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Repetition of Words: The Forgotten Variable in Texts for Beginning and Struggling Readers

Elfrieda H. Hiebert, University of California, Berkeley

Leigh Ann Martin, TextProject

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At the present time, repetition of specific words does not appear to be a factor in the design or selection of individual texts or sets of texts in instructional programs for beginning readers in the United States. As illustrated in Chapter 1 of this volume, approximately 22.9 new unique words appear per every 100 words in the 2007 copyright of an American mid first-grade textbook. In 1962, the rate in this same program was 7.4. These rates reflect historical events, changes in theory and perspectives, and critiques of education that have occurred over the past 45 years. The interest in this chapter is to review research to determine whether this dramatic shift represents a practice that emanates from work that qualifies as scientifically based reading research (Slavin, 2002).

We preface this review with a comment about its comprehensiveness. In 1995 while working with students in a graduate course at the University of Michigan on an analysis of then-current basal reading programs, the first author was confronted with the paradigmshift in the nature of reading textbooks that resulted from changes in guidelines and policies (California English/Language Arts Committee, 1987; Texas Education Agency, 1990). Reading textbooks had shifted from controlled vocabulary texts to anthologies of authentic children's literature. The effects of this shift on the features of words in first- and second-grade reading programs were reported in several publications (Hiebert, 2005; Hiebert, Martin, & Menon, 2005). These analyses showed high percentages of single-appearing words and patterns of word repetition that can be described as serendipitous (i.e., reflecting the typical use of high-frequency words in written language). These results were the impetus for a search of literatures on the role of repetition and the pace of new information in learning to read.

Our aim in this chapter is to summarize critical literatures that we have identified in this decade-long search. We do not claim that the literature that is summarized in this chapter represents all that is known about the role of repetition and pacing in learning to read. We are aware that individual studies and even particular literatures that represent particular paradigms have not been addressed. For example, a substantial literature exists on massed and distributed practice of word learning (Bloom & Shuell, 1981). There is also a research literature (although not large) on repetitions in vocabulary learning (McKeown, Beck, Omanson, & Pople, 1985; Wysocki & Jenkins, 1987) and on learning vocabulary in a foreign language (Kyongho & Nation, 1989). We have chosen to focus on particular literatures and, within those literatures, particular studies to provide an overview of the current research on the repetition of words and linguistic units in learning to read.

Our focus in this chapter is on the students who depend on schools to become literate, not the students who come to first grade reading or become proficient readers within the few first months of school (Lesgold, Resnick, & Hammond, 1985). As was demonstrated by Hiebert (Chapter 1, this volume), automaticity with the 1,000 most-frequent words is not reached until the fourth-grade by the 40th percentile and fifth-grade by the 25th percentile. It is the role of word repetition in the reading development of this portion of an age cohort that provides the focus of this chapter.

A Historical Perspective on Repetition in Texts for Beginning Readers

In an historical review of the texts used for beginning reading instruction in American schools from 1640 to 1940, Monaghan and Barry (1999) showed that, at least prior to the 1930s, the text genres thought appropriate for young students meant that particular words were often repeated in the texts that beginning readers were given to learn to read. The excerpt of a text

(Norton, 1902) that appears in Table 1 illustrates one of the text genres that was often used in beginning reading programs—poems or stories with repeated elements. The repetitive nature of *The house that Jack built* meant that words such as *this, is, the, that* appeared numerous times as did words such as *rat, malt, house, Jack*, and *built*.

It was not until the time from 1914 to 1940 that Venezky (1984) has described as the scientific period in American reading instruction that repetition of words was formalized. The first generation of American educational psychologists such as Thorndike (1903, 1921) drew heavily on explanations from Gestalt psychology to explain and define learning. As interpreted by these early educational psychologists, what needed to be learned (i.e., the stimulus) was the whole word. Words that held high interest for students (e.g., *truck, car, bus*) or those that represent frequently occurring patterns in English (e.g., *cat, rat, hat*) could have become the focus. Instead, Thorndike (1921) in *The Teacher's Word Book* identified the words that occurred most frequently in samples of written language—words such as *the, a, and, at, as,* and *be*. Rather than using texts that had been used up to this point such as *The house that Jack built*, publishers with the advice of educational psychologists devised little stories that used these high-frequency words in a formulaic way. An example of a text that appeared in the 1940 Scott Foresman series (Gray, Baruch, & Montgomery, 1940) is included in Table 1.

The formula for the repetition of words in such texts came from the work of Gates (1930). Gates described observations in classrooms that showed that students spent 50% of the reading period practicing the words that they would read in their texts as the incentive for his experiments on word repetition. This word study was necessary, Gates claimed, because his analyses of the textbooks of the era showed that one out of every 16 running words was a new, unique word. Gates believed that this rate of introduction (approximately 6.25 new words per

100 running words of text) exceeded the number of new words that most students could recognize with accuracy. If new words were repeated more frequently in texts, more of students' time could be spent reading and less on word study.

Gates (1930) conducted research on a set of texts that he designed where 1 of every 150 words was a new, unique word (*150* materials). The same teacher taught two groups which were equated on mental age, intelligence quotient, and scores on a series of reading tests with one group reading the typical materials (i.e., 1 new, unique word out of 16 words) and the other the *150* materials. The students in the *150* materials spent the entire reading period with these materials, while the comparison students also engaged in word study to ensure that they could read the words in their texts. Accuracy levels of the majority of students led Gates (1930) to conclude that the *150* materials were superior only for the very lowest students and that most students in the *150* group could have acquired more words. At the same time, Gates concluded that the students in the *16* materials were asked to progress too rapidly as evident in erroneous recognition of words.

For the next study, Gates (1930) created the *60* materials where one out of every 60 running words of text was a new word. At posttest, students who received the *60* materials recognized more words on the Gates Reading Vocabulary test than the students who received the *150* materials (12 for the former; 9 for the latter). The *60* students also performed better on phrase, sentence, and paragraph reading. In a subsequent study with the *60* materials and existing materials where one in every 14 words was a new, unique word, Gates reported that the students in the *60* materials had superior performances by 30-40%.

Gates (1930) used this research to generate what he called "guesses" as to the number of repetitions per word that must be provided during the first year for students to become successful

readers. He associated the numbers of repetitions with intelligence quotient (IQ) bands with 20 repetitions recommended for the highest band of 120-129 and 55 for the lowest band of 60-69. As this set of hypotheses was translated into textbook programs, it was the number of repetitions for the average band of 90-109—35 repetitions—that came to govern textbook design.

Educational psychologists subsequently combined Gates' (1930) hypotheses regarding number of repetitions with Thorndike's (1903) laws of learning (readiness, exercise, and effect) to guide publishers in the design of beginning reading texts (Smith, 1934/1965). The laws of learning translated into attention to the pace at which new words were presented (effect) and the number of repetitions (exercise). With respect to the law of readiness, the words for which young children were regarded to be ready were high-frequency words that students were already using in their speech.

The application of the laws of learning to texts for beginning readers is evident in the features of text in excerpts 2 and 3 in Table 1. Excerpt 2 is from the text published by Scott Foresman (Elson & Runkel, 1928) prior to the application of Gates' (1930) hypthotheses regarding word repetition to the creation of beginning reading texts. In Excerpt 2, words such as *bread* and *milk* appeared a single time in the text (and for the first time in the program). The one third of the unique words that were repeated were either high-frequency words (e.g., *it, I, a)* or words relevant to the storyline (e.g., *Gustava, spring, sang)*. Once the laws of learning were applied by Gray et al. (1940) in the Scott Foresman reading program (Excerpt 3), new words were distributed in particular sequences and with specific number of repetitions. In the text represented in Excerpt 3, all words but *go* and *down* had appeared in previous texts in the first preprimer. The two new words in this text, *go* and *down*, were repeated 6 and 5 times, respectively. The two words that appeared for the first time in the previous text—*Tim* and

up—each appeared 5 times. By the end of the first preprimer, 17 words each had appeared a minimum of 7 times and an average of 10 times.

This pattern suggests an algorithm. However, while specific formulas based on behaviorist principles are evident in readability formulas (Klare, 1984), we have been unable to find any articles in the archival literature that either describe the algorithm or research that supports its use. By the 1960s, the pattern was applied so rigidly that, as Chall's (1967/1983) analysis showed, students saw few new words. Despite Chall's (1967/1983) critique, highly constrained texts continued to characterize beginning reading programs through the late 1980s. The instructions in the teacher's guides changed as a result of Chall's critique to emphasize greater phonics instruction. However, the texts became even more formulaic. For example, the 1983 Scott Foresman first-grade program had even fewer unique words than had been in the case in the 1940 program represented in Table 1 or the 1962 program that Chall reviewed (Hiebert, 2005). The number of total words within the program had increased substantially but the average number of repetitions per word went from 10 in the 1962 program to 20 in the 1983 program (Hiebert, 2005). There was a strong backlash to this tight control in beginning texts in the late 1980s. While policies on the kind of words that should be prominent in beginning texts has vacillated from highly meaningful words in authentic literature to highly decodable words over the past two decades, the decrease in word repetition that occurred with the textbook adoptions of the late 1980s and early 1990s has not been addressed by policy-makers or researchers.

Current Patterns of Repetition in Beginning Reading Texts

A sea change in text features of reading programs occurred in the late 1980s and early 1990s when the model of beginning texts shifted from the controlled vocabulary recommended

by Gates (1930) to the authentic text of children's literature. According to the perspective that was evident in the California and Texas guidelines for publishers (California English/Language Arts Committee, 1987; Texas Education Agency, 1990) authentic text had the features that would engage students and support comprehension. The support for comprehension was claimed on the basis of cohesiveness and coherence—features that the controlled texts often lacked. In that studies on the effects of controlled texts on comprehension were conducted almost exclusively with students who had at least a modicum of reading proficiency (e.g., Beck, McKeown, Omanson, & Pople, 1984), the generalizability of results to students at the very earliest stages of reading had not been established when policies calling for no controlled vocabulary for all levels went into effect. One aspect of this shift was an increase in the number of unique words at the earliest stages. From the 1983 copyright of Scott Foresman where the average number of repetitions per word was 20, the average number of repetitions in the 1993 plummeted to 3.4.

When the first state-by-state comparison on the National Assessment of Educational Progress (Miller, Nelson, & Naifeh, 1995) showed Californian fourth graders to be performing poor, policies that favored whole language, including authentic texts, were viewed to be the culprit. Subsequently, policy-makers in Texas and California mandated decodable texts as the basis of the next textbook adoption cycles (California English/Language Arts Committee, 1999; Texas Education Agency, 1997). Decodable texts in these policies were defined on the coverage of phonemes in instruction, not on the number of repetitions of linguistic units or words in texts. The repetition of words within the 2000 copyright of Scott Foresman (and other publishers) remained fairly consistent to that of the beginning reading programs that had used authentic literature: 4.8 (Hiebert, 2005). Analyses of the 2007 copyright that were described in Chapter 1

indicate that the pattern is holding steady. Within the 2007 program, the average repetition of words was 4.5.

Hiebert et al. (2005) have shown that the distribution of word repetitions is skewed. Most of the repetitions occur with a small group of words, while a large number of words appear a single time. In their examination of the core vocabulary across three components of three beginning reading programs, Hiebert et al. found that two of the three programs (both mainstream basal programs but differing in the emphasis on decoding) had the same percentage of words that occurred 4 times or more (30%) and the same percentage of single-appearing words (50%). In the third program—a program that emphasizes decoding, 45% of the words appeared four times or more, while 38% appeared a single time. In the two mainstream programs, the 100 most-frequent words accounted for only 4% of the unique words in the corpora but 20% of the words that were repeated four times or more (Hiebert et al., 2005). Foorman, Francis, Davidson, Harm, and Griffin (2004) similarly reported that 229 words were common to the six first-grade programs that they analyzed and that 116 of these words were on the Dolch list.

In summary, recent policies by major textbook adoption states that have focused on different features of texts for beginning readers have failed to attend to the repetition of words. As a result, the words that occur most in texts (by virtue of being high-frequency words) occur a lot. However, they are interspersed with many different words—words with diverse meanings and patterns. As will become evident in the following review of literature, many beginning readers fail to learn these high-frequency words either quickly or automatically when they are presented with numerous other unknown words.

Current Theory and Empirical Evidence on the Repetition of Linguistic Units and Words

We have classified research that gives insight into the number of repetitions that support beginning readers' word recognition into four groups: (a) studies of the repetition of letter-sound units, especially the rime (i.e., the vowel and consonant(s) in a syllable), (b) studies of the self-teaching hypothesis that address learning of orthographic patterns, (c) studies of the repetition of words in experimental tasks where texts are constrained to either a handful of sentences and/or lists, and (d) studies of the repetition of words in instructional texts used as part of classroom instruction. While the first two categories both deal with orthographic units within words, they represent different approaches and traditions in the research literature and consequently will be reviewed separately.

Repetition of Rimes

We begin with a brief overview of research that has compared beginning readers' attention to the grapheme-phoneme correspondences within words relative to rimes. While this review is fair from comprehensive, it is an important literature since the policies of large states with textbook adoptions, specifically California (California English/Language Arts Committee, 1999) and Texas (Texas Education Agency, 1997) mandate that texts be designed around phoneme-grapheme correspondences. In that the mandates of these two states call for texts to be designed around this feature through the end of second grade and, for struggling readers, through the end of middle school in California (California State Board of Education, 2006), evidence that individual grapheme-phoneme correspondences continue to be salient for developing readers

The literature on students' ongoing use of grapheme-phoneme correspondences (especially beyond early stages of reading acquisition) has not been extensive. One pattern

evident in the research is that the frequency of the letter-sound correspondence in written language differentially influences the recognition of children at the very earliest stages of reading. Thompson, Cottrell, and Fletcher-Flinn (1996) established that *b* and *th* in the final position of words occurred significantly less often than *t* and *m*. Based on this information, they assessed 24 children on CV and VC pseudowords incorporating the target consonants. Words with *b* and *th* in the final position were read with significantly lower accuracy than *m* and *t* in the final position. In a second experiment, Thompson et al. (1996) manipulated the amount of exposure beginning readers had to words containing the consonant *b* in the final position by having children read sentences with a target word that ended in *b* or sentences where the target words were omitted in the text but supplied orally by the investigator. The former group significantly improved in the accuracy with which pseudowords with *b* in the final position were read, while the latter group made no improvement.

Once beginning readers attend to grapheme-phoneme correspondences or are in the partial alphabetic stage as Ehri (1998) has described it, their attention moves to units of written language that are larger than individual grapheme-phone correspondences, especially rimes (i.e., the vowel and the following consonants). When rimes are regular (Stuart, Masterson, Dixon, & Quinlan, 1999) and when rimes appear in frequently occurring words (Trieman, Goswami, & Bruck, 1990), beginning readers tend to use them more than individual grapheme-phoneme correspondences in recognizing and remembering words.

The rime is a particularly salient unit in word recognition, once students have grasped the alphabetic principle. The effects of rime family size (e.g., a large rime family such as *cat, hat, bat sat, mat, pat* relative to a small rime family such as *rough, tough*) and frequency of words within rime families (e.g., *cat* vs. *gnat*) on students' word recognition have been examined in a

number of studies. An example of a research program in which these factors have been a focus is that of Leslie and Calhoon (1995; Calhoon & Leslie, 2002).

Leslie and Calhoon (1995) compared reading of words and nonwords based on large, medium, or small rime neighborhood size and the frequency (high, low) of words in lists or stories. The frequency of words as well as the size of their rime neighborhoods influenced less skilled readers' recognition of words on lists, with high-frequency words and words with rimes from large neighborhoods being read more accurately. Reading words in context helped more for low-frequency words in large and medium rime neighborhoods than those in small neighborhoods and for high-frequency words. Since word frequency significantly predicted less skilled readers' ability to read words, Leslie and Calhoon concluded that rime neighborhood size has no influence when students are in the partial-alphabetic stage but the frequency of the word does.

Subsequently, Calhoon and Leslie (2002) examined the word learning of students from first through third grades receiving whole language instruction. Within these classrooms, letter-sound correspondences were not taught explicitly except through the strategy of cross-checking where readers confirm a word's pronunciation with illustrations or sentence context (Clay, 1985). Calhoon and Leslie asked whether the size of the rime neighborhood was a factor with low-frequency words that had a high-frequency counterpart (e.g., low-frequency: *zip*; high-frequency: *ship*). During first grade, words from large neighborhoods were read more accurately in texts than words from medium neighborhoods which, in turn, were read more accurately than those from small neighborhoods. Unlike first grade where the accuracy of high-frequency words on the list did not differ by rime neighborhood, second graders read high-frequency words on the list more accurately than words from medium and small neighborhoods.

With low-frequency words, the effects of rime family size were the same. By third grade, rime neighborhood size had little effect on accuracy in reading words on a list. In stories, however, words from large rime neighborhoods were read significantly better than words from medium neighborhoods (which did not differ from words from small neighborhoods). For low-frequency words, students read them with similar levels of accuracy in stories and word lists. Calhoon and Leslie took these results to confirm their model that rime neighborhood size effects occur once students have reached the partial alphabetic phase. They concluded that word learning occurs as result of frequency of exposure to words and words that share rimes.

Similar effects for rime family size and word frequency results have been reported in other studies. Laxon, Smith, and Masterson (1995) reported that there were significantly more errors on words from small rime neighborhoods, while Laxon, Gallagher, & Masterson (2002) reported that more errors were made on nonwords than words and more errors were made on nonwords with small rime neighborhoods (although the last difference was not significant). Weekes, Castles, & Davies (2006) compared reading of high- and low-frequency words with consistent and inconsistent rime pronunciations, controlling for age at which children acquire the words orally. Significantly more words with consistent rimes were read correctly, regardless of age of oral acquisition of the word. When rimes are inconsistent, significantly fewer errors were made on high-frequency than low-frequency words.

There is sufficient evidence to conclude that the frequency with which letter-sound correspondences, rimes, and words appear in texts influences the accuracy and speed of recognition of words by beginning readers. The evidence does not provide specific numbers of repetitions that support this accuracy and speed of recognition. The evidence does, however, point to general directions: words with more frequent letter-sound correspondences and rimes

are recognized better than words with less frequent patterns. Even when these units appear in nonwords, the frequency of appearance in written language influences students' accuracy and speed (with more frequent patterns recognized more readily than less frequent ones). Further, the frequency with which words appear in texts also predicts accuracy and speed in beginning readers' recognition of words.

Self-Teaching Hypothesis

Similar to the analyses conducted by Foorman et al. (2004) and Hiebert (2005), Jorm and Share (1983) reported that many words in texts of beginning reading instruction appeared a single time. While many students struggle in becoming proficient readers with such texts (Hiebert, Chapter 1; Lesgold et al., 1985), Share (1995) focused on the students who had learned to read with these texts. He proposed the self-teaching hypothesis as an explanation for beginning readers' ability to form the orthographic representations needed for fast sight word recognition through phonological recoding (decoding) of unknown words. According to the self-teaching hypothesis, words that are successfully decoded are added to a lexicon of sight vocabulary by items, not stages. As more and more words are added to readers' lexicons of sight vocabulary, decoding moves beyond the decoding of one-to-one letter-sound correspondences to include larger units such as rimes and morphemes. Both phonological and orthographic components are involved in the self-teaching mechanism. The phonological component is primary as unknown words must be successfully decoded before correct orthographic representations can be formed.

Share (1999) initiated an experimental paradigm that has been used in subsequent tests of the self-teaching hypothesis. Students orally read texts in which one unfamiliar word (the target) has been inserted and, typically, is repeated more than once. Usually, the target word is a

pseudoword for the name of something like an animal, city, fruit, etc. In a session at least a day later, students are given up to three assessments of orthographic learning. The orthographic choice task requires students to select the target word from four choices: the target (e.g., *Yait* (the name of a hypothetical city in a study conducted by Cunningham, Perry, Stanovich, & Share (2002)), a homophonic version of the target word (e.g., *Yate*), and up to two similar words containing transposed or visually similar substituted letters (e.g., *Yoit, Yiat*). In a second task, the time it takes students to begin to read target words and homophones that are displayed one at a time on a computer (onset latency) are compared. The third task involves spelling target words and homophones.

Some studies testing the self-teaching hypothesis have considered the effects of repeated exposures in the formation of orthographic representations of target words. Two studies involving second and third grade readers reading in English (Bowey & Muller, 2005; Nation, Angell, & Castles, 2007) found that increasing the target repetitions within a text resulted in significantly more targets being identified on the orthographic choice task. With a shallower orthography such as Hebrew (de Jong & Share, 2007; Share, 1999, 2004; Share & Shalev, 2004), increasing the number of repetitions of targets did not result in significantly higher accuracy rates on the orthographic choice measure. The differing results from these studies may be due to the orthographic depth of the languages involved. In languages with deeper orthographies, such as English, the correspondence between letters and sounds is more complex, often depending upon larger units such as rimes and morphemes. More exposure to target words may be needed with deeper orthographies to form detailed orthographic representations within memory. This may also explain why self-teaching studies in English have reported that targets were named significantly faster than homophones (Bowey & Miller 2007; Bowey & Muller, 2005;

Cunningham et al., 2002), while studies in Dutch and Hebrew (de Jong & Share, 2007; Share, 2004) reported no significant differences.

One interpretation of the findings within the self-teaching paradigm is that some amount of orthographic knowledge is necessary for more orthographic learning to occur. Cunningham and her colleagues found that neither general cognitive ability nor rapid automatized naming (RAN) ability predicted significant amounts of variance in the orthographic learning of target words by first and second graders (Cunningham, 2006; Cunningham et al., 2002). However, in both of these studies, one or more measures of *existing* orthographic knowledge were administered prior to reading the experimental texts. These measures of existing orthographic knowledge predicted a significant amount of additional variance in orthographic learning beyond that due to decoding ability: 11% for first-grade students and 20% for second-grade students. These measures of existing orthographic knowledge mainly tested the ability of the students to identify existing common vocabulary words from homophones that differed mostly in their vowel spellings. The results of these studies suggest that repetitions of orthographic patterns, such as common vowel spellings or rimes as well as words are important for developing readers.

Share (2004) has theorized that the first encounter with a new word may result in the most orthographic learning, particularly with students possessing more orthographic knowledge. For example, Share noted that when the third-grade students initially encountered a target, they typically decoded the word letter by letter. When these students encountered the same target a second or third time, their pronunciations became much more fluent. While most learning may occur during the first exposure, additional exposures may be needed to refine this knowledge, particularly for beginning readers. Share (1995) recognized that, while too many unfamiliar words will influence comprehension, the occasional unfamiliar word is the impetus whereby

beginning readers develop into fluent readers.

Share's (1995) hypotheses are consistent with several theories of sight word acquisition. In connectionist theory, the first encounter with a novel word results in the largest changes to the weight of the connections, while subsequent encounters refine the system with by making smaller or even minimal changes (Seidenberg & McClelland, 1989). Logan (1997) theorizes that the first encounter with a new word establishes an initial trace within memory, and that subsequent encounters increase the number of memory traces that can be accessed, resulting in faster and less effortful recognition of specific words. Ehri (1998) and Perfetti (1992) have also theorized that the initial encounter with a novel word results in a representation being formed within memory that maps the word's orthography to its pronunciation and meaning. This initial representation may be partial, since a beginning reader may only partially decode a word, but each successful encounter with a word refines the representation. Regardless of whether a single exposure to a new word is enough to result in orthographic learning, repeated exposure to these words is important to firmly establish them within memory as sight words.

An important issue that these studies do not address is the ratio between the numbers of unfamiliar words to known words during text reading. Share (1995) suggests that too many unfamiliar words will disrupt comprehension during reading. The texts used within examinations of the self-teaching hypothesis were designed so that only the target word would be unfamiliar (with the exception of de Jong and Share, 2007). While such control is necessary in these experimental studies, it is not reflective of the types of reading texts that beginning readers encounter (Hiebert et al., 2005). More experimental study is needed on this issue, although Menon and Hiebert (2005) did find that first-grade students who read texts that contained more repetitions of both words and rimes learned more words overall than students who read from

literature basals containing more single-appearing words and words that were more difficult to decode, such as multisyllabic words.

Repetition of Words in Experimental Texts

To guard against the vagaries of word repetition in already existing texts and to control for variables such as words already known by readers, some studies have used carefully constructed texts and/or word lists that are studied under laboratory conditions. For example, Reitsma (1983) investigated how frequency of exposure to individual words affects the speed with which mid-year first graders and older, reading-disabled students recognized words. Children read sentences with a target word two, four, or six times, followed by post-tests which assessed the speed of recognizing individual words. The assessments included homophonic versions of the target words, where spellings differed by only one letter such as *read* and *red* and *to* and *too*. First graders' speed of responding to target words decreased systematically with exposure, with a leveling off between four and six exposures. Apparently, first graders were recognizing words automatically at around four exposures. Further, since first graders recognized the homophonic variants more slowly, Reitsma concluded they were internalizing the spellings of the target words. Based on these findings, it has been suggested that beginning readers need four to six exposures with unfamiliar words before achieving automaticity (Share, 1999). However, it is important to note that many of the first graders in this study (conducted at mid year) had some reading proficiency. Further, the students were reading in Dutch, a language with a more consistent orthography than English (i.e., a shallow orthography). As demonstrated in the studies of self-teaching reviewed earlier, the number of repetitions required by students to recognize words (and orthographic patterns) may be fewer in languages with shallow orthographies.

Another study that is sometimes cited to suggest that additional practice beyond six repetitions is redundant is that of Ehri and Wilce (1983). In this study, skilled (second graders only) and less skilled readers (first graders and two second graders) practiced reading high frequency words and CVC pseudowords. There was no significant difference between pretest and posttest times for the target high-frequency words, whether practiced 6 or 18 times. However, the high frequency words were common to beginning reading texts and the study did not control for prior exposure. Consequently, the lack of improvement in word naming latencies may be due to prior exposures to these words. This interpretation is supported by the fact that the skilled readers were able to recognize these words as quickly as they could name digits, an indication that the words were being recognized automatically. In contrast, the naming latencies for the pseudowords practiced 18 times decreased significantly between pretest and posttest for both skilled and unskilled readers.

Findings from a study by Lemoine, Levy, and Hutchinson (1993) provide stronger evidence that additional practice with words is necessary in order to achieve long-term automaticity. In their experiment, 40 third graders who were reading at a second grade level were trained to read either 50 regular or 50 irregular words. Each word was encountered 5, 10, 15, 20, or 25 times. During training, speed and accuracy gains leveled off after 5-7 repetitions, but during the retention test one week later, the words that had been practiced 15-25 times were read significantly faster and more accurately than those words only practiced 5-10 times. These results suggest that "overlearning" is important in establishing sight vocabulary. Further studies by Levy and her colleagues examining the acquisition, retention and transfer of new words in both text reading and in isolation by second through fourth graders have also found main effects

due to exposure (up to 12) on accuracy and speed (Martin-Chang & Levy, 2005, 2006; Martin-Chang, Levy, & O'Neil, 2007).

The laboratory research on word repetition indicates that beginning readers typically require at least a modicum of repetition to read a word. To date, however, the studies have failed to carefully delineate how these repetitions differ as a function of word features, students' prior word recognition knowledge, and number of new words within a text. Particular features of words have yet to be systematically examined in laboratory studies. For example, there is evidence that the imageability of a word influences the ease with which beginning readers learn to read words (Hargis, Terhaar-Yonkers, Williams, & Reed, 1988; Sadoski & Paivio, 2002) and the speed with which particular rimes are recognized and retained in memory (Laing & Hulme, 1999).

Repetition of Words in Instructional Texts

There are a handful of studies that have considered the relationship of words in instruction and the amount of repetition in texts and students' word recognition. A particular interest during the 1990s was to determine how beginning readers fared with predictable or authentic literature texts where the level of repetition was not controlled. Predictable texts typically contain a pattern (a phrase or sentence(s) that is repeated) with small variations (e.g. "I see a dog", "I see a cat", etc.) and often incorporate rhyme and concrete illustrations as further support. These texts can provide a successful entrée for beginning readers and allow poor readers to focus on comprehension (Leu, DeGroff, & Simons, 1986). However, the overuse of predictable texts may encourage over-reliance on recitation and rhyme rather than actual reading (Johnston, 2000; Landi, Perfetti, Bolger, Dunlap, & Foorman, 2006; Leu et al., 1986).

Stuart, Masterson, and Dixon (2000) examined the words encountered by 20 five-year-old students during their first term of reading instruction. These students were non-readers at the beginning of the term and were taught using a whole language approach that involved the repeated shared reading of books with an adult, focusing on meaning. During this first term the students encountered a mean of 125.9 different words (range 39-277). A mean of 3.7 words (range 0-14) were repeated more than 20 times within the texts, but only 1.3 of these high frequency words (range 0-10) could be read by the beginning readers. Furthermore, when Stuart et al. exposed these students to 16 target words within the context of shared book reading, they found that students recognized an average of 4.95 words soon after exposure and 3.6 words a month later. Similarly, Johnston (2000 found that first graders who were exposed to 41-66 new words per week in predictable texts learned only an average of 5.7 words.

By contrast, first graders who read from texts where words were repeated—whether high-frequency words in a mainstream program or highly decodable words in a phonics program—learn substantially more words. Evidence for this finding comes from Juel and Roper/Schneider (1985) who examined the effects of textbooks with different emphases on first grade children's word learning and strategies. Half of the students read from a basal series that employed decodable words that were repeated an average of 26.3 times, accounting for 69% of the total text. The other students read from a basal preprimer that emphasized high-frequency words, which were longer, less decodable and were repeated on average 15.1 times, accounting for 44% of the total text. Once students had finished the preprimers, subsequent texts in the two programs (i.e., primers and first readers) were very similar in the kinds of words they used. All students also received the same district-wide phonics instruction.

Word repetition was a significant factor for all students; however, the students who read from the high frequency preprimers were more dependent upon the amount of word repetition in order to be successful at recognizing the words within their basals. Furthermore, the students who had read from the decodable preprimers were able to read more new words at the end of the year than the students who had initially read from the high frequency preprimers, suggesting that their early reading experience affected their subsequent ability to read new words.

The studies on predictable text where repetition is serendipitous indicate that, without explicit guidance, beginning readers fail to learn many words. In Juel and Roper/Schneider's (1985) study, repetition of words was a factor for both the decodable and mainstream programs, although more so for the mainstream program that emphasized high-frequency words in the preprimer. One aspect of the Juel and Roper/Schneider study that needs to be born in mind in extending the findings to current texts is that the repetition of the decodable words in the Juel and Roper/Schneider study was substantially higher than is the case in current decodable texts. Studies that include data on students who have gone through current programs of decodable texts where the concern is with the match between individual grapheme-phoneme correspondences and the instructional sequence in the teacher's manual (Stein, Johnson, & Gutlohn, 1999) rather than repetition of words or words with particular patterns show that many of the students who depend on schools to become literate fail to learn many words in either classroom instruction (Hiebert & Fisher, 2006) or in intensive interventions (Vaughn, Cirino, Linan-Thompson, Mathes, Carlson, & Cardenas-Hagan, 2006).

Discussion

The first observation from this review of research is how sparse the literature on repetition of words in beginning reading is. However, patterns from the various literatures that

we have reviewed are evident. First, the familiarity of orthographic and phonological patterns of words does influence beginning readers' recognition of words. Students generalize knowledge of frequent and familiar patterns and use this knowledge with new words. Second, high frequency words are learned more rapidly than words with low frequency.

But, within the literature, the specificity is simply not there. In particular, there is a paucity of information around the pace at which unfamiliar words should be introduced and the ratio of unknown to known words within texts. We are far from having the research base that is needed, particularly when large states, such as California, Texas and Florida, mandate substantial changes in their textbooks. What is it that we can expect from a research base in the future? Before we explore that question, we examine what we cannot have.

One of the aspects that we cannot expect from the research base is to have algorithms at the level specified in current textbook adoptions. For example, specifications of percentages of decodable words that are now mandated by the states of California (California English/Language Arts Committee, 1999) and Texas (Texas Education Agency, 1997), as well as numbers of books mandated per phoneme are simply not justified. The process of learning to read is simply too complex. The variables that enter into the reader-text interaction are simply too many and too complex to isolate. Beginning readers differ in their prior experience with texts (including hundreds, if not thousands of hours, interacting with texts). As Gray and Leary (1935) showed, the variables that can be distinguished across texts are numerous—topics, sentence types and complexity, and frequency and commonality of words. Experiments where "ideal" texts are compared to typical texts are difficult to conduct. One reason is that the variables that need to be controlled are many. It is unlikely that all of the permutations that will need to be considered can be established even in ambitious programs of research. Further, the production of texts,

including illustrations that are comparable to those of existing texts, are expensive and prohibitive without ambitious research funding. At the present time, none of the calls for research from the U.S. Department of Education has made such research a priority.

Within the existing literature, however, several models can be identified that illustrate directions for research programs. One model is a careful documentation of student learning as a result of particular conditions of instruction and text, as illustrated by several studies (Juel & Roper/Schneider, 1985; Lesgold et al., 1985; McGill-Franzen, Zmach, Solic, & Zeig, 2006). Juel and Roper/Schneider (1985) and McGill et al. (2006) contrasted student learning as a result of different features of textbook programs that had been implemented in classrooms. Such contrasts can be useful and there are numerous opportunities for them in current policy contexts. For example, over the past textbook adoption, school districts in California have been limited to purchase of two basal reading programs with state funds. A group of policy-makers have compared student progress as a function of the two programs (Williams, Kirst, Haertel et al., 2005). However, documentation of how the two programs were different was not provided. In the case of McGill-Franzen et al., the manner in which two programs differed in comprehension instruction as well as fluency experiences was provided. This project was conducted with third graders and did not address the issue of repetition. But we provide it as a model for how students' learning can be documented within the current context where textbook programs have been designed to fulfill particular mandates of state policy-makers.

Another model comes from two interventions where particular texts were organized in particular configurations and the effects on beginning readers' performances were documented over a period of time (Jenkins, Peyton, Sanders, & Vadasy, 2004; Menon & Hiebert, 2005). While the amount of repetition of individual words was not analyzed relative to student

performances in these studies, such analyses could be included in future interventions of this type. In that there are numerous interventions going on right now in the country (see, e.g., Vaughn et al., 2006), there is no reason why the nature of word repetition--and the features of this repetition--could not be considered at different points in students' development and for students with different learning trajectories and performances.

Hiebert and Fisher (2006), in their design of a set of texts, provide a third model. They based their text design on specific information about the most critical features of written language such as Wylie and Durrell's (1970) identification of the most frequent and prolific rimes and the most frequent words in written language (Carroll et al., 1971). They were especially interested in identifying words that intersected in prolificacy of rimes, frequency of appearance of at least one or more members of the rime family, and imageability. While the experimental comparisons of these texts with existing texts have been limited in duration, initial analyses show that texts where words have been carefully chosen for these features produce significantly higher levels of speed and accuracy among young English language learners than decodable texts that use the phoneme as the unit of learning and where word repetition is not of concern.

Research on the self-teaching hypothesis illustrates a fourth model. While the work on self-teaching to date has been limited in scope, the attention to the ratio of known to unknown words within this model could be the focus of experiments. It would be hoped in this work that information on students' existing knowledge would be documented thoroughly. Cunningham (2006) has demonstrated how such documentation can be done and how information illuminates what students are learning.

We reiterate our belief that algorithms should not be the aim of this work. Students'

experiences with texts spill over into their home lives. They see words in the environment and media and a variety of contexts within school contexts to the level where the input can be, at best, described with broad strokes. However, guidelines can be provided, especially for students who have particular skill profiles. Such guidelines can respond to current policy mandates and contexts. For example, the patterns that have been reported in this review from a variety of sources call into question the use of texts with, on average four repetitions of wordsin textbooks that are mandated in a state such as California where a significant portion of a grade cohort is learning to speak English at the same time that they are learning to read. If nothing else, the achievement outcomes in that state (and others) suggests that there are problems with current texts (Perie, Grigg, & Donahue, 2005). The amount of input that the children who are not reading when they come to school are expected to process is massive.

We are hopeful that others will join us in identifying areas of already existing research that shed light on the role of the repetition of words and linguistic units in reading acquisition, especially that of students who depend on schools to become literate. We are also hopeful that this review will spark the interest of researchers in considering the role of a variable—the repetition and pacing of unknown words--that has long been recognized as a critical contributor to the ease and automaticity of reading development.

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Table 1.

Illustrations of Texts from First-Grade Reading Books

Year and Program	
The Heart of Oak Books (1st Book) (Norton, 1902)	The House that Jack Built This is the house that Jack built. This is the malt That lay in the house That Jack built. This is the rat That ate the malt That lay in the house that Jack built. This is the cat, That killed the rat, That ate the malt That lay in the house that Jack built.
Elson Readers (Book one) *(Elson & Runkel, 1928)*	Little Gustava Once there was a little girl. Her name was Gustava. One day she heard a little bird. It sang and sang and sang. "Oh, spring has come," said Gustava. "Mother, do you hear the bird? I am so happy! I love the spring!" Her mother gave her some bread and milk. She sat in the warm sun to eat it.
Basic Readers: Curriculum Foundation Series *(1st Preprimer)* (Gray, Baruch, & Montgomery (1940)	Tim and Spot Go up, Tim. Go up. Go up, up, up. Go down, Tim. Go down. Go down, down, down. Oh, Jane. See Spot and Tim. See Spot run. Funny, funny Spot. Funny, funny Tim.