caregiver status**) and your teacher have said it is ok for you to come and help me with it. We are going to be doing some reading activities together. You don't have to do this, but I will do my best to make it as fun as possible. Now I do have one important thing to tell you and that is if you ever want to quit, even in the middle of the project, just let me know because that's ok. It is very important to me to know that you are doing this because you want to.
Do you have any questions for me?
Answer any questions.
So are you ready to do this?

If child says yes then we will begin the project. If child says no then I will give the following follow up question to make sure that the negative response is not due to him or her not wanting to miss something that is going to happen in class while we are away.

Are you saying no because you do not want to do the project or is it because you would rather be back in your class right now but would like to help me later?

If child says yes I will find out if there is a better time and see if that time is ok with the teacher. If the child says it is a bad time a second time there will be no more follow-ups.

If the child says no I will say the following:

Thank you so much for thinking about it, I am really glad you were honest with me. If you change your mind you can come and talk to me when I am in the classroom or tell your teacher. Thanks again for thinking about it.

Appendix C: Scripts and Materials for Pretests in Experiment 1

Letter Knowledge

PI: I am going to show you some cards with letters on them. When I point to the letter, you tell me what letter it is, okay?
Researcher will show the student the cards with the letters on them, and point to each letter. She will record student's responses on a scoresheet.

PI: Very good. Now I am going to show you the letters again, but this time I would like you to tell me the sound that each letter makes, okay?
Researcher shows card, points to letters, and records responses on a scoresheet.

Invented Spelling

PI: Okay, now I am going to ask you to write some words. I will tell you the word, say the word in a sentence, and then say the word again. You will write the word. Just do the best you can.
Researcher hands student paper and a pencil. Time is given to the student to write the word before the next one is read.

1. man, My father is a man, man
2. hat, I will put a hat on the snowman's head, hat
3. cup, I like to drink from my favorite cup, cup
4. glad, I am glad that we have school today, glad
5. dish, My dog eats out of his own dish, dish
6. bump, There is a bump on my uncle's nose, bump
7. rock, That rock is very hard, rock
8. spot, I got a spot on my shirt at lunchtime, spot
9. went, I went to the store with my mom, went
10. bone, My dog loves to chew on his bone, bone
11. landed, The bird landed in the tree, landed
12. pay, I have to pay for my breakfast, pay

Invented Spelling	***Spelling Conventions***
1. **m**an	*initial consonant*
2. ha**t**	*final consonant*
3. c**u**p	*short vowel*
4. **gl**ad	*initial blend*
5. di**sh**	*digraph*
6. bu**mp**	*final blend*
7. ro**ck**	*final consonant pair*
8. **sp**ot	*initial blend, difficult*
9. w**en**t	*consonant-controlled vowel*
10. bon**e**	*final e marker (long vowel)*
11. land**ed**	*-ed inflection*
12. p**ay**	*final long-vowel spelling*

Sight word Recognition

PI: Now I will show you some words and ask you to read them. The words will get harder until you can't read them anymore. That is okay. Just do the best you can.

As researcher points to each word on a graded list of words from the Woodcock Reading Mastery Test- Revised (1987), she scores student's responses on a scoresheet. The assessment stops when the child fails to correctly read 6 consecutive responses.

is	milk	airplane	human
you	car	chair	twilight
and	swim	because	certain
up	fast	beautiful	dwarf
cat	down	slowly	furnace
stop	rug	watch	amazement
come	with	early	torpedo
jump	find	heavy	vehicle
help	said	already	departure
book	night	laugh	yardage
play	sleep	hurry	urgent
sun	after	largest	mechanic
blue	woman	expert	wounded
two	summer	evening	zenith
no	table	passage	petroleum
boy	work	receive	
little	stove	gasoline	
bed	ground	calander	

Nonword Reading

PI: You are doing great! Now I am going to ask you to read some crazy made-up words. These are not real words, but you can read them. When I point to each word, I would like you to do your best to read the word to me.

As researcher points to each word, she records student's responses on a scoresheet.

Decoding: Nonwords		***Decoding Conventions***
bim	nep	*c-v-c word*
zut	mog	*c-v-c word*
juff	cass	*final consonant pair*
pesh	thip	*consonant digraph*
spog	brap	*initial consonant blend*
lesk	rimp	*final consonant blend*
fipe	bame	*final e marker (long vowel)*
deak	hoad	*long-vowel digraph*
fested	gunded	*-ed inflection*
pasking	zufting	*-ing inflection*
dappen	wubbit	*double consonants breaking syllables*

When they are done, the researcher will tell the student that she did great work, and will thank the student for working with her.

Appendix D: Word Learning Scripts and Materials in Experiment 1

Learning Trial

Researcher: I am going to teach you how to read some words. I am going to show you a card with a word on it and read it to you. Then, I would like you to read it right back to me.

Researcher shows first card and says the word aloud. Now can you read it?
The researcher will do this for all 10 cards.

Test Trials

Researcher: Now I am going to show you the words again. They are mixed up into a different order. I will show you a card and would like you to read the word to me. If you can't or you make a mistake I will tell you the right answer. Just try to do the best you can. Let's begin.

If an incorrect answer is given the researcher will respond with "Good try," and then given the correct answer. If the student does not respond the researcher will give the correct answer and say, "I know this is hard but keep trying." If the student gives the correct response the researcher will say, "Good job!"

The researcher will present the 10 words to the student, in different orders, until the student is able to read all 10 words 3 times in a row.

Word Sets

Groups A/B	Groups C/D
NBR	NUMBER
RVR	RIVER
BBL	BUBBLE
DLR	DOLLAR
DMD	DIAMOND
BKT	BLANKET
TKT	TICKET
TBL	TABLE
NDL	NEEDLE
RTL	RATTLE

Appendix E: Scripts and Materials for Posttests in Experiment 1

Spelling Production

PI: I am going to ask you to write the words that you learned the last time I came to your school, okay? Be sure to write the words just like you saw them. Don't worry if you forgot, just do your best.

Researcher will give the student a paper and pencil, and read the words to her. Enough time will be given to write each word before moving on to the next one.

1. dollar, I pay for my lunch with a dollar, dollar
2. table, Sit down at the table to eat, table
3. bubble, Can you blow a bubble with your gum?, bubble
4. blanket, A big blanket will keep you warm, blanket
5. number, My favorite number is eight, number
6. needle, A doctor can give you a shot with a needle, needle
7. river, Let's go sail a boat down the river, river
8. diamond, The lady wore a sparkly diamond on her finger, diamond
9. ticket, Buy a ticket to see a movie, ticket
10. rattle, The baby loves to shake his rattle, rattle

Word Recognition

Great job! Now I am going to show you words on a list, and I would like you to read them to me.

Researcher will use a card to expose one word while covering the words underneath it. As the child reads them, she will mark whether or not it was read automatically (1 sec.)

Sight Word Recognition- Conventional Spellings

BIG

COME

CAN

NUMBER

HAVE

HELP

BUBBLE

LITTLE

NOT

MOTHER

DOLLAR

RED

SAID

RIVER

AND

BALL

GO

BLANKET

RIDE

IN

TABLE

THE

UP

TO

TICKET

WE

WANT

NEEDLE

DID

ARE

FAST

RATTLE

BLUE

ON

DIAMOND

Appendix F: Scripts and Materials for Pretests in Experiment 2

Sight Word Recognition

PI: I am going to ask you to read some words for me. The words will flash up on this screen very quickly, one at a time. After each word you will see this design. *The hash marks (#####) will be on the screen.* You will be able to read some words quickly, but some words might leave the screen too quickly for you to read them. Don't worry, just do your best, okay? Are you ready to begin?

Researcher will begin the t-scope. She will record student's responses on a scoresheet. Students that are able to read any target words will be eliminated from the study.

HAVE	THE
LITTLE	IN
TO	NUMBER
BUBBLE	RIDE
BIG	NOT
WE	CAN
RIVER	DOLLAR
COME	WANT
UP	HELP
ARE	BLANKET
TABLE	MOTHER
SAID	DID
FAST	RED
NEEDLE	DIAMOND
GO	BALL
BLUE	AND
ON	TICKET
RATTLE	

Letter Knowledge

PI: I am going to show you some cards with letters on them. When I say "go," please turn this card over and read the letters going across as quickly as you can.
Researcher will tell the student when to turn over the card and begin reading the words. She will record student's time on a scoresheet.

PI: Very good. Now I am going to show you another card with the letters on it, but this time I am going to point to each letter, and when I do, I would like you to tell me the sound that each letter makes, okay?
Researcher shows card, points to letters, and records responses on a scoresheet.

Invented Spelling

PI: Okay, now I am going to ask you to write some words. I will tell you the word, say the word in a sentence, and then say the word again. You will write the word. Just do the best you can.
Researcher hands student paper and a pencil. Time is given to the student to write the word before the next one is read.

1. man, My father is a man, man
2. hat, I will put a hat on the snowman's head, hat
3. cup, I like to drink from my favorite cup, cup
4. glad, I am glad that we have school today, glad
5. dish, My dog eats out of his own dish, dish
6. bump, There is a bump on my uncle's nose, bump
7. rock, That rock is very hard, rock
8. spot, I got a spot on my shirt at lunchtime, spot
9. went, I went to the store with my mom, went
10. bone, My dog loves to chew on his bone, bone
11. landed, The bird landed in the tree, landed
12. pay, I have to pay for my breakfast, pay
13. ugly, She was scared of the ugly monster, ugly
14. throat, I stayed home from school when I had a sore throat, throat
15. handle, I carry my lunchbox by its handle, handle
16. paper, Please put your name on your paper, paper
17. babies, The babies are playing in the playpen, babies
18. hoping, I am hoping the weather will be nice this weekend, hoping
19. night, We are going out to dinner tomorrow night, night
20. solution, Let's find a solution to this puzzle, solution

Invented Spelling	***Spelling Conventions***
1. **m**an	*initial consonant*
2. ha**t**	*final consonant*
3. c**u**p	*short vowel*
4. **gl**ad	*initial blend*
5. di**sh**	*digraph*
6. bu**mp**	*final blend*
7. ro**ck**	*final consonant pair*

8. **sp**ot *initial blend, difficult*
9. w**en**t *consonant-controlled vowel*
10. bon**e** *final e marker (long vowel)*
11. land**ed** *-ed inflection*
12. p**ay** *final long-vowel spelling*
13. ugl**y** *final y = /ee/*
14. thr**oa**t *long-vowel digraph*
15. hand**le** *syllabic –ie*
16. pap**er** *syllabic –er*
17. bab**i**es *change y to i, add suffix*
18. hoping *drop final e*
19. n**igh**t *other vowel spellings*
20. solu**tion** *advanced final-syllable spelling*

Sight word Recognition

PI: Now I will show you some words and ask you to read them. The words will get harder until you can't read them anymore. That is okay. Just do the best you can.
As researcher points to each word on a graded list of words from the Woodcock Reading Mastery Test- Revised (1987), she scores student's responses on a scoresheet. (See words in Appendix C.) The assessment stops when the child fails to correctly read 6 consecutive responses.

Nonword Reading

PI: You are doing great! Now I am going to ask you to read some crazy made-up words. These are not real words, but you can read them. When I point to each word, I would like you to do your best to read the word to me.
As researcher points to each word, she records student's responses on a scoresheet.

Decoding: Nonwords		***Decoding Conventions***
bim	nep	*c-v-c word*
zut	mog	*c-v-c word*
juff	cass	*final consonant pair*
pesh	thip	*consonant digraph*
spog	brap	*initial consonant blend*
lesk	rimp	*final consonant blend*
fipe	bame	*final e marker (long vowel)*

deak	hoad	*long-vowel digraph*
fested	gunded	*-ed inflection*
pasking	zufting	*-ing inflection*
dappen	wubbit	*double consonants breaking syllables*
fisket	morden	*mixed consonants breaking syllables*
pight	foom	*igh or oo*
fimple	jabble	*syllabic –le*
nopper	ponker	*syllabic -er*

When they are done, the researcher will tell the student that she did great work, and will thank the student for working with her.

Appendix G: Word Learning Scripts and Materials in Experiment 2

Learning Trial- Attention Group

Researcher: Today I am going to teach you how to read some words in a certain way. The way you will be reading the words today is to uncover the letters of the words to show the sounds they make as you say the sounds of the word. I am going to show you a card with a word on it and show you how to do this. *Researcher presents a card with the practice words printed on it.* This word is "little." When you read the word, cover the word with your finger, like this. When you say the first part of the word, show me the letters that make that sound. When you say the second part of the word, show me the rest of the word. Watch me as I read the word and do this. *Researcher models how to read the word while exposing the syllables.* Now you try. Remember, you only want to show the letters you are saying. *Student reads the word while exposing the syllables.* Great! Let's try with a couple more words. *Student practices with two more words.*

Good job! Now, I am going to teach you how to read some words. I am going to show you a card with a word on it and read it to you. Then, I would like you to read it right back to me, using your finger in the way we just practiced.

Researcher shows first card and says the word aloud. Now can you read it?
Researcher will make sure the letters uncovered match the syllables that are pronounced. The researcher will do this for all 10 cards.

Test Trials- Attention Group

Researcher: Now I am going to show you the words again. They are mixed up into a different order. I will show you a card and would like you to read the word to me, using your finger in the way we practiced. If you can't or you make a mistake I will tell you the right answer. Just try to do the best you can. Let's begin.

If an incorrect answer is given the researcher will respond with "Good try," and then give the correct answer; the student will repeat the word while segmenting it. If the student segments the word incorrectly, the researcher will model the correct segmentation while reading the word, and then the student will do so. If the student does not respond the researcher will give the correct answer and say, "I know this is hard but keep trying." If the student gives the correct response the researcher will say, "Good job!"

The researcher will present the 10 words to the student, in different orders, until the student is able to read all 10 words 3 times in a row.

Learning Trial- No Attention Group

Researcher: I am going to teach you how to read some words. I am going to show you a card with a word on it and read it to you. Then, I would like you to read it right back to me.

Researcher shows first card and says the word aloud. Now can you read it?
The researcher will do this for all 10 cards.

Test Trials- No Attention Group
Researcher: Now I am going to show you the words again. They are mixed up into a different order. I will show you a card and would like you to read the word to me. If you can't or you make a mistake I will tell you the right answer. Just try to do the best you can. Let's begin.

If an incorrect answer is given the researcher will respond with "Good try," and then given the correct answer; the student will repeat the word. If the student does not respond the researcher will give the correct answer and say, "I know this is hard but keep trying." If the student gives the correct response the researcher will say, "Good job!"

The researcher will present the 10 words to the student, in different orders, until the student is able to read all 10 words 3 times in a row.

Word Sets

Groups A/B
NBR
RVR
BBL
DLR
DMD
BKT
TKT
TBL
NDL
RTL

Groups C/D
NUMBER
RIVER
BUBBLE
DOLLAR
DIAMOND
BLANKET
TICKET
TABLE
NEEDLE
RATTLE

Appendix H: Scripts and Materials for Posttests in Experiment 2

Sight Word Recognition

PI: I am going to ask you to read some words to me. The words are going to pop up on this screen here, one at a time. After each word you will see this design. *The hash marks (#####) will be on the screen.* When you see the word, read it out loud. Are you ready to begin?

When the child is ready, the researcher will begin the t-scope.

Word Recognition By Sight Posttest (T-Scope) - Conventional Spellings

HAVE

THE

LITTLE

IN

TO

NUMBER

BUBBLE

RIDE

BIG

NOT

WE

CAN

RIVER

DOLLAR

COME

WANT

UP

HELP

ARE

BLANKET

TABLE

MOTHER

SAID

DID

FAST

RED

NEEDLE

DIAMOND

GO

BALL

BLUE

AND

ON

TICKET

RATTLE

Word Recognition By Sight Posttest (T-Scope) - Simplified Spellings

HAVE

LITTLE

TO

BBL

BIG

WE

RVR

COME

UP

ARE

TBL

SAID

FAST

NDL

GO

BLUE

ON

RTL

THE

IN

NBR

RIDE

NOT

CAN

DLR

WANT

HELP

BKT

MOTHER

DID

RED

DMD

BALL

AND

TKT

Spelling Production

PI: Very good. Now I am going to ask you to write the words that you learned the last time I came to your school, okay? Be sure to write the words just like you saw them. Don't worry if you forgot, just do your best.

Researcher will give the student a paper and pencil, and read the words to her. Enough time will be given to write each word before moving on to the next one.

1. dollar, I pay for my lunch with a dollar, dollar
2. table, Sit down at the table to eat, table
3. bubble, Can you blow a bubble with your gum?, bubble
4. blanket, A big blanket will keep you warm, blanket
5. number, My favorite number is eight, number
6. needle, A doctor can give you a shot with a needle, needle
7. river, Let's go sail a boat down the river, river
8. diamond, The lady wore a sparkly diamond on her finger, diamond
9. ticket, Buy a ticket to see a movie, ticket
10. rattle, The baby loves to shake his rattle, rattle

Word Recognition

Great job! Now I am going to show you words on a list, and I would like you to read them to me.

Researcher will use a card to expose one word while covering the words underneath it. As the child reads them, she will mark whether or not it was read correctly.

Word Recognition By Sight or Decoding- Conventional Spellings

BIG

COME

CAN

NUMBER

HAVE

HELP

BUBBLE

LITTLE

NOT

MOTHER

DOLLAR

RED

SAID

RIVER

AND

BALL

GO

BLANKET

RIDE

IN

TABLE

THE

UP

TO

TICKET

WE

WANT

NEEDLE

DID

ARE

FAST

RATTLE

BLUE

ON

DIAMOND

Word Recognition by Sight or Decoding- Simplified Spellings

BIG

COME

CAN

NBR

HAVE

HELP

BBL

LITTLE

NOT

MOTHER

DLR

RED

SAID

RVR

AND

BALL

GO

BKT

RIDE

IN

TBL

THE

UP

TO

TKT

WE

WANT

NDL

DID

ARE

FAST

RTL

BLUE

ON

DMD

Nonword Reading

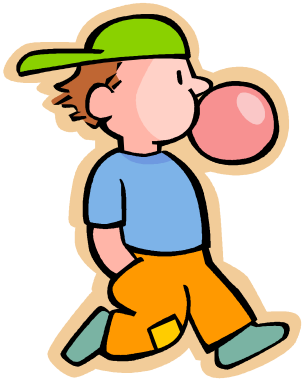
PI: You are doing great! Now I am going to ask you to read some crazy made-up words, like you did a few days ago. These are not real words, but you can read them. When I point to each word, I would like you to do your best to read the word to me.
As researcher points to each word, she records student's responses on a scoresheet.

Nonwords Analogous to Target Words

Bicket
Rable
Tumber
Nollar
Dattle
Bliver
Ranket
Tubble
Niamond
Deedle

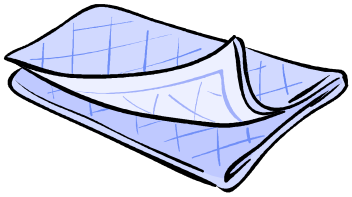
You did a great job! Thank you very much for working with me.

Appendix I: Pictures Printed on Cards in Picture Condition

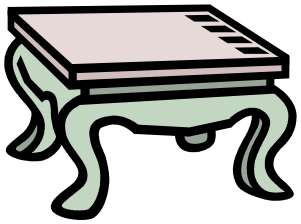


BUBBLE; BBL

TICKET; TKT



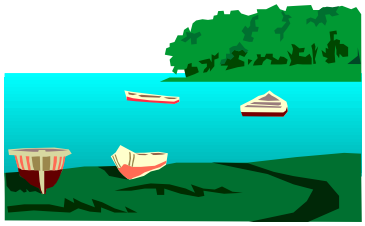
BLANKET; BKT



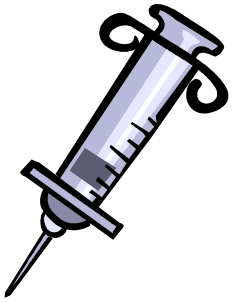
TABLE; TBL

RATTLE; RTL

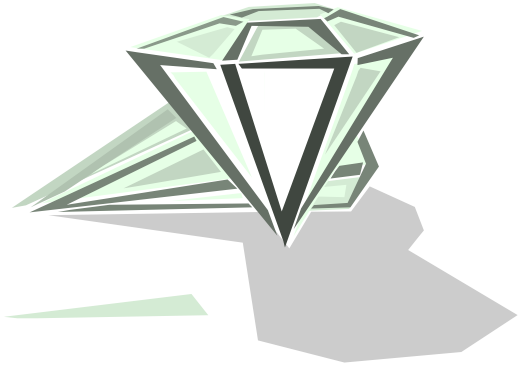
NUMBER; NBR



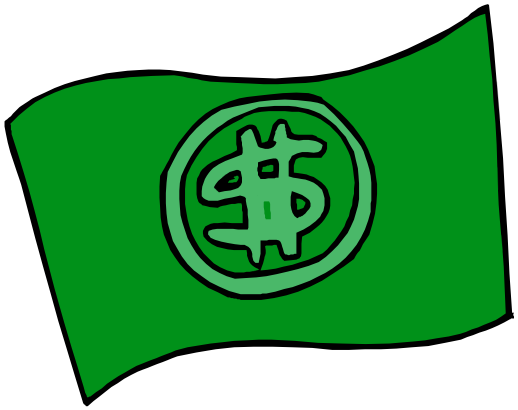
RIVER; RVR



NEEDLE; NDL



DIAMOND; DMD



DOLLAR; DLR

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